Algebra II

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Summary of Unit

Students will construct and compare linear, quadratic, and exponential models and solve problems in this lesson. They will observe the functions using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. To do this, I will have six lesson plans spread out over the course of three weeks to teach the students. I will have frequent formative assessments to see where students are, and a summative assessment at the end of each lesson. Each summative assessment will be created in such a way that students will be able to learn even when they are making, presenting, and reflecting on the project. By the end of the unit students will actually have had fun learning math and will be able to use their knowledge in the real world for unlimited situations.

Establish Goals

Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function

Students will understand that

•linear functions are used to resolve real world issues.
•different types of quadratics represent real world issues.
•exponential functions are different than other functions.

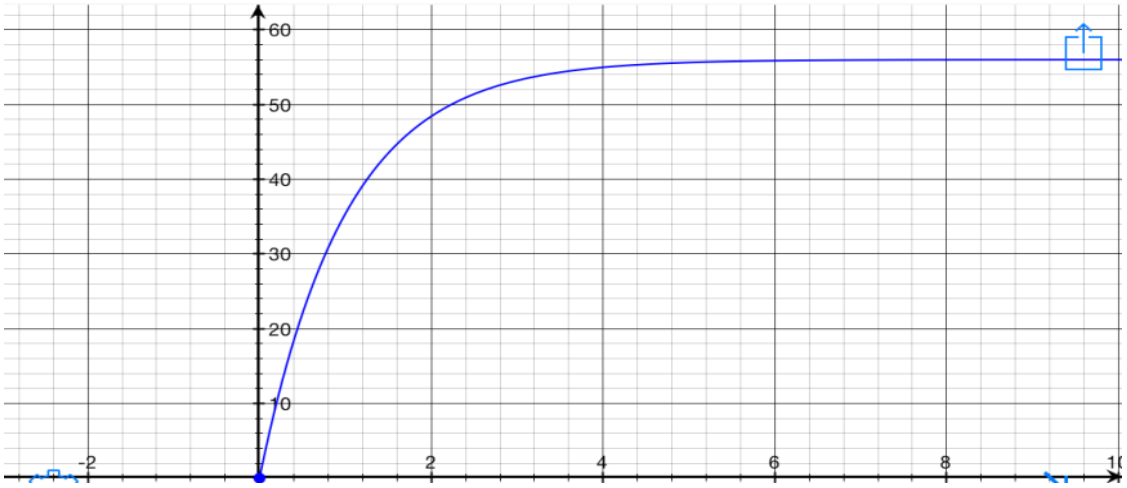
Essential Questions

•How are linear functions used to resolve real world issues?
•Why do different types of quadratics represent real world issues?

•How are exponential functions different than other functions?

Students will know

•terminology (linear, slope, intercepts, quadratics, maximum, minimum, tangent line, exponents, logarithms, natural log, asymptote, horizontal, vertical, cartesian, coordinate, function, variable, parabola, concave, convex, vertex)
•formulas (slope-intercept: y=mx+b, standard form (linear): Ax+By=C, point-slope: (y-y1)=m(x-x1), slope: m=(y2-y1)/(x2-x1), y-form: y= -(A/B)x-(C/B), vertex form: y=a(x-h)^2+k, quadratic formula: x=(-b±(b^2-4ac)^1/2)/2a, basic log equation: logb(y)=x and b^x=y, as well as the properties of logs including product rule, quotient rule, and power rule, natural log: y=ln(x))
•critical details (graphing, making a table, recognizing asymptotes, exponent rules, rise over run, factoring, finding x-intercepts, maximum and minimum points)



Students will be able to

•predict an exponential function and what it represents.
•illustrate a quadratic function and how it relates to the real world.
•design a linear function and relate it to a real life situation.
•analyze a quadratic function's properties.
•consider how linear equations relate to the real world.
•recognize the difference between exponential functions and other functions.

Performance Task Overview

In an attempt to get more students to participate in activities, the CEO of BASES (British Association of Sport and Exercise Sciences) has asked you, a sports science analyst, to create an informational presentation about an activity for students. This information is going to be brought into school to show students to increase their interest in activities. Your job, as a sports science analyst, is to examine the basic linear, quadratic, and exponential functions involved with an activity of your choice. You must present this information in a way that is informative, engaging, and tasteful to the CEO of Bases and the students. It is important that you provide appropriate examples of how each activity represents the three functions in order to make the presentation educational. Using a Nearpod presentation, illustrate the different mathematical components involved with your activity. Pitch this presentation to the CEO of BASES for approval.

Expectations

Absences: Students are expected to come to me to get their information before the next class. For example if you miss a blue day, please come and see me when I am available before the next blue day. You must communicate with me so you do not fall behind and get lost. I will have online screencasts and videos that students can watch whether they have missed class or not. The screencasts will look back on the material from that day, provide examples, and be a great resource for students who are absent so they can view it on their own time.

Plagiarism: Students who are caught plagiarizing will receive an immediate zero and be sent to administration. Plagiarism is zero tolerance and will be taken very seriously. Be sure to cite correctly in your documents and give appropriate credit where credit is due.

Assignments: All assignments will be given with a reasonable amount of time to complete. The assignments will have clear goals and be relevant to the information that we are learning. Students who need an extended due date should talk to me 24 hours before the expected completion of the assignment. If this is not met, the student will lose points for late work. Assignments are to be done to the best of your ability; points will be lost for unjust incomplete work.

Classroom Expectations: Students shall show respect to everyone, ask questions, be attentive in class, and most importantly have fun and learn! I expect that by the end of the class all students will show mastery in the content area. Raise your right hand and please repeat after me: "If at any point I am confused in class... I will not hesitate to ask a question... because I know... Mr. Cabaniss... Will not judge me on any question... and will be glad to help me."

Benchmarks (200 points)

• NEARPOD (23.333 POINTS): Students will create a presentation to show different uses of linear models. Students will explain the different components of a liner model and explain original graphs by giving specific examples. Work should be shown in the process of finding all answers; be sure to cite all websites used appropriately.

• PREZI (23.333): Students will show real world linear models, use pictures, and explain processes. You will need to include at least six (6) stages of work, three (3) of which will be different real world options. The dependent variable should not be reused in any of the problems, meaning you will examine multiple real world applications. If this is going to be on the internet for others to view, be sure that you get permission to use all pictures and information, unless it is in the public domain or creative commons.

• IMOVIE (23.333 POINTS): In groups of two, examine real world situations to create quadratic functions. You should include at least three real world situations in which you would use a quadratic function. The dependent variable should not be reused in any of the examples. If you use any graphics that are not original be sure to report the permission status of the graphics.

• BLOG (23.333 POINTS): Regularly update blogs to talk about different properties like minimums/maximums, x-intercepts, concavity, etc... You should have at least four (4) blog posts--one of which sums up all of the properties learned. Include one personal image in each of the blog posts. It would be ideal to post a blog post after each class so you are current with the properties of quadratics.

• GLOGSTER (23.333 POINTS): Demonstrate what to look for in an exponential function and be able to

create a mental picture of the function. The Glogster should include animations, several graphics, and be aesthetically pleasing. Be sure that if this is on the internet for people to see that you give appropriate credit to other authors of information and graphics and state the permission status. Be creative--make your Glogster look the best. Anonymously students will submit who they think created the best Glogster. The winner will receive a prize!

• JEOPARDY (23.333 POINTS): Students create a game to interact with students to show the differences between exponents and other functions. The class will be split up into groups of three and be asked to create a Jeopardy category for a specific exponential process. At the end, the class will collectively synthesize all of the Jeopardy categories into one game and they will play. The team who wins Jeopardy will win a prize.

PERFORMANCE TASK (60 POINTS): Please see above.

Grading Scale

A (93 -100), **A-** (90 - 92), **B+** (87 - 89), **B** (83 - 86), **B-** (80 - 82), **C+**(77 - 79), **C** (73-76), **C-** (70 - 72), **D+**(67 - 69), **D** (63 - 66), **D-** (60 - 62), **F** (0 - 59).

Unit Cover Page

Unit Title: *Algebra 2* **Grade Level(s):** *11,12*

Subject/Topic Area(s): *Linear, Quadratic, and Exponential Models*

Key Words: *Linear, Quadratic, Exponential, Graphing*

Designed By: *Sean Cabaniss* **Time Frame:** _____

School District: _____ **School:** _____

Brief Summary of Unit (including curricular context and unit goals):

Students will construct and compare linear, quadratic, and exponential models and solve problems in this lesson. They will observe the functions using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. To do this, I will have six lesson plans spread out over the course of three weeks to teach the students. I will have frequent formative assessments to see where my students are, and a summative assessment at the end of each lesson. Each summative assessment will be created in such a way that students will be able to learn even when they are making, presenting, and reflecting on the project. In order to get my students to be engaged in class, I will use differentiation to accommodate for all students learning styles. I will also try and hook students with activities within the first few minutes of class based on the lesson that I will be presenting that day. This will, hypothetically, keep them involved for the remainder of class, and help them to succeed.

Unit design status: __ *completed Template pages - Stage 1, 2, and 3*

__ *completed Blueprint for each performance task* __ *completed rubric(s)*

__ *directions to students & teachers* __ *materials & resources listed*

__ *suggested accommodations* __ *suggested extensions*

Status: *initial draft (date - _____)* *revised draft (date - _____)*

__ *peer reviewed* __ *content reviewed* __ *field tested* __ *validated* __ *anchored*

Stage 1: Identify Desired Results.

Established Goals:

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Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function

What understandings are desired?

Students will understand that:

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- *linear functions are used to resolve real world issues.*
- *different types of quadratics represent real world issues.*
- *exponential functions are different than other functions.*

What essential questions will be considered?

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- *How are linear functions used to resolve real world issues?*
- *Why do different types of quadratics represent real world issues?*
- *How are exponential functions different than other functions?*

What key knowledge and skills will students acquire as a result of this unit?

Students will know:

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- *terminology (linear, slope, intercepts, quadratics, maximum, minimum, tangent line, exponents, logarithms, natural log, asymptote, horizontal, vertical, cartesian, coordinate, function, variable, parabola, concave, convex, vertex)*
- *formulas (slope-intercept: $y=mx+b$, standard form (linear): $Ax+By=C$, point-slope: $(y-y_1)=m(x-x_1)$, slope: $m=(y_2-y_1)/(x_2-x_1)$, y-form: $y= -(A/B)x-(C/B)$, vertex form: $y=a(x-h)^2+k$, quadratic formula: $x=(-b\pm(b^2-4ac)^{1/2})/2a$, basic log equation: $\log_b(y)=x$ and $b^x=y$, as well as the properties of logs including product rule, quotient rule, and power rule, natural log: $y=\ln(x)$)*
- *critical details (graphing, making a table, recognizing asymptotes, exponent rules, rise over run, factoring, finding x-intercepts, maximum and minimum points)*

Students will be able to:

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- *predict an exponential function and what it represents.*
- *illustrate a quadratic function and how it relates to the real world.*
- *design a linear function and relate it to a real life situation.*
- *analyze a quadratic function's properties.*
- *consider how linear equations relate to the real world.*
- *recognize the difference between exponential functions and other functions.*

Stage 2: Determine acceptable evidence.

What evidence will show that students understand?

Performance Tasks* (Summary in G.R.A.S.P.S. form): T

Goal: *Your task is to create an informational presentation about the process of skydiving.*
Role: *You are a sports science analyst.*
Audience: *Your client is the CEO of Skydive New England.*
Situation: *The challenge involves dealing with linear, quadratic, and exponential functions.*
Product/Presentation: *You will create a Nearpod presentation in order to present your calculations to the CEO of Skydive New England.*
Standards: *Product (Understanding of Nearpod: 15%, Required elements: 30%, Originality: 10%, Work is shown: 10%, Understanding mathematical concepts: 20%, Detail and creativity: 15%); Presentation (Comprehension: 25%, Professionalism: 10%, Preparedness: 15%, Vocabulary: 15%, Posture and eye contact: 15%, Content: 20%).*

**Complete a Performance Task Blueprint for each task (next page).*

Other Evidence (quizzes, tests, prompts, observations, dialogues, work samples, etc.):

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- *Glogster: Demonstrate what to look for in an exponential function and be able to create a mental picture of the function.*
- *iMovie: Show a real world situation and create a quadratic function from it.*
- *Prezi: Show real world linear models and use pictures and explain processes.*
- *Blog: Update blogs to show different properties like minimums/maximums, acceleration, x-intercepts, etc...*
- *Nearpod: Have students create a presentation to show different uses of linear models.*
- *Jeapardy: Have students create a game to interact with students to show the differences between exponents and other functions.*

Student Self-Assessment and Reflection:

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- *Pre-Assessment: Teacher prepared pretest.*
- *Checking for understanding: Function aerobics, slap it, whip around, thumbs up-thumbs down, exit cards, four corners.*
- *Self Assessment: Self: The teacher would provide a checklist with requirements that the students would need to fill out. Peer: The students would "pass along" their work to other students for feedback. Teacher: Student-teacher one-on-one conferences to check up on students.*

Assessment Task Blueprint

What understandings/goals will be assessed through this task? G

Students will understand that:
•linear functions are used to resolve real world problems.
•different types of quadratics represent real world issues.
•exponential functions are different than other functions.

•Common Core Standards
•Content Area: Algebra
•Domain: Linear, Quadratic, Exponential Models

What criteria are implied in the standard(s)/understanding(s) *regardless* of the task specifics? What qualities must student work demonstrate to signify that standards were met?

Algebra

Quadratic and exponential models

Through what authentic performance task will students demonstrate understanding?

Task Description: T

In an attempt to get more students to participate in activities, the CEO of BASES (British Association of Sport and Exercise Sciences) has asked you, a sports science analyst, to create an informational presentation about an activity for students. This information is going to be brought into school to show students to increase their interest in activities. Your job, as a sports science analyst, is to examine the basic linear, quadratic, and exponential functions involved with an activity of your choice. You must present this information in a way that is informative, engaging, and tasteful to the CEO of Bases and the students. It is important that you provide appropriate examples of how each activity represents the three functions in order to make the presentation educational. Using a Nearpod presentation, illustrate the different mathematical components involved with your activity. Pitch this presentation to the CEO of BASES for approval.

What student products/performances will provide evidence of desired understandings?

Nearpod

Presentation

By what criteria will student products/performances be evaluated?

- *Understanding of Nearpod: 15%*
- *Required elements: 30%*
- *Originality: 10%*
- *Work is shown: 10%*
- *Understanding mathematical concepts: 20%*
- *Detail and creativity: 15%*

- *Comprehension: 25%*
- *Professionalism: 10%*
- *Preparedness: 15%*
- *Vocabulary: 15%*
- *Posture and eye contact: 15%*
- *Content: 20%*

Stage 3: Plan learning experiences and instruction.

Consider the W.H.E.R.E.T.O. elements.

(W) *1.1 Students will understand that linear functions are used to resolve real world issues.* ***(Where)****, Real Life: A distance vs. time graph shows how far, fast, or long (time) someone has traveled at a constant rate.* ***(Why)****, Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.* ***(What)***
(H) *1.2 The room will be divided into three sections. Each section will be responsible for walking around the room at a specific speed: slow, medium, fast. The students will walk like this for one minute. After the minute is up, we will examine what the graphs would look like for the three groups of students walking on a distance vs. time graph. The slopes will vary.*
(E) *1.3 Students will know the following: linear, slope, intercepts, cartesian, coordinate, function, variable, slope intercept, point slope, graphing, rise over run. (****Equip****), The graphic organizer, clock, will be used to logically put steps in order for understanding. The cooperative learning model, mix-freeze-pair, will enable students to walk around the room and meet with other students to discuss topics given by the teacher. After they discuss, they can ask questions or move on to the next individual and topic. (****Explore****), The students will use Nearpod to create a presentation to the class about linear functions and how they are used to resolve real work issues. Students will work alone, although in pods for troubleshooting, on this project and be expected to share. (****Experience****)*
(R) *1.4 Slap It will consist of students using a fly swatter to "slap" answers on a table or on a wall. This will engage students, and show me if they understand the concepts of linear functions and how they are used to resolve real world issues. (****Rethink),*** *Peers will use Passalong to give in depth feedback based on the quality, content, etc... of the project dealing with linear functions in the real world.* ***(Rethink/Revise),*** *Students will self-assess themselves by using a checklist to see if they have all of the components of their presentation. This will consist of the different real world applications as well as necessary parts of linear functions. (****Revise/Refine****),*
(E) *1.5 Formative Assessment -* ***Pre-Assessment:*** *The teacher prepared pretest will consist of the rudimentary skills for linear, quadratic, and exponential functions. This will give me a basis for where students are starting in class so I can tier effectively.* ***Checking for Understanding****: Slap It.* ***Timely Feedback:*** *Self: Checklist; Peer: Passalong****(Evaluate****)*
(T) *1.6* ***Tailors***
Verbal: *During my lesson, I will frequently ask questions to the class so students will be able to respond verbally.*
Logic: *Students will be asked important questions like: why does this apply in the real world? What do certain components of a graph represent? etc...*
Visual: *Throughout the entire lesson I, as well as students, will have the opportunity to draw graphs and solve problems on the board.*
Musical: *I will show linear math song on YouTube for student to reference when they need to later on.*
Kinesthetic: *My hook will be my kinesthetic intelligence because students will be asked to walk around the room and then later graph their distance vs. time.*
Intrapersonal: *Students will have the opportunity to work on linear problems alone before they share with other students.*
Interpersonal: *I will have students share and compare answers on examples in class about real life applications of linear function.*
Naturalist: *Students will examine the height vs. time graph of a tree, and see how it grows in the first few years of its life.*
(O) *1.7 Students will be able to consider how linear equations relate to the real world.* ***(Empathy)***

Stage 3: Plan learning experiences and instruction.

Consider the W.H.E.R.E.T.O. elements.

(W) *2.1 Students understand that linear functions are used to resolve real world issues.* ***(Where)****, Real Life: Being able to create your own linear models on a graphs can allow you to predict how long it will take to drive across America based upon an average speed.* ***(Why)****, Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.* ***(What)***
(H) *2.2 Have each student take out their phone, and send a text, granted it's free, to someone they know (not in this school). Propose to them, theoretically, if it cost them $0.25 a text, and a flat rate of $20.00 a month, how much would they spend if they sent, 5, 25, 1000 texts in one month?*
(E) *2.3 Students will know the following: linear, slope, intercepts, cartesian, coordinate, function, variable, standard form, y-form, graphing, making a table, rise over run, finding intercepts. (****Equip****), The use of an inverted triangle will allow students to create a hierarchy of importance for relating linear functions to a real life situation. This way they can put what they think is the most important in the biggest box. The cooperative learning exercise, one stray, will let students compare answers of problems with multiple groups and share information. Some students will be advised to walk around and bring concepts to other groups.* ***(Explore)****, With a partner, create a Prezi to show your real life creation of linear models. Use pictures and graphs to facilitate getting the concepts across. (****Experience****)*
(R) *2.4 Whip Around will consist of students listing three items after the teacher poses the question. Then students will all stand, and the teacher will call on students at random to say one of their items. If their topic is called they can sit. This process will continue until all the students are sitting. This is a good kinesthetic activity for students to test their knowledge. (****Rethink),*** *Students will work with each other using Passalong to give in depth positive and constructive feedback to each other about their Prezi and how they can design a linear function that relates to the real world.* ***(Rethink/Revise),*** *Students will use a checklist to ensure that they have all the necessary components of their Prezi and that is meets all of the requirements. (****Revise/Refine****),*
(E) *2.5 Formative Assessment -* ***Checking for Understanding****: Whip Around.* ***Timely Feedback:*** *Self: Checklist; Peer: Passalong* ***(Evaluate)***
(T) *2.6* ***Tailors***
Verbal: *During the checking for understanding, Whip Around, students will be asked to share their answer to a question with the class.*
Logic: *Because the students are connecting linear functions to the real world they are logically thinking how and why the linear functions connect using specific examples.*
Visual: *With the product, Prezi, students will be expected to create an aesthetically pleasing Prezi, that will visually capture how to design a linear function.*
Kinethestic: *I will have students move around the room to other table to discuss their answers with their classmates.*
Intrapersonal: *Providing students time to work alone in class on select problems will focus on their intrapersonal intelligence.*
Interpersonal: *The hook will have students use their phones and communicate with other people.*
(O) *2.7 Students will be able to design a linear function and relate it to a real life situation.* ***(Application) Product:*** *Prezi,* ***Number of Days:*** *2-3 days (****Organize****)*

Stage 3: Plan learning experiences and instruction.

Consider the W.H.E.R.E.T.O. elements.

(W) *3.1 Students understand that different types of quadratics represent real world issues.* ***(Where)****, Real Life: A quadratic model can tell you the slowest, or fastest someone was traveling on a given interval.* ***(Why)****, Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.* ***(What)***
(H) *3.2 Each student will be given a ping pong ball and a paddle to use at the beginning of class. They will try to see how many they can bounce successfully in a row. Obviously they will need to use this resource respectfully or else they will lose their privilege. We will graph what a height vs. time graph will look like of a ping pong ball bounced at different heights is.*
(E) *3.3 Students will know quadratics, maximum, minimum, parabola, vertex, quadratic formula, finding x-intercepts, finding minimum and maximum points. (****Equip****), The sandwich chart will act as a way for students to describe the topic, insert supporting details that I tell them, or that they feel are important, and then conclude with a statement that will help them understand the information. The cooperative learning model, circle the sage, is a way for students to use their peers to help each other learn. There will be multiple sages, students who feel the have a good understanding of the content, who will be able to answer questions and describe some of the properties of quadratics. After the students will be able to go back to their original groups to compare notes. (****Explore****), Individually, students will create their own blog sites, and make multiple posts to it when they feel they have learned something new throughout the lesson. At the end, the students will make a summative blog post about the properties of a quadratic and be able to explain them in depth using examples. (****Experience****)*
(R) *3.4 Thumbs up, thumbs down is a good way for students to express their comfortability of the content so I can decide whether I need to spend more time on specific items or move on. (****Rethink),*** *Students will meet with the teacher to have a conference about their blog posts to make sure everything is going on schedule and that they have the correct understanding of the task at hand.* ***(Rethink/Revise),*** *Students will have a checklist to ensure they have the appropriate information covered in their blogs and that it meets all of the criteria. (****Revise/Refine****),*
(E) *3.5 Formative Assessment -* ***Checking for Understanding****: Thumbs up, thumbs down.* ***Timely Feedback:*** *Self: Checklist; Teacher: Conference* ***(Evaluate)***
(T) *3.6* ***Tailors***
Verbal: *In part of the class students will have opportunities to respond verbally to questions asked about quadratic function's properties.*
Logic: *Students will look at a quadratic function either on their calculator or on the board and be asked to analyze the maxs, mins, intercepts, and slopes.*
Visual: *As part of analyzing the functions, students will be asked to draw the graph of their pictures.*
Musical: *Assign students a property for a quadratic, in groups, and then instruct them to make a single verse of a song using it. The whole class will then synthesize their verses into one song.*
Kinethestic: *The checking for understanding will allow students to move around as they physically show what functions will look like.*
Intrapersonal: *In the product at the end of the lesson, students will be able to create their own blog posts--a personal way of expressing information.*
Interpersonal: *For the checking for understanding I can have students find others in the classroom who are displaying the same function.*
(O) *3.7 Students will be able to analyze a quadratic function's properties.* ***(Perspective) Product:*** *Blog,* ***Number of Days:*** *2-3 (****Organize****)*

Stage 3: Plan learning experiences and instruction.

Consider the W.H.E.R.E.T.O. elements.

(W) *4.1 Students understand that different types of quadratics represent real world issues.* ***(Where)****, Real Life: A quadratic function can tell you the trajectory and where an object, such as a missile will land.* ***(Why)****, Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.* ***(What)***
(H) *4.2 To hook students I will have them come into the room and sit down while I bounce bouncy balls all over the room. I will make sure to tell my students to use them respectfully or we won't be able to do this. I will have them think about how bouncy balls could represent a quadratic function and them write the ideas down on the board*
(E) *4.3 Students will know quadratics, maximum, minimum, tangent line, parabola, concave, convex, vertex, vertex form, quadratic formula, factoring, finding x-intercepts, finding minimum and maximum points. (****Equip****), The use of a sequence chart will help students be able to put certain concepts into steps. This will be particularly helpful when they need to look back and understand. The cooperative learning model, rally coach, is a great way for students to help each other and work through problems. This will allow them to be teacher free for a little while if they can help each other get through the problems. (****Explore****), As groups of three, students will create a movie about illustrating quadratic functions and relating them to the real world. (****Experience****)*
(R) *4.4 Function Aerobics is a great way for students to visualize a quadratic function by using their body. They can also look around the room to see what other students are doing in order to get a good understanding of the different quadratics. I can split students into groups and assign them different quadratics to represent.* ***(Rethink),*** *The class will utilize Pass Along to get constructive feedback on their movie before meeting with the teacher. This is a good time to bounce ideas off one another to enhance the movie. When they meet with the teacher they will discuss any concerns that they have about the movie and ask any questions regarding the ability to illustrate a quadratic and relate it to the real world.* ***(Rethink/Revise),*** *Students will then use their checklists to make sure that they have the adequate information for illustrating a quadratic and relating it to the real work in movie fashion. (****Revise/Refine****),*
(E) *4.5 Formative Assessment -* ***Checking for Understanding****: Function Aerobics.* ***Timely Feedback:*** *Self: Checklist; Peer: Passalong; Teacher: Conference.* ***(Evaluate****)*
(T) *4.6* ***Tailors***
Logic: *Students will connect quadratic functions to the real world and give several examples.*
Visual: *Students will use their product, a movie, to visually display quadratic functions and how they relate to the real world.*
Musical: *Students will each be given a question; they will be put into groups based on their answers. Each group will then create a tune using their team members that involves their answer to the question (which will be a number). Eg. a tune 5 seconds long if one of the x intercepts was 5, a tune using 5 different objects around the room, etc...*
Kinethestic: *During the checking for understanding students will move their limbs to represent quadratic functions.*
Intrapersonal: *Students will be given time in order to think of how quadratic functions relate to the real world, coming up with a few examples.*
Interpersonal: *Students will then share their findings of how quadratic functions relate to the real world in small groups.*
(O) *4.7 Students will be able to illustrate a quadratic function and how it relates to the real world.* ***(Interpretation) Product:*** *Movie,* ***Number of Days:*** *2-3 (****Organize****)*

Stage 3: Plan learning experiences and instruction.

Consider the W.H.E.R.E.T.O. elements.

(W) *5.1 Students understand that exponential functions are different than other functions.* ***(Where)****, Real Life: Exponential functions can model how a skydiver can reach terminal velocity when jumping from a plain.* ***(Why)****, Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.* ***(What)***
(H) *5.2 To hook the students, I will have the lights off as they come into class and have a video up on the board. Once all the students come in and are seated the video will start, and it will be a roller coaster ride. After the video I will have them describe how this could relate to an exponential function.*
(E) *5.3 Students will know exponents, logarithms, asymptote, horizontal, vertical, basic log function, recognizing asymptotes. (****Equip****), A tree chart will help students be able to get a big picture of a concept and then expand on it. They will "branch" out on the different ideas within each concept to create a tree of ideas. Pairs check is a great way for students to work and help each other out. They will collaborate on answers with themselves and other pairs in the room after the prompt is over. (****Explore****), Individually, students will create a Glogster and show visuals about exponential functions and what they represent. (****Experience****)*
(R) *5.4 Four Corners will make students think logically about the question given to them. I will need to ensure that students actually go to the corner that they think rather than following the heard. This will provide a good basis for students to reflect and talk to other classmates about the question and why they picked their respected corners. (****Rethink),****Students will meet with the teacher and talk about their Glogster and its process. This will be a time for them to ask questions and make sure they understand how to predict an exponential function and what it represents.* ***(Rethink/Revise),*** *Students will use their checklist to make sure that they have all of the required information in their Glogster about the exponential functions and what they represent. (****Revise/Refine****),*
(E) *5.5 Formative Assessment -* ***Checking for Understanding****: Four Corners.* ***Timely Feedback:*** *Peer: Passalong; Teacher: Conference.* ***(Evaluate)***
(T) *5.6* ***Tailors***
Logic: *This is key for students in this section: to be able to look at a function and have a mental mindset of what it looks like.*
Visual: *The product, Glogster, will be a good visual aid for students to understand predicting exponential functions and what they represent.*
Kinthestic: *The checking for understanding will allow students to talk around the room to a corner that represents an answer, from there they will discuss.*
Intrapersonal: *Individual class work will be provided for students so they can work alone privately.*
Interpersonal: *Students will get together in groups and compare answers to questions proposed in class.*
Naturalist: *Students will take a concept of something that happens in nature, and relate it to an exponential function.*
(O) *5.7 Students will be able to predict an exponential function and what it represents.* ***(Explanation) Product:*** *Glogster,* ***Number of Days:*** *2-4 (****Organize****)*

Stage 3: Plan learning experiences and instruction.

Consider the W.H.E.R.E.T.O. elements.

(W) 6.1 Students understand that exponential functions are different than other functions. **(Where)**, Real Life: Exponential functions can show how a species of animals can repopulate very quickly. **(Why)**, *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.* **(What**)
(H) I will hook my students by bringing them outside and breaking the class up into several groups. I will be running, along with the help of other teachers/coaches, to show how an exponential function differs from other functions. I will start from standing and sprint, another teacher will run at a constant rate, and another teacher will start off slow, go faster, and then slow again. These will represent exponential, linear, and quadratic functions respectively.
(E) 6.3 Students will know exponents, logarithms, natural log, asymptote, horizontal, vertical, basic log function, log properties, recognizing asymptotes. (**Equip**), Students will use a describing wheel in order to cover the key ideas of a total concept. They will be able to put any details they want in the sections of the wheel, as well as what I instruct them to put in. Cooperative play will engage the students to work with specific materials that I provide them with to think about exponentials and how they work. For example I could provide them with a website to play around with different components of an exponent. Also, a scenario by which they would need to model with the use of an exponent, or even a graphing calculator so they can graph their own functions and see what they look like. (**Explore**), Students, in groups of two, will be responsible for creating a section in a virtual game of Jeopardy. If they each make a section, the final product will be the whole game in which they can play among themselves in the class. (**Experience**)
(R) 6.4 The class will be asked questions that they are to answer on their individual white boards. This addresses many intelligences and is a good way for the teacher to see the understanding of the students. I will have students who have the wrong answer meet with students who got the correct answer so they can resolve the problem. (**Rethink),** The students will use Passalong to get constructive criticism of their jeopardy ideas. This will allow them to enhance it and make it better before they need to submit it for final use. Each group will meet with the teacher to make sure that there are no uncertainties before the project starts, and that each student in the group has a good understanding of how to recognize the differences between exponentials and other functions. **(Rethink/Revise),** The students will use their checklists to ensure that they have all of the necessary materials in their Jeopardy game. (**Revise**/**Refine**),
(E) 6.5 Formative Assessment - **Checking for Understanding**: White Board Quiz. **Timely Feedback:** Self: Checklist; Peer: Passalong; Teacher: Conference. **(Evaluate**)
(T) 6.6 **Tailors**
Verbal: Using a white board quiz will allow students to write their answers down and demonstrate their knowledge on a white board.
Logic: Students will be able to decipher the difference between exponential functions and other functions by examining graphs, a table, and the function itself.
Visual: The hook will provide students with a good visual of exponential functions as they will be watching a video of the velocity vs. time of a roller coaster
Kinthestic: I will have students get up and move around into different groups to separate them for Jeopardy.
Intrapersonal: The describing wheel will make students work together in order to write down important information that happened in class.
Interpersonal: The product will make students work together in class to win Jeopardy.
(O) 6.7 Students will be able to recognize the difference between exponential functions and other functions. **(Self-Knowledge) Product:** Virtual Jeopardy, **Number of Days:** 2-3 (**Organize**)

Stage 3: Plan learning experiences and instruction.

Consider the W.H.E.R.E.T.O. elements.

Friday	5 *3.1 Quadratic Functions (W)* *3.2 Ping pong ball (H)* *3.3 Sandwich Chart (E)* *3.4 Self/Teacher assess (R)* *3.5 Thumbs up, Thumbs down (E-2)* *3.7 Perspective (O) 2-4 days*	10	15 Presentations
Thursday	4	9 *5.1 Exponential Functions (W)* *5.2 Roller Coaster Video(H)* *5.3 Tree Chart (E)* *5.4 Peer/Teacher assess (R)* *5.5 Four Corners (E-2)* *5.7 Explanation (O) 2-4 days*	14
Wednesday	3 *2.1 Linear Functions (W)* *2.2 Text on phone (H)* *2.3 Inverted Triangle (E)* *2.4 Self/Peer assess (R)* *2.5 Whip Around (E-2)* *2.7 Application (O) 2-4 days*	8	13 Performance task overview, explain rubrics, begin researching issue.
Tuesday	2	7 *4.1 Quadratic Functions (W)* *4.2 Bouncy Balls (H)* *4.3 Sequence Chart (E)* *4.4 Self/Peer/Teacher assess (R)* *4.5 Function Aerobics (E-2)* *4.7 Interpretation (O) 2-4 days*	12
Monday	1 *1.1 Linear Functions (W)* *1.2 Walk around room—graph DvsT (H)* *1.3 Clock Organizer (E)* *1.4 Self/Peer assess (R)* *1.5 Slap It (E-2)* *1.7 Empathy (O) 2-4 days*	6	11 *6.1 Exponential Functions (W)* *6.2 Teachers Run (H)* *6.3 Describing Wheel(E)* *6.4 Self/Peer/Teacher assess (R)* *6.5 Whiteboard (E-2)* *6.7 Self-Knowledge (O) 2-4 days*

Making A Presentation : Nearpod

Teacher Name: **Mr. Cabaniss**

Student Name: _____

CATEGORY	Phenomenal	Great	Not too shabby	Needs work
Required Elements 30%	The presentation includes all of the required elements(a poll, a draw it, and a video), as well as additional information about the chosen activity.	The presentation includes two out of the three required elements as well as additional information about the chosen activity.	The presentation includes one of the three required elements as well as additional information about the chosen activity.	The presentation did not have any of the required elements.
Originality 10%	Several of the features (visual, audio, kinesthetic, musical) surrounding the activity reflect an exceptional degree of student creativity in their creation and/or display.	One or two of the features (visual, audio, kinesthetic, musical) reflect student creativity in their creation and/or display.	The features (visual, audio, kinesthetic, musical) are made by the student, but are based on the designs or ideas of others.	No features (visual, audio, kinesthetic, musical) made by the student are included.
Detail and Creativity 15%	The presentation is exceptionally attractive in terms of design, layout, and neatness.	The presentation is attractive in terms of design, layout and neatness.	The presentation is acceptably attractive though it may be a bit messy.	The presentation is distractingly messy or very poorly designed. It is not attractive.
Understanding of Mathematical concepts 20%	Student can accurately answer 90-100% of the questions related to math in the presentation and processes used in the app to create the presentation.	Student can accurately answer about 75-89% of the questions related to math in the presentation and processes used in the app to create the presentation.	Student can accurately answer about 50-74% of questions related to math in the poster and processes used in the app to create the presentation.	Student appears to have insufficient knowledge (can answer less than 50% of the questions) about the math in the presentation or processes used in the app to create the presentation.
Work is shown 10%	Student illustrates 90-100% of the mathematical work in the presentation and it can be easily understood by peers.	Student illustrates 75-89% of the mathematical work in the presentation and it can be mostly understood by peers.	Student does not illustrate a majority of the mathematical work (50-75%); the work is hard to follow and confusing.	Student does not show any mathematical work (less than 50% is shown).
Understanding Nearpod 15%	The student shows an exceptional understanding of the program and would be able to present with it at a conference.	The student shows great understanding with the program and would be able to help out peers with it.	The student understands the program. A strong sense of understanding the program is not apparent.	The student does not understand how to use the program. The presentation is bogged down by the lack of understanding.

If outside sources were used, credits must be present in order to receive any credit for the presentation.

Date Created: **Sep 22, 2013 07:49 pm (CDT) By: Sean Cabaniss using RubiStar**

Oral Presentation Rubric : Process of Skydiving

Teacher Name: **Mr. Cabaniss**

Student Name: _____

CATEGORY	Phenomenal	Great	Not too shabby	Needs work
Comprehension 25%	Student is able to accurately answer almost all questions posed by classmates about the basics of the linear, quadratic, and exponential models.	Student is able to accurately answer most questions posed by classmates about the basics of the linear, quadratic, and exponential models.	Student is able to accurately answer a few questions posed by classmates about the basics of the linear, quadratic, and exponential models.	Student is unable to accurately answer questions posed by classmates about the basics of the linear, quadratic, and exponential models.
Professionalism 10%	The student looks ready for a presentation and acts in a very professional mannor.	The student looks and acts professional enough to convince the CEO.	The student is reasonably professional, however, not enough for a presentaion to the CEO.	The student does not present themselves in a professional mannor.
Preparedness 15%	Student is completely prepared and has obviously rehearsed the pitch to the CEO.	Student seems pretty prepared but might have needed a couple more rehearsals of the pitch to the CEO.	The student is somewhat prepared, but it is clear that rehearsal was lacking in the pitch to the CEO.	Student does not seem at all prepared to present the pitch to the CEO
Vocabulary 15%	Uses vocabulary appropriate for the presentation. Shows a deep understanding of the words associated with linear, quadratic, and exponential functions.	Uses vocabulary appropriate for the presentation. Shows an understanding of the words associated with linear, quadratic, and exponential functions.	Uses some acceptable vocabulary for the presentation. Shows a novice understanding of words associated with linear, quadratic, and exponential functions.	Does not use acceptable vocabulary for the presentation. Few words associated with linear, quadratic, and exponential function.
Posture and Eye Contact 15%	Stands up straight, looks relaxed and confident. Establishes eye contact with everyone in the room during the pitch to the CEO.	Stands up straight and establishes eye contact with everyone in the room during the pitch to the CEO.	Sometimes stands up straight and establishes eye contact during the pitch to the CEO.	Slouches and/or does not look at people during the pitch to the CEO.
Content 20%	Shows a full understanding of the basics of the linear, quadratic, and exponential models.	Shows a good understanding of the basics of the linear, quadratic, and exponential models.	Shows a good understanding of parts of the basics of the linear, quadratic, and exponential models	Does not seem to understand the basics of the linear, quadratic, and exponential models very well.

Date Created: **Sep 19, 2013 09:59 am (CDT) by Sean Cabaniss using RubiStar**

UNIVERSITY OF MAINE AT FARMINGTON
COLLEGE OF EDUCATION, HEALTH AND REHABILITATION

LESSON PLAN FORMAT

Teacher's Name: Sean Cabaniss **Lesson #:** 1 **Facet:** Empathy
Grade Level: 11-12 **Numbers of Days:** 4
Topic: Consider how linear equations relate to the real world

PART I:

Objectives
Student will understand that linear functions are used to resolve real world issues.
Student will know the following: linear, slope, intercepts, cartesian, coordinate, function, variable, slope intercept, point slope, graphing, rise over run.
Student will be able to be able to consider how linear equations relate to the real world.

Product: Nearpod

Maine Learning Results (MLR) or Common Core State Standards (CCSS) or Next Generation Science Standards (NGSS) Alignment

Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function*

Rationale: Student will get a good understanding of linear equations, including properties, graphs, and real world applications to create a Nearpod presentation. Through these understandings, they will be able to compare it to quadratic and exponential functions later in the unit.

Assessments

Pre-Assessment: (Lesson 1 only)
The teacher prepared pretest will consist of the rudimentary skills for linear, quadratic, and exponential functions. This will give me a basis for where students are starting in class so I can tier effectively.

Formative (Assessment for Learning)
Section I – checking for understanding during instruction
Slap It will consist of students using a fly swatter to "slap" answers on a table or on a wall. This will engage students, and show me if they understand the concepts of linear functions and how they are used to resolve real world issues.

Section II – timely feedback for products (self, peer, teacher)
Peers will use Passalong to give in depth feedback based on the quality, content, etc... of the project dealing with linear functions in the real world. Students will self-assess themselves by using a checklist to see if they have all of the components of their presentation. This will consist of the different real world applications as well as necessary parts of linear functions.

Summative (Assessment of Learning):
Nearpod (23.333 points): Have students create a presentation to show different uses of linear models. Students will explain the different components of a liner model and explain different original graphs by giving specific examples. They will work alone, although in pods for troubleshooting, on this project and be expected to share.

Integration

Technology: In this lesson, I will use Nearpod as the final product, and YouTube to look up math songs and engage the musical learners.

Content Areas: Students will walk around at the beginning of class and later examine how their walking represents a liner equation. This would connect to PE, as students are moving around and using their kinesthetic intelligence. I will provide a linear math song from YouTube that students will listen to in class. This will incorporate Music class, which would be the musical intelligence.

Groupings
Section I - Graphic Organizer & Cooperative Learning used during instruction
The graphic organizer, clock, will be used to logically put steps in order for understanding. The cooperative learning model, mix-freeze-pair, will enable students to walk around the room and meet with other students to discuss topics given by the teacher. After they discuss, they can ask questions or move on to the next individual and topic.

Section II – Groups and Roles for Product
The students will use Nearpod to create a presentation to the class about linear functions and how they are used to resolve real work issues. Students will work alone, although in pods for troubleshooting. They will be put into pods by their favorite number, and the lowest 1/5 of numbers will be pod one, the second lowest 1/5 of numbers will be pod two. Students will be expected to share these presentations in class. The teacher will score this product using a rubric.

Differentiated Instruction

MI Strategies

Verbal: During my lesson, I will frequently ask questions to the class so students will be able to respond verbally.
Logic: Students will be asked important questions like: why does this apply in the real world? What do certain components of a graph represent? etc...
Visual: Throughout the entire lesson I, as well as students, will have the opportunity to draw graphs and solve problems on the board.
Musical: I will show linear math song on YouTube for student to reference when they need to later on.
Kinesthetic: My hook will be my kinesthetic intelligence because students will be asked to walk around the room and then later graph their distance vs. time.
Intrapersonal: Students will have the opportunity to work on linear problems alone before they share with other students.
Interpersonal: I will have students share and compare answers on examples in class about real life applications of linear function.
Naturalist: Students will examine the height vs. time graph of a tree, and see how it grows in the first few years of its life.

Modifications/Accommodations
From IEP's (Individual Education Plan), 504's, ELLIDEP (English Language Learning Instructional Delivery Education Plan) *I will review student's IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*

Plan for accommodating absent students: Absent students can look online at videos that I provide to help understand the lesson if classes are missed. The student is still responsible for coming in to see me to discuss important aspects of the lesson that we covered. I will also have a screencast of this lesson for not only absent students, but students who want to relook at the lesson on their free time.

Extensions

Technology (SAMR): Nearpod is an example of redefinition on the SAMR model because it can include multiple multiple tools such as formative quizzes, polls, drawings, slideshows, and videos for each student. The program can be displayed on each and every student's laptop or iOS device so they are engaged and follow along in class.

Gifted Students:
If I have gifted students in the classroom, I will tier to make sure that they are challenged appropriately. I will do this by challenging students to do more difficult homework problems, but also giving them the option to do problems that are easier. By relating the lesson to the real world, I will encourage them to think critically.

Materials, Resources and Technology

- *Calculators*
- *Paper*
- *White board markers*
- The graphic organizer, clock
- 2 fly swatters for "Slap It"

Source for Lesson Plan and Research
Graphic Organizer: http://www.eduplace.com/graphicorganizer/
Cooperative
Learning: http://edu221resources.wikispaces.com/file/view/cooperative_learning_strategies.pdf/426402320/cooperative_learning_strategies.pdf
Rubric: http://rubistar.4teachers.org/
Math song for musical intelligence: http://www.youtube.com/watch?v=_oqKaT3V-Us
Nearpod: http://www.nearpod.com/
CFU: http://nelearn.myelearning.org/pluginfile.php/439/mod_page/content/17/strategies.pdf

PART II:

Teaching and Learning Sequence (Describe the teaching and learning process using all of the information from part I of the lesson plan)

Agenda

Class 1
Introductions: Go around the room to say your name and your favorite and least favorite thing about math (5 min)
Pass out and discuss syllabus (10 min)
Pre-Assessment (10 min)
Hook: Walking around class: (5 min)
Hand out and explain graphic organizer: Clock (5 min)

Discussion about hook: graph the different students' functions, talk about their slope, different ways to find slope, what it represents. Making an equation using point slope (30 min)
Exit ticket: each student needs to do 4 problems, and make up a real world application for each. They will do the four alone, and then meet in groups to discuss (15 min)

Class 2
Watch math song, take a short questionnaire quiz about general hobbies, likes, and dislikes (10 min)
Quick review of material (5 min)
Talk about changing point slope into slope intercept. Finding the y intercept and what it represents: putting it into a sentence (20 min)
Cooperative learning: mix-pair-share (15 min)
Introducing Nearpod (15 min)
Talking about rubric and expectations (15 min)

Class 3
Quick review from last class/answer questions (15 min)
CFU: Slap it (15 min)
Find pods for Nearpod, get in groups for in-class work on presentation. Teacher will meet with each student individually (50 min)

Class 4
Nearpod Presentations (80 min)

Teaching and Learning Sequence

The room will be set up into a "U" shape so students will be able to communicate with each other and they will theoretically stay engaged more. Students will understand that linear functions are used to resolve real world issues. They will will know the following: linear, slope, intercepts, cartesian, coordinate, function, variable, slope-intercept, point slope, graphing, and rise over run (see content notes below). Using these, studentswill be able to be able to consider how linear equations relate to the real world.

First, students will go around the room and tell everyone their name as well as their favorite and least favorite thing about math. I will then pass out the syllabus, discuss, and answer questions. The syllabus will outline the course for the students and give them a clear goal and understanding of where they are going in the course. The pre-assessment will follow and will give me a better understanding of all the students' prior knowledge. After the pre-assessment I will get into my hook where students will walk around the room at different speeds for one minute.

They will be put into groups so they know which speed each individual group is going at. This hook will be a nice segue into the content knowledge for the day. Before getting into the lesson, I will hand out the graphic organizer, clock, and it will be used to logically put steps in order for understanding. Next, we will look at graphs of different students' functions, talk about their slope, different ways to find slope, what slope represents, and making an equation using point-slope form. After students walk around the room, we will take a look at where they started, the origin, and where they ended, their second point. (if they walk slow: distance=30m, medium: distance=45m, fast: distance=60m) Plotting these points on a graph will then make a line.These points are coordinates on the cartesian coordinate plane. This line is infinite, meaning it goes on forever. This line is a position vs. time, and the line has a slope. The formula for finding the slope is y2-y1/x2-x1. If we take the six points: [(0,0), (60,30)], [(0,0), (60,45)], [(0,0), and (60,60)], we can see which people were walking at faster by the answer we get from plugging the points in to the slope formula. *If we take the first set of points: (0,0), and (60,30), the slope will look like 30-*

0/60-0=1/2. How is this applied to what we did? Well, what are the independent and dependent variables? Y, the dependent variable, is distance, while x, the independent variable, is time. If we have y points over x points for the slope we just found, we would have 1 meter/2 seconds. The second set of points will reveal that they were walking slightly faster, and the last set of points will show that they were walking the fastest. EXAMPLE FOR HOOK. There is another way to find the slope: Rise over run. Look at the graph, y is rise, x is run. If we count up to 30, and then over to 60, it is 30/60, or 1/2. EXAMPLE 2. Because we have a slope, we can create an equation for the line in point-slope form (y-y1)=m(x-x1). Point slope is a way for students to put a point and a slope, hence "point-slope", into this formula and get an equation for a line. If we put in the point: (60,30), and the slope: 1/2, we get (y-30)=1/2(x-60). EXAMPLE 3. Lastly students will be given four problems and be asked to complete them individually. Before they leave the class they will relate each problem to the real world, and meet with other students to discuss what they answered. This will be their EXIT TICKET.
Where, Why, What, Hook, Tailors: Verbal, Logic, Visual, Intrapersonal, Interpersonal

At the beginning of the class students will listen to a linear math song. This will hopefully be a mini hook. During this I will hand out a short questionnaire about their hobbies and interests. SEE HAND OUT 2. Next is the quick review of material from last class. Point-slope isn't necessarily the most ideal form to have the equation in for graphing the line. Let's look at point-slope, and manipulate it a little bit. (y-y1)=m(x-x1) where we will distribute m to get y-y1=mx-mx1. Add y1 to both sides to isolate y and get y=mx-mx1-y1. Keep in mind that m, x1, and y1 are numbers. Let's look back at last class where we left off with (y-30)=1/2(x-30). Through distribution we get y-30=(1/2)x-30. Solve for y by adding 30 to both sides, we get y=(1/2)x+0. Changing point-slope into y-intercept makes it easier for us to plug in values and find coordinates for the graph. EXAMPLE 4. We can also see the y-intercept and the slope very easily.What does that zero represent? The 0 is the y intercept, or where the line intersects they y-axis. Put this it a sentence that applies to what we just did. When the time (x) was zero, our y (distance) was also zero. This means that we had not traveled any distance at time zero. What can our equation tell us? Our equation tells us, because it is infinite, that we can plug in any x value to find out how far we would have traveled at that time, and any y value to find out how long it would take us to travel a certain distance. This is all assuming that we have not changed speeds. For example, looking at the two points, we could say something like: at time 0, I was in tree 5 feet in the air. When the time started, I climbed to ten feet. It took me 5 seconds to climb that high. EXAMPLE 5. In the slope-intercept form, the last number that is a constant is the y-intercept. This tells us where the line crosses the y-axis. Then I will have students prepare for mix-pair-share. They will walk around the room until I shout pair, and they find a partner to talk about a prompt for a couple minutes. The prompts are listed below. Following this I will explain Nearpod to the students and demonstrate how to create presentations, publish, and share. I will also go over the rubric and the expectations of the project so the students know what they are doing.
Equip, Explore, Rethink, Tailors: Kinesthetic, visual, logical, naturalistic

Students will be able to be able to consider how linear equations relate to the real world. The class will have time to ask questions. Next we will play Slap It which will consist of students using a fly swatter to "slap" answers on the board. The questions are posed below. Following students will be put into groups by oldest to youngest in the class. For the remainder of the class they will have time to ask questions and work on their projects in their groups. Nearpod (23.333 points): Have students create a presentation to show different uses of linear models. Students will explain the different components of a liner model and explain different original graphs by giving specific examples. The students will use Nearpod to create a presentation to the class about linear functions and how they are used to resolve real work issues. Students will work alone, although in pods for troubleshooting. They will be put into pods by their favorite number, and the lowest 1/5 of numbers will be pod one, the second lowest 1/5 of numbers will be pod two. Students will be expected to share these presentations in class.
Explore, Experience, Revise, Refine, Tailors: Kinesthetic, intrapersonal**.**

The teacher will score this product using a rubric. Peers will use Passalong to give in depth feedback based on the quality, content, etc... of the project dealing with linear functions in the real world. They will pass their ideas along so that students can give positive as well as constructive feedback to their peers to help advance their projects. Students will self-assess themselves by using a checklist to see if they have all of the components of their presentation.
Evaluate, Tailors: Interpersonal, intrapersonal.

Content Notes
Student will know the following: Linear: a line that has a constant slope throughout an infinite number of points. Slope: the rate at which at line changes. Intercepts: A point at which a line crosses or touches the x axis or y axis. Cartesian: A graph used to plot points. Coordinate: An ordered pair that are used to graph on the Cartesian plain. Function: Similar to an equation, however, points can be plugged in to get outputs necessary for graphing. Variable: In this instance, x, y, or m, that are unknowns. We will find them by solving for them when the others are known. Slope-intercept: A formula that is in a specific format to find the slope and the y-intercept very easily. (y=mx+b where m is the slope, and b is the y-intercept). Point-slope: A formula that is used to plug in a point and a slope. This is used to find point-slope after manipulation. Graphing: Plotting points, or coordinates, on a graph, and making lines from the graph. Rise over run: Another way to find the slope of an equation by counting the difference in y and dividing it by the difference in x.

EXAMPLES OF HOOK:
You have the two points: (3,4), and (4,7), find the slope. Answer: 7-4/4-3 = 3/1 = 3.
You have the two points: (-4,-5) and (-1,3), find the slope. Answer: 3-(-5)/-1-(-4) = 2/3.
You have the two points: (0,8) and (6,-2), find the slope. Answer: -2-8/6-0 = -10/6 = -5/3.

EXAMPLE 2:
Provide graph with the line that goes through the points (0,0) and (3,2). Answer: up 2, over 3, 2/3.
Provide graph with the line that goes through the points (-2,-2) and (2,2). Answer: up 4, over 4, 4/4 = 1.
Provide graph with the line that goes through the points (-1, 6) and (4,1). Answer: down 5, over 5, -5/5 = 1.

EXAMPLE 3:
Put the point and slope into the equation (0,0) and m=4. Answer: (y-0)=4(x-0)
Put the point and slope into the equation (55, 20) and m= -8. Answer: (y-20)= -8(x-55)

Exit Ticket: Take the following points, find the slope, and relate them to the real world in your own way.
(0,0), (5,3). Answer: Slope= 3/5. I rolled a bowling ball town the lane and at 5 seconds it was at 3 yards. It was traveling at 0.6 yards/second.
(0,0), (25,75). Answer: Slope= 75/25 = 3. A plane was taking off from a runway and when it reached 25 seconds it was at 75 meters. Its elevation was increasing at 3 meters/ second.
(0,0), (1,8). Answer: Slope= 8. A bear is climbing a tree, and after 1 second he is 8 feet up the tree. He is climbing at 8 feet/second.

EXAMPLE 4:
Take the following point-slope equations and put them into slope-intercept.
(y-1) = 4(x-5). Answer: y-1=4x-20. y=4x-19.
(y-0) = -3/2(x-12). Answer: y=(-3/2)x+18.
(y+6) = 2(x+3). Answer: y+6=2x+6. y=2x.

EXAMPLE 5:

For the following points, find the slope, and explain with a real world scenario what it means with the slope.
(0,3), (5,15). Answer: At time zero, I was driving at 3 feet/second, and at time 5 seconds, I was driving at 15 feet/second. My speed was increasing at 12 feet/5 seconds.
(0,22), (44,44). Answer: At time zero, I had already eaten 22 Cheetos, and at time 44 seconds, I had eaten 44 Cheetos. I was eating Cheetos at 1 Cheetos/2 seconds.

PROMPTS FOR MPS:
Take these points and create a real world scenario using the slope, and the y intercepts.
Pair 1: (0,0) (5,12)
Pair 2: (0,2) (4,1)
Pair 3: (2,2) (7,3)
Pair 4: (3,4) (6,1)

SLAP IT:
Slap the correct graph on the board from the list of functions
j. y=2x
c. (y-2)=4(x+2)
a. y=4x-2
g. (y+3)=(x-1)
h. (y-1)=x
i. y=8x+1
b. y=x
e. (y+1)=1/2(x-6)
d. y=(1/3)x-1
f. (y-20)=(x+22)

Handouts
Short Questionaire
Exit Ticket
clock

Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale

Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Learning Styles

Clipboard: I will accommodate for the clipboard by using sequential learning, visual directions and clear expectations. My notes are put into a specific order so that students will get the most from the lesson, some directions will be on handouts and some will be on the board, and the syllabus will have the clear expectations for the class.

Microscope: I will pose a lot of questions to students so they can discover their learning before it is taught to them. Several discussion sessions will be used so students will be able to participate and further their research within the content.

Puppy: In my first class, I will have students recite an oath saying that they can ask any questions whenever they want and I will not judge them. I will make my class judgement free so that everyone can feel comfortable asking questions. Many times students have questions that they want to ask but keep it to themselves; however, I don't want students to miss out on information.

Beach Ball: Students will be able to choose how functions relate to the real world. I will compile resources from different places and use different teaching techniques to reach out to the beach ball.

Rationale: This lesson shows that I have mastered the standard because I provide students with in-depth information on linear functions and their meaning. Connecting the linear functions to the real world allows students to understand why this information is important. I present the information in a way that allows students to get a good understanding of the content and they will continue to learn throughout their summative assessment.

Standard 6 - Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Formative: Slap It will consist of students using a fly swatter to "slap" answers on a table or on a wall. This will engage students, and show me if they understand the concepts of linear functions and how they are used to resolve real world issues.

Summative: Nearpod (23.333 points): Have students create a presentation to show different uses of linear models. Students will explain the different components of a liner model and explain different original graphs by giving specific examples.

Rationale: The students will use the formative and summative assessments to get a better understanding of the content area. Through the use of both of these assessments they will be able to further their learning through peer teacher rather than the teacher teaching.

Standard 7 - Planning Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Content Knowledge: They will will know the following: linear, slope, intercepts, cartesian, coordinate, function, variable, slope-intercept, point slope, graphing, and rise over run.

MLR or CCSS:
Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function*

Facet: Empathy.

Rationale: The students will have a good understanding of most components dealing with linear equations. As this

is their first lesson, they will continue to learn more about linear functions in lesson two, as well as quadratics and exponentials in lessons 3-6. For now, they have been introduced to linear functions and will have a good basis moving forward.

Standard 8 - Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

MI Strategies:
Verbal: During my lesson, I will frequently ask questions to the class so students will be able to respond verbally.
Logic: Students will be asked important questions like: why does this apply in the real world? What do certain components of a graph represent? etc...
Visual: Throughout the entire lesson I, as well as students, will have the opportunity to draw graphs and solve problems on the board.
Musical: I will show linear math song on YouTube for student to reference when they need to later on.
Kinesthetic: My hook will be my kinesthetic intelligence because students will be asked to walk around the room and then later graph their distance vs. time.
Intrapersonal: Students will have the opportunity to work on linear problems alone before they share with other students.
Interpersonal: I will have students share and compare answers on examples in class about real life applications of linear function.
Naturalist: Students will examine the height vs. time graph of a tree, and see how it grows in the first few years of its life.

Type II Technology: In this lesson, I will use Nearpod as the final product, and YouTube to look up math songs and engage the musical learners. Nearpod is an example of redefinition (type II technology) on the SAMR model because it can include multiple multiple tools such as formative quizzes, polls, drawings, slideshows, and videos for each student. The program can be displayed on each and every student's laptop or iOS device so they are engaged and follow along in class.

Rationale: Throughout my lesson I use a variety of teaching strategies and technologies that facilitate student learning. Through accommodating for the eight MI strategies, I am able to reach out to students and make sure that they have a deep understanding of the content I am presenting to them. By connecting all of my information to the real world, students will build skills and apply knowledge in meaningful ways.

NETS STANDARDS FOR TEACHERS

1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

a. Promote, support, and model creative and innovative thinking and inventiveness

b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources

c. Promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes

d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments

Rationale: I chose 1. b. because I am basing my instruction on real world applications of the content. Students will be presented with real world scenarios before mathematics portion is introduced. I will encourage critical thinking for students to come to understand the concepts and use a variety of type II technologies to enhance students' learning.

2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S.

a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity

b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress

c. Customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources

d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching

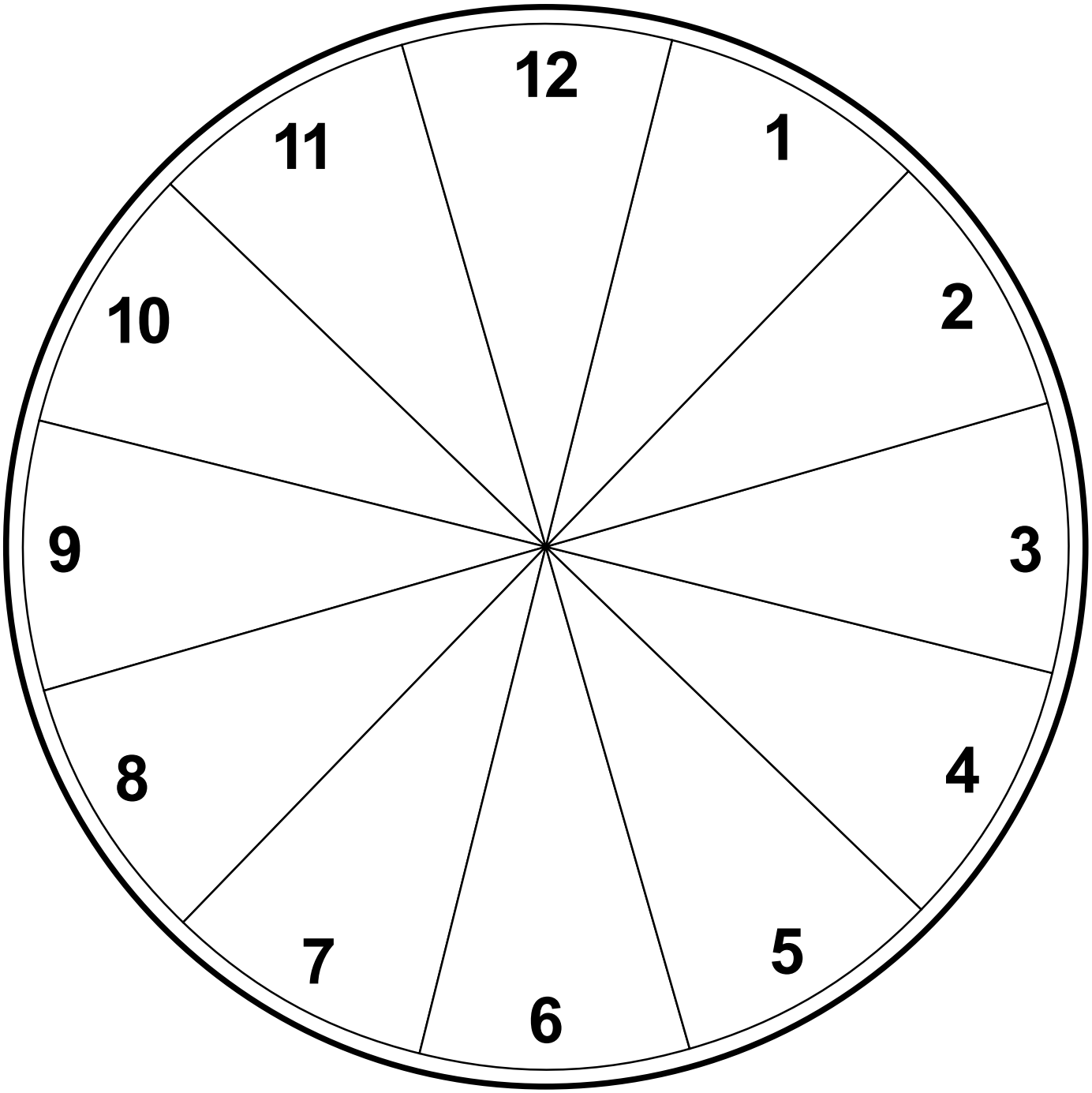
Rationale: I chose 2. c. because I have a wide variety of activities for students to learn from. By incorporating the eight intelligences into my lesson, I am accommodating to students' diverse learning styles.

Name _____ Date _____

Clock

Write details in time order in each section. Not all sections need to be filled in.

Topic _____



Short Questionnaire
Name:

1. What is your favorite hobby?_____.
2. What is your favorite subject?_____.
3. How do you learn best?_____

_____.
4. What can I do that will help you out in the classroom?_____

_____.

Exit Ticket
Name:

Please find the slope for each set of points and relate each to the real world:

1. (0,0) , (5,6)

2. (0,0) , (25,50)

3. (0,0) , (3,15)

UNIVERSITY OF MAINE AT FARMINGTON
COLLEGE OF EDUCATION, HEALTH AND REHABILITATION

LESSON PLAN FORMAT

Teacher's Name: Mr. Cabaniss **Lesson #:** 2 **Facet:** Application
Grade Level: 11-12 **Numbers of Days:** 3
Topic: Consider how linear equations relate to the real world

PART I:

Objectives
Students will understand that linear functions are used to resolve real world issues.
Students will know the following: x-intercepts, standard form, making a table.
Students will be able to design a linear function and relate it to a real life situation.

Product: Prezi

Maine Learning Results (MLR) or Common Core State Standards (CCSS) or Next Generation Science Standards (NGSS) Alignment
Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function*

Rationale: Students will exhibit mastery in this lesson by presenting a Prezi to the class. They will understand other linear forms that were not discussed in lesson 1, and be able to create their own linear function that they can relate to themselves.

Assessments

Formative (Assessment for Learning)
Section I – checking for understanding during instruction
Whip Around will consist of the teacher posing a question to the students. The students will come up with three ideas for the question and stand up. The teacher will call on students at random to say one of their ideas for the question. If their idea is called and other students have a similar one they can all cross it off their lists. This process will continue until all the students have crossed everything off their lists and are sitting. This is a good kinesthetic activity for students to demonstrate their knowledge and get a good understanding of the content.

Section II – timely feedback for products (self, peer, teacher)
Students will work with each other using Passalong to give in depth positive and constructive feedback to each other about their Prezi information. They will design a linear function that relates to the real world, and through this feedback, students will be pushed to a new level of thinking and creativity of their presentation. Students will use a checklist to ensure that they have all the necessary components of their Prezi and that is meets all of the requirements. Having this checklist is important so students will know the necessary components of their presentation.

Summative (Assessment of Learning):
Prezi (23.333): Students will show real world linear models, use pictures, and explain processes. You will need to

include at least six (6) stages of work, three (3) of which will be different and original real world applications. The dependent variable should not be reused in any of the problems, meaning you will examine multiple real world applications. If this is going to be on the internet for others to view, be sure that you get permission to use all pictures and information, unless it is in the public domain or creative commons.

Integration

Technology: In this lesson I will use technology in a couple of ways: the hook will consist of students using their phones to send a text, and the summative will be a Prezi created by students.

Content Areas: Art is included in this lesson as students will be including graphics into their Prezi presentation. Even though the students are not physically drawing they are still constructing artwork digitally to go in the presentation.

Groupings

Section I - Graphic Organizer & Cooperative Learning used during instruction

The use of an inverted triangle will allow students to create a hierarchy of importance for relating linear functions to a real life situation. This way they can put what they think is the most important in the biggest box. The cooperative learning exercise, one stray, will let students compare answers of problems with multiple groups and share information. Some students will be advised to walk around and bring concepts to other groups.

Section II – Groups and Roles for Product

In pairs, students will create a Prezi that demonstrates their mastery of creating linear functions that relate to the real world. Students will be put into pairs by a random name generator that can be found online. Each team will be expected to share their presentation, and the teacher will score the presentation using a rubric.

Differentiated Instruction

MI Strategies

Verbal: During the checking for understanding, Whip Around, students will be asked to share their answer to a question with the class.
Logic: Because the students are connecting linear functions to the real world they are logically thinking how and why the linear functions connect using specific examples.
Visual: With the product, Prezi, students will be expected to create an aesthetically pleasing Prezi, that will visually capture how to design a linear function.
Kinthestic: I will have students move around the room to other table to discuss their answers with their classmates.
Intrapersonal: Providing students time to work alone in class on select problems will focus on their intrapersonal intelligence.
Interpersonal: The hook will have students use their phones and communicate with other people.

Modifications/Accommodations

From IEP's (Individual Education Plan), 504's, ELLIDEP (English Language Learning Instructional Delivery Education Plan) *I will review student's IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*

Plan for accommodating absent students: Absent students can look online at videos that I provide to help understand the lesson if classes are missed. The student is still responsible for coming in to see me to discuss important aspects of the lesson that we covered. I will also have a screencast of this lesson for not only absent students, but students who want to relook at the lesson on their free time.

Extensions

Technology (SAMR): The product, Prezi, is considered modification because it has advanced characteristics to a poster. It uses technology to enhance it and make the content come alive. You can use animations and graphics to

make the presentation aesthetically pleasing, engaging, and interactive.

Gifted Students: If I have gifted students in the classroom, I will tier to make sure that they are challenged appropriately. I will do this by challenging students to do more difficult homework problems, but also giving them the option to do problems that are easier. By relating the lesson to the real world, I will encourage them to think critically.

Materials, Resources and Technology

- Graphic organizer: inverted triangle
- Calculator
- White board markers
- Erasers

Source for Lesson Plan and Research
Random Student Generator: http://www.classtools.net/main_area/fruit_machine.swf
Graphic Organizer: http://www.eduplace.com/graphicorganizer/
Cooperative Learning:
http://edu221resources.wikispaces.com/file/view/cooperative_learning_strategies.pdf/426402320/cooperative_learning_strategies.pdf
Rubric: http://rubistar.4teachers.org/
CFU: http://nelearn.myelearning.org/pluginfile.php/439/mod_page/content/17/strategies.pdf
Standard Form: http://www.mathsisfun.com/algebra/standard-form.html
Linear Equations: http://www.mathwarehouse.com/algebra/linear_equation/real-world-application.html
Prezi: http://prezi.com/

PART II:

Teaching and Learning Sequence (Describe the teaching and learning process using all of the information from part I of the lesson plan)

Agenda

Day 1:
Graphic organizer (5 min)
Hook: Cell phones and texting (10min)
Discussion about hook, creating linear equations from scratch, and standard form (35 min)
Introduce summative assessment: Prezi (15 min)
Assign partners for Prezi, meet, and discuss (15 min)

Day 2:
Talk about x-intercepts and making a table (20 min)
One Stay (10 min)
CFU: Whip Around (15 min)
Work time for Prezi (35 min)

Class 3:
Prezi Presentations (80 min)

Teaching and Learning Sequence

The class will still be arranged in a horseshoe shape so students will be able to work together and be engaged in the classroom. Students understand that linear functions are used to resolve real world issues. First the graphic organizer, inverted triangle, will be passes out. It will allow students to create a hierarchy of importance for relating

linear functions to a real life situation. This way they can put what they think is the most important in the biggest box. The hook will require that all students take out their phones and send someone they know a text. This will probably grab students' interest as they are not able to do this in other classes. Have them send it to someone they know will text back, not someone else in the school! If they get the person to text back, they get a mini prize. They have 10 minutes from when they sent the text to see if someone will respond. This leads into the first real life example of the hook. What if you have Verizon Wireless as your phone company (you don't have one of those fancy plans), and you want to see how much it will cost you to text in the upcoming month. You know that they charge a flat monthly rate of $20.00, but they also charge $0.20 a text. How many texts do you send a month, on average? Have someone in the room take a calculator and average everyone's answers. Take that number and use it to find out how much money it will cost them to send that many texts. What is our first step? What part of this is varied, meaning what will change? What won't change? What are the independent and dependent variables? ANSWER: If we don't have any points from a graph, what we can do is analyze the information given. If we know that you are charged a flat rate of $20.00 per month, that is not going to change throughout the month, so that will be our initial starting point, or our y-intercept. When time is 0, our cost is $20. What is being varied is how many texts we are sending. This is why it is multiplied by the x. So we get the equation y=0.2x+20. Now we can take this and find out how much money we will spend no matter the amount of texts we send (granted we send >0). How much for 20 texts? ANSWER: $24.00. How much for 100 texts? ANSWER: $40.00. How much would it cost to send the amount of texts as the person in the room who sends the most? Ex. 1200? ANSWER: $260.00. EXAMPLE 1.

Now we will do a quick exercise on manipulating variables to get the form Ax+By=C, or standard form. Someone give me one of their examples that they just did on the exercise. For example: Susie is riding her bike at 5 miles per hour, and has already traveled 2 miles. Find out how far she has traveled in 2 hours. What does our equation look like? What is the variable? What is the constant, or our initial value? ANSWER: y=5x+2. In two hours she would have traveled 12 miles having already started two miles ahead of the game. So if we take this equation and put it into standard form with A, B, and C being constants, what does it look like? What are A, B, and C? ANSWER: A is 5, B is 1, and C is 2. By manipulating and getting the constant alone we have 5x-y = -2. Generally we want the leading term to be positive, although it really isn't too big a deal. I multiplied the equation by (-1) to get the leading term to be positive. EXAMPLE 2. Why is this important? Because in the future you will need to solve systems of equations that will require equations be set up like that to compare them. As for now, we will just manipulate them.
Where, Why , What, Hook Tailors: Interpersonal, intrapersonal, spatial, logical, verbal.

In the last lesson we talked about y-intercepts and their meaning. X-intercepts have a meaning as well. When a line crosses the x axis (somewhere other than the origin), it then means that y is zero, and x is some number that means something about the equation. For example the point (2,0) and slope 4. What does this mean? ANSWER: A runner is at the starting line. When the gun is shot the runner waits 2 seconds and then starts to run at 4 meters per second. If the runner's opponent started running from time zero at the same rate, who will win the race if it is a 400m race. ANSWER: y=4x-8 for the runner who started late, after 400m, the runner takes 102 seconds or 1 minute and 42 seconds. The other runner's equation looks like y=4x. After 400m it took the runner 100 seconds, or 1 minute and 40 seconds.

It is important to make a table sometimes to visually get a grip of the points from the function. For example with the two equations we just used, we can make two tables with x and y values. X, being the input, and y, being the output. What would the first few points for the first equation y=4x-8 look like? ANSWER: (x(0) y= -8), (x(1) y= -4), (x(2) y=0), (x(3) y=4). What other reasons would tables be helpful? ANSWER: Getting a table can be helpful for finding slope, creating a line, and easily viewing points on a line.

The cooperative learning exercise, one stray, will let students compare answers of problems with multiple groups and share information. Some students will be advised to walk around and bring concepts to other groups. Whip Around will consist of students listing three items after the teacher poses the question. Then students will all stand, and the teacher will call on students at random to say one of their items. If their topic is called they can sit. This process will continue until all the students are sitting. This is a good kinesthetic activity for students to test their knowledge. .
Equip, Explore, Rethink, Tailors: Kinesthetic, spatial, interpersonal, logical, verbal.

Students will work with each other using Passalong to give in depth positive and constructive feedback to each other about their Prezi and how they can design a linear function that relates to the real world. Prezi (23.333): Students will have a summative assessment that involves them creating a presentation on Prezi with another student. They will show real world linear models, use pictures, and explain processes. Students will need to include at least six (6) stages of work, three (3) of which will be different and original real world applications. The dependent variable should not be reused in any of the problems, meaning you will examine multiple real world applications. If this is going to be on the internet for others to view, be sure that you get permission to use all pictures and information, unless it is in the public domain or creative commons. Students will be split up into groups using the random name generator
Explore, Experience, Revise, Refine, Tailors: Spatial, interpersonal, intrapersonal.

Students will be able to design a linear function and relate it to a real life situation. Students will use a checklist to ensure that they have all the necessary components of their Prezi and that is meets all of the requirements.They will be evaluated on their Prezi's using a rubric.
Evaluate, Tailors: Spatial, Intrapersonal.

Content Notes
Students will know the following: X-intercepts: The point at which a line crosses the x-axis. Standard form: A form for a linear equation that makes it easier for viewing, and setting up systems of equations. Making a table: The set of points: f(x), y, that represent a specific line.

EXAMPLE 1
In the previous example we looked at Verizon Wireless' rates. Would it be better to switch to U.S. Cellular, who charges a $30 flat rate fee, but $0.15 per text if you send 20 texts, 100 texts? ANSWER: y=0.15x+30. y(20)= $33.00 <--- more money. y(250)=$67.50 <--- less money.

A cab company owned by Mr. CABaniss charges flat rate $5.00 for whoever steps in the cab, and $0.50 for every mile. What does the equation look like? Find f(2), f(10), f(50). ANSWER: f(x)=0.5x+5. f(2)=$6.00. f(10)=$10.00. f(50)=$30.00

Create your own real life linear equation and fine two points.

EXAMPLE 2
Take the following linear equations and put them into standard form.
y+x=1
-6x=3y+1
-2y=-12x+6
4=3x+2y

Handouts
Graphic Organizer: Inverted Triangle

Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale

Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Learning Styles

Clipboard: In this lesson I will make it accessible for the clipboard to learn by providing clear and visual directions. The worksheets will be detailed and give clear expectations of what is expected of the student. When we

use whip around, I will put their ideas on the board so students will be able to see what other students say and in what order they are presented.

Microscope: The microscope will have plenty of opportunities to learn well in this lesson because I will introduce many questions that will lead into discovery learning. They will want to dig deeper into information, and I will focus on details to help them get the most from it.

Puppy: I will always have a safe and judge free learning zone. For example, in our CFU, whip around, students will be expected to say ideas to the class and write them down. No ideas will be made fun of or patronized. All questions are accepted and will be answered seriously.

Beach Ball: I have accommodated for the beach ball by giving them personal freedom on multiple activities and handouts. The students will be able to create their own real world applications of the material with their own numbers. This will demonstrate to me that they are understanding the information as well. Also doing a variety of activities will keep the beach ball engaged and make them want to learn.

Rationale: I have successfully achieved integrating the learning styles into my classroom because of the way I have accommodated for each and every type of student. All students learn differently and have different personalities, of course, so it is my job to work with all of them to help them learn the best. By having a variety of activities, examples, and choices, the students in the class will learn the best and have the best opportunity to learn.

Standard 6 - Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Formative:
Whip Around will consist of the teacher posing a question to the students. The students will come up with three ideas for the question and stand up. The teacher will call on students at random to say one of their ideas for the question. If their idea is called and other students have a similar one they can all cross it off their lists. This process will continue until all the students have crossed everything off their lists and are sitting. This is a good kinesthetic activity for students to demonstrate their knowledge and get a good understanding of the content.

Summative:
Prezi (23.333): Students will show real world linear models, use pictures, and explain processes. You will need to include at least six (6) stages of work, three (3) of which will be different real world options. The dependent variable should not be reused in any of the problems, meaning you will examine multiple real world applications. If this is going to be on the internet for others to view, be sure that you get permission to use all pictures and information, unless it is in the public domain or creative commons.

Rationale: By doing these formative and summative assessments, students will demonstrate to me that they understand the knowledge. Whip around will enable them to think about the different components of the information I am teaching them, while the Prezi will allow them to work in groups of two and learn from each other. Because they will be presenting the Prezi's in class, they will continue to learn from each presentation.

Standard 7 - Planning Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Content Knowledge: Students will know the following: x-intercepts, standard form, making a table.

MLR or CCSS or NGSS
Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models

Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function*

Facet: Application

Rationale: I have met this standard because the students will have an even deeper understanding of linear functions, graphing, and how they all connect to the real world even after the first lesson. They will be able to make important connections to the real world including situations that they may deal with everyday.

Standard 8 - Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

MI Strategies:

Verbal: During the checking for understanding, Whip Around, students will be asked to share their answer to a question with the class.
Logic: Because the students are connecting linear functions to the real world they are logically thinking how and why the linear functions connect using specific examples.
Visual: With the product, Prezi, students will be expected to create an aesthetically pleasing Prezi, that will visually capture how to design a linear function.
Kinthestic: I will have students move around the room to other table to discuss their answers with their classmates.
Intrapersonal: Providing students time to work alone in class on select problems will focus on their intrapersonal intelligence.
Interpersonal: The hook will have students use their phones and communicate with other people.

Type II Technology: In this lesson I will use technology in a couple of ways: the hook will consist of students using their phones to send a text, and the summative will be a Prezi created by students. The product, Prezi, is considered modification because it has advanced characteristics to a poster. It uses technology to enhance it and make the content come alive. You can use animations and graphics to make the presentation aesthetically pleasing, engaging, and interactive.

Rationale: I will capture all of the intelligences by integrating them into the lesson through physical and hands-on activities, group work, individual work, and verbal exercises. By applying a type II technology to the lesson, students will have a great opportunity to get involved with it and use it to help them learn better.

NETS STANDARDS FOR TEACHERS
1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.
a. Promote, support, and model creative and innovative thinking and inventiveness

b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources

c. Promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes

d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments

Rationale: I met 1. c. because I will provide students with a graphic organizer on the first day of this lesson. This will allow them to think, plan and be creative with their storage of notes and information. Through the use of the student checklist, the students will be able to reflect on their work and determine whether or not it is done well

enough or has the required elements.

2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S.

a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity

b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress

c. Customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources

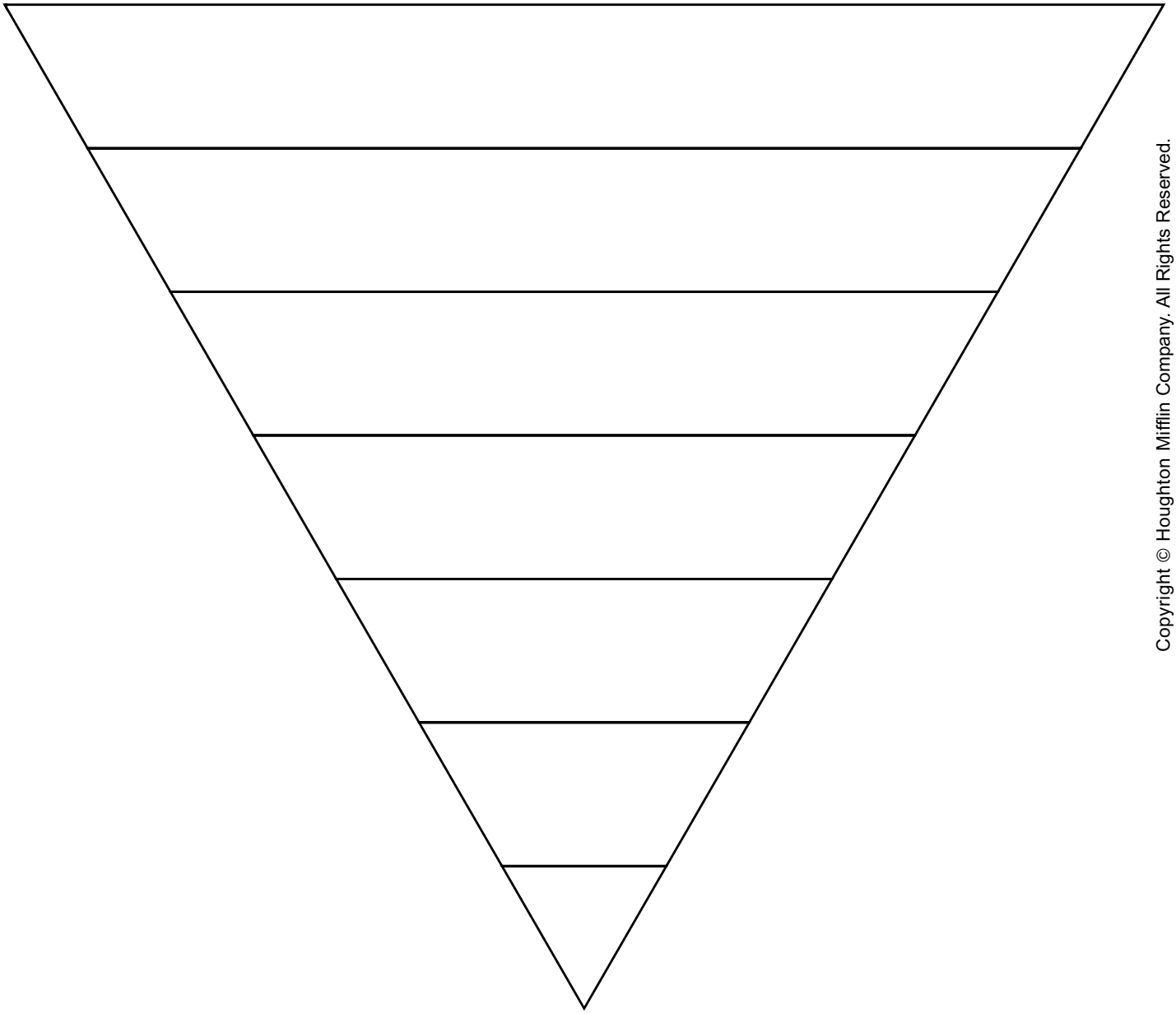
d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching

Rationale: I met 2. a. because I will use a few different technologies in this lesson plan. While it may seem minor, the use of the random name generator is a good example of the use of technology and how it can be used to solve problems. The students, in groups, will also use Prezi, a great type II technology, to demonstrate their knowledge as well as learn the content through each other's presentations.

Name _____ Date _____

Inverted Triangle

Write a broad topic on the top line. Write one part of the topic on the next line. Write one part of that topic below it. Keep going until you get a focused topic.



UNIVERSITY OF MAINE AT FARMINGTON
COLLEGE OF EDUCATION, HEALTH AND REHABILITATION

LESSON PLAN FORMAT

Teacher's Name: Mr. Cabaniss **Lesson #:** 3 **Facet:** Perspective
Grade Level: 11-12 **Numbers of Days:** 3
Topic: Students will be able to analyze a quadratic function's properties.

PART I:

Objectives
Students will understand that different types of quadratics represent real world issues.
Students will know quadratics, maximum, minimum, parabola, vertex, quadratic formula, finding x-intercepts, finding minimum and maximum points.
Students will be able to analyze a quadratic function's properties.

Product: Blog

Maine Learning Results (MLR) or Common Core State Standards (CCSS) or Next Generation Science Standards (NGSS) Alignment
Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function*

Rationale: By creating a blog, students will be able to see progress of what that they have learned. They will update their blog after each lesson for homework so they can see the logic in quadratics. While they will not know all of quadratics, they will get the basic understanding throughout this lesson, which will be important leading into the next lesson. That is why creating the blog will help them to have and see steps.

Assessments

Formative (Assessment for Learning)
Section I – checking for understanding during instruction
Thumbs up, thumbs down is a good way for students to express their comfortability of the content so I can decide whether I need to spend more time on specific items or move on.

Section II – timely feedback for products (self, peer, teacher)
Students will meet with the teacher to have a conference about their blog posts to make sure everything is going on schedule and that they have the correct understanding of the task at hand. They will have a checklist to ensure they have the appropriate information covered in their blogs and that it meets all of the criteria.

Summative (Assessment of Learning):
Blog (23.333 points): Regularly update blogs to talk about different properties like minimums/maximums, x-intercepts, concavity, etc... You should have at least four (4) blog posts--one of which sums up all of the properties learned. Include one personal image in each of the blog posts. It would be ideal to post a blog post after each class so you are current with the properties of quadratics.

Integration

Technology: The students will use a blog that they create online in order to show what they have learned throughout the lesson.

Content Areas: The use of a blog will relate to English Language Arts because students will express their knowledge through words.

Groupings

Section I - Graphic Organizer & Cooperative Learning used during instruction

The sandwich chart will act as a way for students to describe the topic, insert supporting details that I tell them, or that they feel are important, and then conclude with a statement that will help them understand the information. The cooperative learning model, circle the sage, is a way for students to use their peers to help each other learn. There will be multiple sages, students who feel the have a good understanding of the content, who will be able to answer questions and describe some of the properties of quadratics. After the students will be able to go back to their original groups to compare notes.

Section II – Groups and Roles for Product

Individually, students will create their own blog sites, and make multiple posts to it when they feel they have learned something new throughout the lesson. At the end, the students will make a summative blog post about the properties of a quadratic and be able to explain them in depth using examples.

Differentiated Instruction

MI Strategies

Verbal: In part of the class students will have opportunities to respond verbally to questions asked about quadratic function's properties.
Logic: Students will look at a quadratic function either on their calculator or on the board and be asked to analyze the maxs, mins, intercepts, and slopes.
Visual: As part of analyzing the functions, students will be asked to draw the graph of their pictures.
Musical: Assign students a property for a quadratic, in groups, and then instruct them to make a single verse of a song using it. The whole class will then synthesize their verses into one song.
Kinthestic: The checking for understanding will allow students to move around as they physically show what functions will look like.
Intrapersonal: In the product at the end of the lesson, students will be able to create their own blog posts--a personal way of expressing information.
Interpersonal: For the checking for understanding I can have students find others in the classroom who are displaying the same function.

Modifications/Accommodations

From IEP's (Individual Education Plan), 504's, ELLIDEP (English Language Learning Instructional Delivery Education Plan) *I will review student's IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*

Plan for accommodating absent students: Students will be able to go online and view a screencast that I will create. This will be an overview from the lesson so they can see what I did in class and have it explained them. They will be expected to come in and see me so they can pick up the missed work; handouts will be tacked up in the back of the room so they can come in and grab it even if I am in the middle of another lesson.

Extensions

Technology (SAMR): The use of a blog is Augmentation because it is not quite at the Type II level. It is a great way to write using digital tools and post it on the internet for other people to see. This is not simply substitution because they can customize their blogs and make it personalized. It is on the verge of Modification, although it does

not have the Type II characteristics.

Gifted Students: For gifted students I will have challenges, more or less, that will attempt to bring their learning to the next level. For class examples I will have them work on them and have a time trial. No prize will be given to students who finish first, although for gifted students simply finishing first is a reward in and of itself. I will stress to other students that finishing first does not matter, they can take as much time as they deem they need. I will also accommodate for them by assigning harder homework problems. All students can attempt them, and if students get them wrong it will not be representative on their grades. Also, gifted students will have the opportunity to be a sage in the cooperative learning model, circle the sage, which will allow them to demonstrate their knowledge.

Materials, Resources and Technology
Calculators
Ping pong balls and paddles

Source for Lesson Plan and Research
Graphic Organizer: http://www.eduplace.com/graphicorganizer/
Cooperative Learning:
http://edu221resources.wikispaces.com/file/view/cooperative_learning_strategies.pdf/426402320/cooperative_learning_strategies.pdf
Rubric: http://rubistar.4teachers.org/
CFU: http://nelearn.myelearning.org/pluginfile.php/439/mod_page/content/17/strategies.pdf
Blog: http://www.blogger.com/home
Finding the vertex:
http://www.uiowa.edu/~examserv/mathmatters/tutorial_quiz/geometry/findingvertexofparabola.html

PART II:

Teaching and Learning Sequence (Describe the teaching and learning process using all of the information from part I of the lesson plan) *Take all the components and synthesize into a script of what you are doing as the teacher and what the learners are doing throughout the lesson. Need to use all the WHERETO's. (1-2 pages)*

Agenda

Day 1
Sandwich Chart (3 min)
Hook: Have ping pong balls and paddles for students in groups of two to use. (7 min)
Discussion on what a graph of this looks like w/points from a table (10 min)
Talk about what a quadratic function looks like (negative, shifted left to right, shifted up and down) (20 min)
Look for zeros (factoring) what they represent (30 min)
Setting up each students' blog (10 min)

Day 2
Review from last class (finding zeros) (10 min)
Finding the vertex of the function (20 min)
Looking for minimum and maximum points (20 min)
Checking for understanding--Thumbs up thumbs down--of specific topics with Q&A (15 min)
Work time on blog posts (15 min)

Day 3
Cooperative Learning: Circle the Sage (15 min)
Finding the y-intercept (10 min)
Creating real work examples of quadratic functions (25 min)
Work together in groups of two to make personal real world examples (15)
Work time on blogs (15 min)

Teaching and Learning Sequence

The class will still be arranged in a horseshoe shape so students will be able to work together and be engaged in the classroom. Students understand that different types of quadratics represent real world issues. The graphic organizer, Sandwich Chart, will be handed out to each student and they will be instructed to fill this in whenever they want, and when they're instructed to. It will help them to put important steps on the chart in a specific order. The hook for the class will require that each student get with a partner (probably someone that they are competitive with so they can try and beat each other. Each group will have one paddle and one ball and they will bounce the ball on the paddle up and down to see how many they can get in a row. They will be asked to use these respectfully and not get out of control or else their privilege will be lost. Then they will consider what the height vs. time graph of the ball hitting the paddle looks like. This will lead into the lesson for the day.

The height vs. time graph of the ball will represent a quadratic function, for example, f(x)=x^2. We can check points from creating a table and see that it makes sense with distance vs. time. Now we can examine other types of quadratic functions such as ones that satisfy y=ax^2+bx+c, or y=ax^2+c, or the negative of the two, y= -ax^2+bx+c, and y= -ax^2+c. The larger the number in front of the (x^2) the more steep the quadratic will grow. The smaller the number, the slower the quadratic will grow. For example, if we have y=5x^2+2x+3, we know that this will grow significantly faster than y=0.2x^2+2x+3. Also, functions that start out with a negative constant in front of the (x^2) will open downwards. Now I will write an equation on the board and have the students graph it using their arms to show how it will look. For example a function that is y=2x^2+stuff will open upwards so they will make a "U" with their arms, and a function that is y= -2x^2+stuff will open downwards so they will make a "n" with their arms. EXAMPLE 1.

Now we will look at functions that satisfy the form y=ax^2+bx+c, and examine what the "bx" and "c" represent. If we make a table of points for the function and graph it: y=x^2+2x-3, we will see that the function is shifted down and to the left. This is slightly different than if it were simply y=x^2-3, which would have been shifted down only. We need three points in order to graph a quadratic. The vertex, and two good points on each side of the vertex. Many times we can find those points by setting our equation to zero, like we did for a linear equation, and solving for the x-intercepts. How many x-intercepts can a quadratic function have? There are three answers, 0, 1, and 2. So we will first want to find the vertex, and we can do that by graphing and looking. Parabolas are symmetric, meaning that they have a line of symmetry going through the vertex. So if we take two x values on each side of the vertex that share the same y value, we can find the midpoint, and plug that into the equation and get out the y point, which will be the vertex. For example, if we graph the equation y=x^2+2x-3, we can take the points x= -3,1 and find their midpoint, -1, and plug that into the original equation and get y= -1^2-2-3= -4. So our vertex is (-1,-4). EXAMPLE 2. Now if we want to find that a lot easier, we can use the form x= -b/2a. This gives us an x value that we can plug into the function and get out a y value. This saves us time from graphing and is much simpler. We get the a and the b from ax^2+bx+c. For example, with the equation that we just looked at, we can find the vertex by substituting a and b in and get (-2/2)= -1. Plug that back into the original equation and get -4, so we get the same point for the vertex: (-1,-4). EXAMPLE 3.

In order to find the x intercepts of a function we need to do what? Remember from linear functions? We need to plug in 0 for y and solve for x. so for example if we have y=x^2, we set x^2=0 and take the square root of both sides, and get x=0. This only has one x intercept at (0,0) when we plug 0 back into the original function. What if we had y=x^2+2x+1? Set that equal to zero to get 0=x^2+2x+1. After factoring we get (x+1)(x+1)=0. Set each one equal to zero to get x= -1. This has one intercept at (-1,0). If we look at y=2x^2+6x+4, and we set it equal to zero we get 0=2x^2+6x+4. After we factor we get (2x+4)(x+1)=0. We get x= -2,-1, so our two x-intercepts are (-2,0) and (-1,0). EXAMPLE 4.

How many y-intercepts will we have in a quadratic? There will always be 1. This is because when we plug 0 in for x we will always get one y. EXAMPLE 5.

Where, Why , What, Hook Tailors: Kinesthetic, Intrapersonal, Interpersonal, Visual.

Students will know quadratics, maximum, minimum, parabola, vertex, finding x-intercepts, finding y-intercept. The sandwich chart will act as a way for students to describe the topic, insert supporting details that I tell them, or that they feel are important, and then conclude with a statement that will help them understand the

information. The cooperative learning model, circle the sage, is a way for students to use their peers to help each other learn. There will be multiple sages, students who feel the have a good understanding of the content, who will be able to answer questions and describe some of the properties of quadratics. After the students will be able to go back to their original groups to compare notes. I will use a checking for understanding called thumbs up, thumbs down. It is a good way for students to express their comfortability of the content so I can decide whether I need to spend more time on specific items or move on. This will also be a good time for them to ask questions about the content of anything they are feeling confused about.
Equip, Explore, Rethink, Tailors: Kinesthetic, visual, auditory, interpersonal

Individually, students will create their own blog sites, and make multiple posts to it when they feel they have learned something new throughout the lesson. At the end, the students will make a summative blog post about the properties of a quadratic and be able to explain them in depth using examples. They will meet with the teacher to have a conference about their blog posts to make sure everything is going on schedule and that they have the correct understanding of the task at hand. Students will have a checklist to ensure they have the appropriate information covered in their blogs and that it meets all of the criteria.
Explore, Experience, Revise, Refine, Tailors: Intrapersonal, interpersonal, linguistic,

Students will meet with the teacher to have a conference about their blog posts to make sure everything is going on schedule. After this meeting they should have a good understanding of the task at hand. They will have a checklist to ensure they have the appropriate information covered in their blogs and that it meets all of the criteria.
Evaluate, Tailors:

Content Notes
Students will know quadratics: a function representative of a second degree. Maximum: A point at which a function goes from increasing to decreasing—the slope is zero. Minimum: A point at which a function goes from decreasing to increasing—the slope is zero. Parabola: A second degree function, most notable for having a vertex, and line of symmetry at the vertex. Vertex: The point at which the parabola has a maximum or minimum. X-intercepts (zeros): The points at which a line crosses the x-axis. This is found when zero is substituted for y. There are three possibilities for x-intercepts with quadratics: zero, one, or two intercepts. Y-intercept: The one y value for which a line crosses the y-axis. There will always be only one value as long as the function we are looking at is a true function.
EXAMPLE 1:
y=5x^2+stuff
y= -5x^2+stuff
y= -0.5x^2 +stuff
y= x+2
y= -100x^2+stuff
y= 100x^2+stuff
y=x^2
y= -x^2

EXAMPLE 2
Look at the two graphs on the board of:
y=x^2+x-6 Given the two x-intercepts are x= -3,2. -3+2=-1/2= -0.5 f(0.5)= -5.25 (-0.5, -5.25)
y= -2x^2+5x+7 Given the two x-intercepts are x= -1,3.5. ANSWER: -1+3.5=2.5/2=1.25 f(1.25)=10.125 (1.25,10.125)

EXAMPLE 3
Let's look at the previous two examples and find those again using the new way, are they the same?
y=x^2+x-6 ANSWER: -1/2 --> f(-0.5)=-5.25. Same
y= -2x^2+5x+7 ANSWER: -5/-4 ---> f(1.25). Same
y=x^2-1 ANSWER: 0/2=0 f(0)= -1 --> (0,-1)
y=25x^2-50x-1250 ANSWER: 50/50=1 f(1)= -1275 --> (1, -1275)

EXAMPLE 4
Find the x-intercepts:
x^2+6x+5 ANSWER: (x+5)(x+1) x= -5,-1
x^2-x-2 ANSWER: (x+1)(x-2) x= -1, 2
2x^2+7x-4 ANSWER: (2x-1)(x+4) x= 1/2,-4
3x^2+10x+3 ANSWER: (3x+1)(x+3) x= -1/3,-3

EXAMPLE 5
y=10x^2+4x-2 ANSWER: y= -2
y=x^2+3x+20 ANSWER: y=20
y=4x^2+4x ANSWER:y=0

Handouts
Rubric for blog posts
Sandwich chart

Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale

Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Learning Styles

Clipboard: In this lesson I will make it accessible for the clipboard to learn by providing clear and visual directions. The worksheets will be detailed and give clear expectations of what is expected of the student. The graphic organizer, sandwich chart, will help students to see things put into order and help them see which parts of quadratics are the most important.

Microscope: The microscope will have the ability to learn through discovery in this lesson as I will pose a lot of questions about quadratics. They will be able to look farther in depth on certain topics if they so choose.

Puppy: My classroom will always be a safe environment for students to learn in. All questions will be taken seriously and I will make sure that it is a judgment free zone. In this lesson students will use "thumbs up, thumbs down" as a way to tell me if they have an understanding of the topic. If there is one student who has a thumbs down I will make sure I go over it either on the board or with them personally.

Beach Ball: In this lesson the beach ball will have the opportunity to be heard as they can volunteer for the cooperative learning model, "circle the sage." This will allow them to talk with their peers and answer questions pertaining to the class. They will also have the freedom to write whatever they like in their blog posts referring to quadratics.

Rationale: I have accommodated for the different types of students in my classroom. Through specific activities, students will be able to exert their knowledge multiple ways as we know some show it in different ways than others. By allowing students options in my classroom I am giving them opportunities to succeed that they might not have had in other rooms. Hopefully this will encourage them to participate and be successful in my class.

Standard 6 - Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Formative: Thumbs up, thumbs down is a good way for students to express their comfortability of the content so I can decide whether I need to spend more time on specific items or move on.

Summative: Blog (23.333 points): Regularly update blogs to talk about different properties like minimums/maximums, x-intercepts, concavity, etc... You should have at least four (4) blog posts--one of which sums up all of the properties learned. Include one personal image in each of the blog posts. It would be ideal to post a blog post after each class so you are current with the properties of quadratics.

Rationale: Thumbs up, thumbs down is a good way for students to show whether they think they know the knowledge or not. I can pose a question on the board, and I will be able to know, just by glancing around the room, which students want to see another example and which students know what they are doing. The summative assessment, blog, will allow students to demonstrate their knowledge of quadratics through writing. When I read their blogs I will also be able to tell which students need a little bit more attention in specific areas and which students are excelling. This summative assessment will actually be more like a graded formative assessment as we will still be able to learn from it after it is completed, and students can go back and fix what they did wrong.

Standard 7 - Planning Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Content Knowledge: Students will know quadratics, maximum, minimum, parabola, vertex, finding x-intercepts (zeros), y-intercept (zero).

MLR or CCSS or NGSS
Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function*

Facet: Perspective

Rationale: I have met them common core standards by introducing quadratics to the students. They will have a good understanding now of how quadratics work, and be able to relate it back to linear functions. When the students relate it to linear functions they will be able to see that quadratics increase much more quickly than linear functions do. This will help them in lesson five and six when we will relate quadratic and linear functions to exponential functions.

Standard 8 - Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

MI Strategies:
Verbal: In part of the class students will have opportunities to respond verbally to questions asked about quadratic function's properties.
Logic: Students will look at a quadratic function either on their calculator or on the board and be asked to analyze the maxs, mins, intercepts, and slopes.
Visual: As part of analyzing the functions, students will be asked to draw the graph of their pictures.
Musical: Assign students a property for a quadratic, in groups, and then instruct them to make a single verse of a song using it. The whole class will then synthesize their verses into one song.
Kinthestic: The checking for understanding will allow students to move around as they physically show what functions will look like.
Intrapersonal: In the product at the end of the lesson, students will be able to create their own blog posts--a personal way of expressing information.

Interpersonal: For the checking for understanding I can have students find others in the classroom who are displaying the same function.

Type II Technology: There is no type II technology used in this lesson. The use of blogs is close, although it is likely considered a type I technology.

Rationale: By incorporating the different kinds of learning strategies in my lessons I will be able to help students learn in a way that best suits them. Through individual work time, group work, moving around, displaying things visually, getting students to think outside the box, and having them create songs, they will get multiple perspectives into the lesson that will hopefully help them in understanding the concepts.

NETS STANDARDS FOR TEACHERS

1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

a. Promote, support, and model creative and innovative thinking and inventiveness

b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources

c. Promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes

d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments

Rationale: I chose 1. a. because I am having students create a blog site and make multiple posts to demonstrate their quadratic knowledge to me. They will have to be creative in designing their blog so that it is aesthetically pleasing and that it covers the correct topics that we discussed. I will be supportive of this by reading each of their blog posts and giving them feedback on it to help them improve it and help them to understand it better where they might have some loopholes.

2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S.

a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity

b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress

c. Customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources

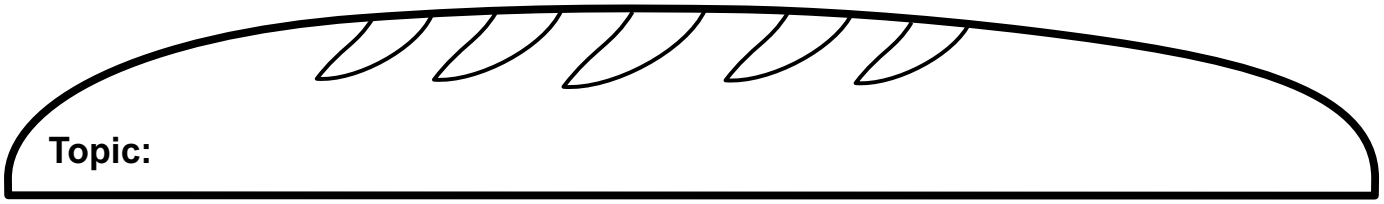
d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching

Rationale: I chose 2. c. because I will use a variety of activities to help students who have diverse learning styles. They will be able to use their laptops and online resources as they create their blogs. In class, I will have different activities for specific learning styles such as creating a verse of a song, and circle the sage to help students understand the material.

Name _____ Date _____

Sandwich Chart

Write your topic at the top. Add details to the middle layers. Add a concluding sentence at the bottom.



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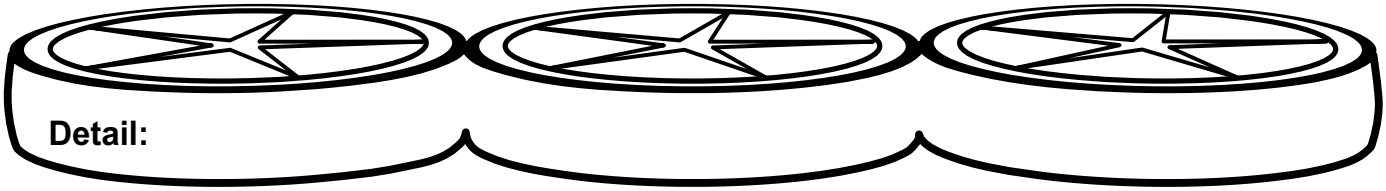

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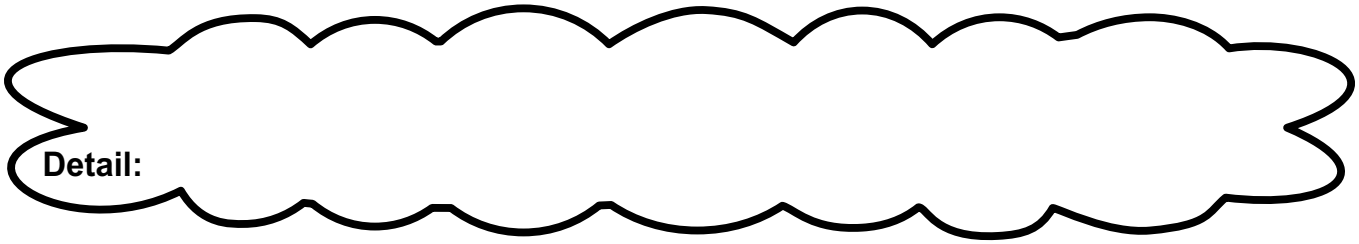


Detail:

Detail:

Concluding Sentence:

UNIVERSITY OF MAINE AT FARMINGTON
COLLEGE OF EDUCATION, HEALTH AND REHABILITATION

LESSON PLAN FORMAT

Teacher's Name: Mr. Cabaniss **Lesson #:** 4 **Facet:** Interpretation
Grade Level: 11-12 **Numbers of Days:** 4
Topic: Students will be able to illustrate a quadratic function and how it relates to the real world.

PART I:

Objectives
Students will understand that different types of quadratics represent real world issues.
Students will know tangent line, concave, convex, vertex form, quadratic formula.
Students will be able to illustrate a quadratic function and how it relates to the real world.

Product: iMovie

Maine Learning Results (MLR) or Common Core State Standards (CCSS) or Next Generation Science Standards (NGSS) Alignment
Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function*

Rationale: Through the use of iMovie, students will be able to use a great type II technology in order to help them engage themselves and learn from real world situations. They will demonstrate four real world applications of quadratics and be able to prove that they know the content by handing in separate sheets with their work.

Assessments

Formative (Assessment for Learning)
Section I – checking for understanding during instruction
Function Aerobics is a great way for students to visualize a quadratic function by using their body. They can also look around the room to see what other students are doing in order to get a good understanding of the different quadratics. I can split students into groups and assign them different quadratics to represent.

Section II – timely feedback for products (self, peer, teacher)
The class will utilize Pass Along to get constructive feedback on their movie before meeting with the teacher. This is a good time to bounce ideas off one another to enhance the movie. When they meet with the teacher they will discuss any concerns that they have about the movie and ask any questions regarding the ability to illustrate a quadratic and relate it to the real world. Students will then use their checklists to make sure that they have the adequate information for illustrating a quadratic and relating it to the real work in movie fashion.

Summative (Assessment of Learning):
iMovie (23.333 points): In groups of two, examine real world situations to create quadratic functions. You should include at least three real world situations in which you would use a quadratic function. The dependent variable should not be reused in any of the examples. If you use any graphics that are not original be sure to report the permission status of the graphics.

Integration

Technology: Students will use iMovie for this summative assessment which comes standard on their one-to-one laptops.

Content Areas: This lesson involves movie production, which may be a class offered at certain schools,

Groupings

Section I - Graphic Organizer & Cooperative Learning used during instruction

The use of a sequence chart will help students be able to put certain concepts into steps. This will be particularly helpful when they need to look back and understand. The cooperative learning model, rally coach, is a great way for students to help each other and work through problems. This will allow them to be teacher free for a little while if they can help each other get through the problems.

Section II – Groups and Roles for Product

As groups of two, students will create a movie about illustrating quadratic functions and relating them to the real world. They will be split up into groups by their knowledge of iMovie. They will line up from most knowledgeable to least familiar. The line will then be split in the middle and then it will slide, not fold, to match up with someone. Ideally it should end up that someone who is somewhat knowledgeable is matched with someone who is not familiar, and someone who is very knowledgeable is with someone who is somewhat knowledgeable.

Differentiated Instruction

MI Strategies

Logic: Students will connect quadratic functions to the real world and give several examples.
Visual: Students will use their product, a movie, to visually display quadratic functions and how they relate to the real world.
Musical: Students will each be given a question; they will be put into groups based on their answers. Each group will then create a tune using their team members that involves their answer to the question (which will be a number). Eg. a tune 5 seconds long if one of the x intercepts was 5, a tune using 5 different objects around the room, etc...
Kinthestic: During the checking for understanding students will move their limbs to represent quadratic functions.
Intrapersonal: Students will be given time in order to think of how quadratic functions relate to the real world, coming up with a few examples.
Interpersonal: Students will then share their findings of how quadratic functions relate to the real world in small groups.

Modifications/Accommodations

From IEP's (Individual Education Plan), 504's, ELLIDEP (English Language Learning Instructional Delivery Education Plan) *I will review student's IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*

Plan for accommodating absent students: I will have screencasts available to students who are absent. They will be able to watch videos of the lesson that I did that day in class and come to me later with any questions and pick up papers. I will have an area in the back of the room for students to come in and grab the work that they missed. Ideally, students should come see me after school or during the school day when both of us are free so I can give them one on one attention.

Extensions

Technology (SAMR): iMovie would be a good example or redefinition because it is a great type II technology that allows you to use video, edit video, and add in creative designs. There is so much that can be done with iMovie, and it allows students to create great products to further their learning.

Gifted Students: Students who excel will have the opportunity to further their knowledge rather than being kept back. I will propose more difficult problems for them to do if they find that the ones they are doing with the rest of the class are too easy. This is not creating busy work because I am not asking them to do more, I am substituting the easy problems for harder problems for them. For example, if there are a list of 30 problems, the harder problems are typically towards the end. I would give students the choice of what range of problems they want to do. Students who are feeling average with the material will probably do 1-15, students who are feeling a little above average might try 7-22, and students who are really feeling good about the content will probably try 15-30.

Materials, Resources and Technology
Foam darts

Source for Lesson Plan and Research
Vertex form: http://www.mathwarehouse.com/geometry/parabola/standard-and-vertex-form.php
Concave vs. Convex: http://www.economics.utoronto.ca/osborne/MathTutorial/CV1F.HTM
Graphic Organizer: http://www.eduplace.com/graphicorganizer/
Cooperative
Learning: http://edu221resources.wikispaces.com/file/view/cooperative_learning_strategies.pdf/426402320/cooperative_learning_strategies.pdf
Rubric: http://rubistar.4teachers.org/
CFU: http://nelearn.myelearning.org/pluginfile.php/439/mod_page/content/17/strategies.pdf
Rubric: http://rubistar.4teachers.org/
iMovie: http://www.wikihow.com/Make-a-Video-Using-iMovie
Online Checklist: http://scribbless.com/lists/list/180051

PART II:

Teaching and Learning Sequence (Describe the teaching and learning process using all of the information from part I of the lesson plan) *Take all the components and synthesize into a script of what you are doing as the teacher and what the learners are doing throughout the lesson. Need to use all the WHERETO's. (1-2 pages)*

Agenda

Day 1
Graphic organizer (5 min)
Hook: Throwing balls (10 min)
Creating a quadratic equation from scratch (using vertex form) (35 min)
Introduce iMovie, show my product: (20 min)
Get in groups and start brainstorming (10 min)

Day 2
Review of creating quadratic equations Q&A (10 min)
CFU: Function Aerobics (10 min)
Introduction to quadratic formula (35 min)
Concave vs. convex (10 min)
Work time for iMovie (15 min)

Day 3
Review of quadratic formula (10 min)
Finding tangent lines (25 min)
Rally Coach (15 min)
Work time on iMovie (30 min)

Day 4
Presentations of iMovie (80 min)

Teaching and Learning Sequence

The class will be arranged into a horseshoe shape so that the students will be out of their typical rows of desks, and so they will be able to collaborate easily with their neighbors. Students will understand that different types of quadratics represent real world issues. First I will hand out the graphic organizer, sequence chart. The use of a sequence chart will help students be able to put certain concepts into steps. This will be particularly helpful when they need to look back and understand what they have learned the previous classes. To hook students I will have them come into the room and sit down while I hand out balls to throw. I will make sure to tell my students to use them respectfully or we won't be able to do this. In the previous lesson, we looked at how bouncing a ping pong ball could represent a quadratic equation, but did not actually create a quadratic function from it. Today, we will take a few points and create a quadratic function from them. I will have them pick a person from the other side of the room to throw the ball to. the ball will not be hard, so there won't be a chance of hurting someone. There will be no "pegging" of the balls. We will take a look at how the ball rises and falls over time. This would be a distance vs. time graph, as opposed to throwing it up and down in our hands, which would be a height vs. time graph. We will do this by using vertex form. Vertex form looks like this: f(x)=a(x-h)^2+k, where a is a constant that represents how quickly the quadratic opens and which direction it opens, and h and k represent the vertex of the equation. For example, if we had f(x)=3(x-2)^2+1, we could say that the function opens relatively quickly upward, and has the vertex, (2,1). EXAMPLE 1.

But let's say we do not know the equation of our parabola, and we want to make one. What do you suppose we might need to do this? We need two points, and one of which is the vertex. We can have any other point once we have the vertex. So we will use the form y=a(x-h)^2+k, where the point (h,k) is the vertex. So let's say we have two points: (-1,-4) and (3,12) where the first point is our vertex. We will plug that into our equation and get: y=a(x+1)^2-4. From there, we will plug in our second point and solve for a: 12=a(3+1)^2-4. a=1. So we go back and plug "a" and the vertex into the equation and get: y=(x+1)^2-4, or y=x^2+2x-3. EXAMPLE 2.

In the previous lesson we were able to find zeros of a quadratic function by factoring. We found that there were three types of x-intercepts: no intercepts, one intercept, and two intercepts. So let's look at y=x^2+2x-3. We can use the quadratic formula, how many of you have heard of that? It looks like this? x= (-b±(b^2-4ac)^(1/2))/2a. Where we can look at the form ax^2+bx+c. So with a=1, b=2, and c= -3, we get x= (-2±((-2)^2-4(1)(-3))^(1/2))/2(1) which simplifies to x= (-2±4)/2 so our two x intercepts are (1,0) and (-3,0). These are the same answers to if we were to factor. Either way is acceptable to find the x-intercepts. Now this strategy is particularly helpful for when we have something that looks like EXAMPLE 3.

Determining the concavity of a function can tell us whether the quadratic function has a minimum or maximum point. Concave and convex are a couple of vocabulary words that you will probably need to know down the road. So if I show you a picture of a quadratic with a negative leading coefficient, this would be considered conCAVE. This is because it will be opening up downward, and you can think of it as being in a cave for conCAVE. If I give you a quadratic with a positive leading coefficient, then what do you suppose it will be? This will be a convex function, meaning it opens upward. So if we have functions that concave, and open downward, is this a minimum or maximum point on the graph? This would be a maximum point, because the function would be going from increasing to decreasing. Why is this helpful? If we were talking about a car's velocity vs. time, and graphed it for when it was decelerating, stopping, and then accelerating again, we would have a graph that is convex, opening upward. What kind of point would we have? We would have a minimum. Now if we solved for what this point was, which would probably be a single x-intercept, we would know that is where the car, for one moment in time, is motionless.

To find a line tangent to a quadratic function we must first remember what two components make up a linear line. We need a point and a slope. So if I were to give you a quadratic function, a point, and a slope, you could create an linear line from the point and the slope, graph the linear line on the same graph as the quadratic function, and the linear line would only touch the quadratic in one spot. For example, if I gave you the quadratic y=x^2, the point, (2,4), and the slope: m=4, you would be able to create a tangent line by using point-slope form, and then graph it with the quadratic. The equation ends up being y=4x-4. This equation has the same slope as the point (2,4) on the quadratic, and will touch the point. EXAMPLE 4.

Where, Why , What, Hook Tailors: Kinesthetic, interpersonal, intrapersonal, visual, logic

The cooperative learning model, rally coach, is a great way for students to help each other and work through problems. This will allow them to be teacher free for a little while if they can help each other get through the problems. Function Aerobics will help students to visualize a quadratic function by using their body. They can also look around the room to see what other students are doing in order to get a good understanding of the different quadratics. I can split students into groups and assign them different quadratics to represent.
Equip, Explore, Rethink, Tailors: Interpersonal, kinesthetic, interpersonal, logical, visual.

Students will be able to illustrate a quadratic function and how it relates to the real world. They will accomplish this through their product. As groups of two, students will create a movie about illustrating quadratic functions and relating them to the real world. They will be split up into groups by their knowledge of iMovie. They will line up from most knowledgeable to least familiar. The line will then be split in the middle and then it will slide, not fold, to match up with someone. Ideally it should end up that someone who is somewhat knowledgeable is matched with someone who is not familiar, and someone who is very knowledgeable is with someone who is somewhat knowledgeable. The class will utilize Pass Along to get constructive feedback on their movie before meeting with the teacher. This is a good time to bounce ideas off one another to enhance the movie. When they meet with the teacher they will discuss any concerns that they have about the movie and ask any questions regarding the ability to illustrate a quadratic and relate it to the real world. Students will then use their checklists to make sure that they have the adequate information for illustrating a quadratic and relating it to the real work in movie fashion.
Explore, Experience, Revise, Refine, Tailors: Interpersonal, visual.

Each student will have a one-on-one conference with the teacher to ensure that they each have a good understanding of the content and that they are able to create an iMovie. This conference will likely happen during iMovie work time when students are in their groups talking to each other. Some conferences will talk longer than others, but it is good to sit down and get a feel for where each student it at.
Evaluate, Tailors: Interpersonal.

Content Notes
Students will know tangent line: a linear line that shares the same point and slope with a higher degree polynomial. Concave: A graph of a curve that is representing negative acceleration, and in this case, having a maximum point. Convex: A graph of a curve that is representing positive acceleration, and in this case, having a minimum point. Vertex form: A form that a quadratic function can be in that will easily show the vertex. y=a(x-h)^2+k, where (h,k) is the vertex. Quadratic formula: A formula that finds the x-intercepts of a quadratic function: x= (-b±(b^2-4ac)^(1/2))/2a.

EXAMPLE 1
Find the vertex of the following functions, and which direction the function opens:
f(x)=2(x-1)^2-3 ANSWER: (1,3) upwards
f(x)= -(x+6)^2+10 ANSWER: (-6,10) downwards
f(x)= 4(x-(4/3))^2-(11/10) ANSWER (4/3, -11/10) upwards
f(x)= -x^2 ANSWER (0,0) downwards

EXAMPLE 2
Create a quadratic equation from the following points (you pick which point is the vertex). Then relate each to the real world.
(1,2) (3,8) ANSWER: 8=a(3-1)^2+2... a=3/2... y=3/2(x-1)^2+2
(-4,6) (0,-2) ANSWER: 6=a(-4-0)^2-2... a=1/2... y=1/2x^2-2
(0,0) (4,16) ANSWER: 16=a(4-0)^2+0... a=1... y=x^2

EXAMPLE 3
Find the x-intercepts
y=6x^2-16x+8 ANSWER 16±((-16)^2-4(6)(8))^(1/2))/2(6). Next 16±((64)^(1/2))/12. Next (16±8)/12. So we get x= 2/3, 2. So our two x-intercepts are (2/3,0) and (2,0)

y=x^2 ANSWER 0±((0)^2-4(1)(0))^(1/2))/2(1). Next everything simplifies to 0. There is one intercept at 0, so it just grazes the x-axis at the origin.
y=x^2+3x+4 ANSWER -3±((-3)^2-4(1)(4))^(1/2))/2(1). The problem with this one is that the discriminant turns out negative. Why can't we do this? What might this mean? Graph it and tell me why. It doesn't cross the x-axis, no x-intercepts.

EXAMPLE 4
Find the tangent line to the curve:
y=2x^2-5x+3 @ point (2,1) slope=3 ANSWER: (y-1)=3(x-2)... y=3x-5
y= -x^2+3x+2 @ point (5,-8) slope= -7 ANSWER: (y+8)= -7(x-5)... y= -7x+43
y=0.5x^2+7x-12 @ point (-1,-18.5) slope=6 ANSWER: (y+18.5)=6(x+1)... y=6x-12.5

Handouts
Sequence chart
Rubric
Online checklist

Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale

Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Learning Styles

Clipboard: The clipboard will be able to see things put into order with the use of the sequence chart. This graphic organizer is good to help students visually see what they are doing and it will help them to stay organized.

Microscope: The microscope will have plenty of opportunities to get in depth into the content. They will be asked to think outside the box for multiple concepts and then relate them to what we are doing. While some students will struggle with it, giving microscopes the opportunity to do this will help them to understand more and have a better experience.

Puppy: Through the use of the cooperative learning model and the checking for understanding, I will make sure that students feel safe sharing their answers in the class, and I will ensure that any inappropriate comments will be taken seriously and will not be tolerated. In theory this should create a safe learning environment for the puppy.

Beach Ball: With the cooperative learning model, the beach ball will be able to be talkative and be productive at the same time. By giving the beach ball a variety of choices they will be more willing to cooperate and participate with respect in the classroom.

Rationale: Each type of student in my classroom will have their needs met. Through a variety of different teaching strategies, the clipboards, microscopes, puppies, and beach balls will be catered to. Because we will do lots of different activities, they will have many opportunities to understand the content.

Standard 6 - Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Formative:
Students will use Function Aerobics to visualize a quadratic function by using their body. They can also look around the room to see what other students are doing in order to get a good understanding of the different quadratics. I can split students into groups and assign them different quadratics to represent.

Summative:
iMovie (23.333 points): In groups of two, examine real world situations to create quadratic functions. You should include at least three real world situations in which you would use a quadratic function. The dependent variable should not be reused in any of the examples. If you use any graphics that are not original be sure to report the permission status of the graphics.

Rationale: Through these assessments students will be able to show their knowledge in multiple ways. The formative assessment, function aerobics will help them to be quick at understanding what different quadratic functions look like. This is important for grasping the varieties of quadratics. The summative assessment, iMovie, will further the students learning, because they are creating real life examples. They will also be presenting in front of their classmates so they will learn even after they have completed their product.

Standard 7 - Planning Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Content Knowledge:
Students will know quadratics, maximum, minimum, tangent line, parabola, concave, convex, vertex, vertex form, quadratic formula, factoring, finding x-intercepts, finding minimum and maximum points.

MLR or CCSS or NGSS
Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function*

Facet: Interpretation

Rationale: I will meet the standard by making sure the students have a great understanding of quadratics before they move onto exponential functions. Because they will have a good understanding of quadratics and linear functions at this point, they will be in good position moving into lessons five and six. Ultimately, they will be comparing how each type of function increases or decreases using a graph and a table. They have a good basis moving forward now.

Standard 8 - Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

MI Strategies:
Logic: Students will connect quadratic functions to the real world and give several examples.
Visual: Students will use their product, a movie, to visually display quadratic functions and how they relate to the real world.
Musical: Students will each be given a question; they will be put into groups based on their answers. Each group will then create a tune using their team members that involves their answer to the question (which will be a number). Eg. a tune 5 seconds long if one of the x-intercepts was 5, a tune using 5 different objects around the room, etc...
Kinthestic: During the checking for understanding students will move their limbs to represent quadratic functions.
Intrapersonal: Students will be given time in order to think of how quadratic functions relate to the real world, coming up with a few examples.
Interpersonal: Students will then share their findings of how quadratic functions relate to the real world in small

groups.

Type II Technology: The type II technology that I am using in this lesson is iMovie. This type of technology is type II because it allows students to record video, edit video, add effects, and use sounds to create a finished product. Through the uses of the different components of iMovie, students will be able to be creative and generate a finished product that is very engaging.

Rationale: The students in my class will have their needs met during the lessons. Because I am doing several different activities, each type of student will have the opportunity to get into the lesson and learn the content. Each student has their own individual learning style, and through the different components of my lesson I will reach out to them.

NETS STANDARDS FOR TEACHERS

1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

a. Promote, support, and model creative and innovative thinking and inventiveness

b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources

c. Promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes

d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments

Rationale: I chose 1.b. because I am making students create an iMovie based off of real life events that they are going to recreate. This will engage them in the real world and create great problem solving skills and help them to create an online presence.

2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S.

a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity

b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress

c. Customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources

d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching

Rationale: I chose 2.d. because through different formative and summative assessments, students will be able to learn the content. The summative assessment, iMovie, is a great use of technology for the students to express their knowledge in a real life situation. They will get a lot from seeing each other's presentations and how each group related something to the real world. The use of this technology used in this summative assessment is better than giving the typical paper and pencil exam.

Name _____ Date _____

Sequence Chart

List steps or events in time order.

Topic
First
Next
Next
Next
Next
Next
Next
Last

Math - Problem Solving : Quadratics in the Real World

Teacher Name: **Mr. Cabaniss**

Student Name: _____

CATEGORY	Gold	Silver	Bronze	Not on the Podium
Required Components 25%	The movie has at least three (3) unique examples of how quadratics relate to the real world.	The movie has three (3) examples of how quadratics relate to the real world, although they are not entirely unique.	The movie has two (2) or three (3) examples of how quadratics realate to the real world that show limited uniqueness.	The movie has one (1) example of how quadratics relate to the real world that are not unique.
Explanation 25%	The mathematical explanations are detailed and clear. The audience can easily grasp quadratics by watching.	The mathematical explanations are clear. The audience grasp most of the concepts in the movie about quadratics.	The mathematical explanations are a little difficult to understand, however, critical components are included.	The mathematical explanations are difficult to understand and the movie is missing several critical components.
Neatness and Organization 20%	The movie's layout is neat, clear, organized fashion that is easy to understand.	The movie's layout is in a neat and organized fashion that is generally easy to read.	The movie's layout is in an organized fashion but may be hard to read at times.	The movie's layout is sloppy and unorganized. It is hard to know what information goes together.
Presentation 15%	The movie has a smooth delivery that holds audience attention.	The movie is fairly smooth delivery that holds audience attention most of the time.	The movie is not smooth, but able to maintain interest of the audience most of the time.	The movie's delivery is not smooth and audience attention often lost.
Originality 15%	The content and the movie have a large amount of original thought. Ideas are creative and inventive.	The content and the movie show some original thought. Work shows new ideas and insights.	Other people's ideas are used in the movie (credit was given), but there is little evidence of original thinking.	Other people's ideas are used; no credit is given.

If there are no credits given where they are necessary, the project will be given an incomplete

Date Created: **Nov 03, 2013 12:54 pm (CST) By: Sean Cabaniss using Rubistar**

UNIVERSITY OF MAINE AT FARMINGTON
COLLEGE OF EDUCATION, HEALTH AND REHABILITATION

LESSON PLAN FORMAT

Teacher's Name: Mr. Cabaniss **Lesson #:** 5 **Facet:** Explanation
Grade Level: 11-12 **Numbers of Days:** 3
Topic: Students will be able to predict an exponential function and what it represents.

PART I:

Objectives

exponential functions are different than other functions.
Students will know exponents, logarithms, log properties, $y=e^x$, $y=\ln(x)$
Students will be able to predict an exponential function and what it represents.

Product: Glogster

Maine Learning Results (MLR) or Common Core State Standards (CCSS) or Next Generation Science Standards (NGSS) Alignment

Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function*

Rationale: Students will use the product, Glogster, in order to present their introductory knowledge of exponential functions. They will use different graphics to make their product appealing, and highlight the specific things that they learned dealing with exponential functions. When they present their product, I will get a good understanding at that point of whether or not they have mastered what I have taught them. This will be beneficial moving forward into the last lesson.

Assessments

Formative (Assessment for Learning)

Section I – checking for understanding during instruction
Four Corners will make students think logically about the question given to them. I will need to ensure that students actually go to the corner that they think rather than following the heard. This will provide a good basis for students to reflect and talk to other classmates about the question and why they picked their respected corners.

Section II – timely feedback for products (self, peer, teacher)
Students will meet with the teacher and talk about their Glogster and its process. This will be a time for them to ask questions and make sure they understand how to predict an exponential function and what it represents. Next they will use their checklist to make sure that they have all of the required information in their Glogster about the exponential functions and what they represent.

Summative (Assessment of Learning):

Glogster (23.333 points): Demonstrate what to look for in an exponential function and be able to create a mental picture of the function. The Glogster should include animations, several graphics, and be aesthetically pleasing. Be sure that if this is on the internet for people to see that you give appropriate credit to other authors of information

and graphics and state the permission status. Be creative—make your Glogster look the best. Anonymously students will submit who they think created the best Glogster. The winner will receive a prize!

Integration

Technology: This lesson uses the Glogster as the summative assessment. Glogster is an online poster maker that has unique features to make the poster appealing.

Content Areas: This lesson includes some History, as students have the option to research the history of the number e. It also includes art, because students will be expected to make their Glogsters appealing and aesthetically pleasing for presentation. They could create their own graphics by hand, and incorporate it into the Glogster if they took a picture of it and uploaded it.

Groupings

Section I - Graphic Organizer & Cooperative Learning used during instruction

A tree chart will help students be able to get a big picture of a concept and then expand on it. They will "branch" out on the different ideas within each concept to create a tree of ideas. The cooperative learning model, pairs check, is a great way for students to work and help each other out. They will collaborate on answers with themselves and other pairs in the room after the prompt is over.

Section II – Groups and Roles for Product

Individually, students will create a Glogster and show visuals about exponential functions and what they represent. The students will be expected to present their Glogster in some way to the class, although they will not be graded on their presentation, solely on the content within the Glogster.

Differentiated Instruction

MI Strategies

Logic: This is key for students in this section: to be able to look at a function and have a mental mindset of what it looks like.
Visual: The product, Glogster, will be a good visual aid for students to understand predicting exponential functions and what they represent.
Kinthestic: The checking for understanding will allow students to talk around the room to a corner that represents an answer, from there they will discuss.
Intrapersonal: Individual class work will be provided for students so they can work alone privately.
Interpersonal: Students will get together in groups and compare answers to questions proposed in class.
Naturalist: Students will take a concept of something that happens in nature, and relate it to an exponential function.
Musical: Students will be able to include music in their product which will add a powerful effect to auditory learners (depending on the music).

Modifications/Accommodations

From IEP's (Individual Education Plan), 504's, ELLIDEP (English Language Learning Instructional Delivery Education Plan) *I will review student's IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*

Plan for accommodating absent students:

I will have screencasts available to students who are absent. They will be able to watch videos of the lesson that I did that day in class and come to me later with any questions and pick up papers. I will have an area in the back of the room for students to come in and grab the work that they missed. Ideally, students should come see me after school or during the school day when both of us are free so I can give them one on one attention.

Extensions

Technology (SAMR):
The product, Glogster, is an example of a type II technology because it has the ability to include video as well as audio into the online poster. This poster can be designed and customized in order to make it aesthetically appealing and interactive. It is an example of modification because it is taking a normal poster, but adding virtual graphics and other properties not possible on other products.

Gifted Students:
Students who excel will have the opportunity to further their knowledge rather than being kept back. I will propose more difficult problems for them to do if they find that the ones they are doing with the rest of the class are too easy. This is not creating busy work because I am not asking them to do more, I am substituting the easy problems for harder problems for them.

Materials, Resources and Technology
Paper
Pencils

Source for Lesson Plan and Research
Exponents: http://www.purplemath.com/modules/expofcns.htm
e^x and ln(x): http://www.regentsprep.org/regents/math/algtrig/ATP8b/exponentialFunction.htm
Graphic Organizer: http://www.eduplace.com/graphicorganizer/
Cooperative
Learning: http://edu221resources.wikispaces.com/file/view/cooperative_learning_strategies.pdf/426402320/cooperative_learning_strategies.pdf
Rubric: http://rubistar.4teachers.org/
CFU: http://nelearn.myelearning.org/pluginfile.php/439/mod_page/content/17/strategies.pdf
Roller Coaster video: http://www.youtube.com/watch?v=PmJrld8Ig3s
Homework night 1: http://www.regentsprep.org/regents/math/algtrig/ATE9/LogPrac.htm
Checklist: http://scribbless.com/
Online practice: http://www.regentsprep.org/regents/math/algtrig/ATE9/logEquationPrac.htm

PART II:

Teaching and Learning Sequence (Describe the teaching and learning process using all of the information from part I of the lesson plan)

Agenda

Day 1
Hand out Graphic Organizer (5 min)
Hook about roller coaster (15)
Introduction to exponentials (20 min)
Intro to logarithms (10 min)
Logarithmic properties (20 min)
Introduction to Glogster (10 min)

Day 2
Review from last class (10 min)
Discussion about $y=e^x$ (20 min)
Discussion about $y=\ln(x)$ (20 min)
Checking for understanding (30 min)

Day 3
Review from last class (10 min)
Cooperative learning model (20 min)
Presentations (50 min)

Teaching and Learning Sequence

The room will be set up in the shape of a horseshoe. This will get students out of the typical rows and allow them to be able to collaborate with their peers. To hook the students, I will have the lights off as they come into class and have a video up on the board. Once all the students come in and are seated the video will start, and it will be a roller coaster ride. After the video I will have them describe how this could relate to an exponential function. Before I jump into that too much I will hand out their graphic organizer, tree chart, which allows students to put things into a order of importance. They will be able to see which things are important, and "branch" off from big ideas to have more refined specific ideas. I will prompt them to put certain things on the chart; however, they will have opportunities to put whatever they want on it. From the video on roller coasters, I will talk about how the ride increases in speed. This will ultimately be connected back to linear and quadratic functions. So if we look at how the roller coaster's speed increases over time, we can see that it is basically moving at constant rate up to the top, and then it accelerates quickly downward. This could be representative of a function such as $y=2^x$. Obviously we would have a constraint on time, because the roller coaster would not be increasing in speed forever, it would level off at some point. So now we will consider the difference between $y=2^x$, $y=4^x$, $y=10^x$. Looking at these graphs, what can we tell about the relationship between x and y. As x increases, y will slowly increase depending on what we start with for x values. If our x values are negative, we will see very small y values. This is because when we put a negative value in, for example with $y=2^x$, it makes the equation reciprocate, and the exponent becomes positive. so, $f(-4)=2^{(-4)}$ or, $1/2^4$. As the negative numbers increase, the values get smaller. So, if we increase the x values with positive numbers, the y values increase, and increase rapidly. Then I will propose this question. What one y value do all of these functions have in common? I will give them some time to think about this, then we will discuss. If we plug in zero for each function, what do we get? Well, any number to the zero power is 1. So each one of these graphs goes through the point, 0,1. Will these graphs ever touch 0? No, because if we look at the graph closely, and on the calculator, the function will never tough zero. Now, let's consider what it would look like if we had something like $y= -(2^x)$, $y= -(4^x)$, and $y= -(10^x)$. The functions would still be increasing very quickly, however, for every x value, what would our y values be? Everything would be negative. It is important to realize where the parentheses are, because if the negative sign was inside the parentheses, it would be an alternating negative to positive function. Now, if we had $y= -(2^{-x})$, what would this function look like? It would be reversed and negative. By putting large negative numbers in, we would be getting large positive exponents out, which would result in a backwards function from what we had. And lastly, if we had $y=2^{-x}$, graphed it would be decreasing very quickly, because the larger the x input, the smaller the y output. I want students to be able to conceptualize what these graphs will look like before they even need to grab a calculator. They should be able to visualize them. This skill will be particularly helpful moving forward with more complex exponentials and what types of graphs make sense and what types of graphs don't.

Now, we will look at the basics of logarithms. How many of you have ever seen $\log_b(y)=x$? This is the same thing as $b^y=x$. So we can take that with numbers filled in, and actually compute it. For example, if we have $\log_2(x)=3$, we would rewrite this as $2^3=x$. $x=8$. Now we could be thrown a curve ball when it says $\log_2(8)=y$. Rewritten, this looks like $2^y=8$. From here, we would need to think about 2 to the what power equals 8. Now right off the top of our heads we know that $2^3=8$ like in our previous problem, but this is where we get into log properties. See content notes for EXAMPLE 1: log properties, and EXAMPLE 2. They will use this website for their homework on practicing log properties.

The next class we will review some of the information I covered the previous class before getting into work with e^x and ln(x). The last class we considered graphs of functions like $y=2^x$, $y=4^x$, and $y=10^x$, and how by increasing the base of the function, the ys would increase much more quickly with the xs. Alternately, if we plug in negative numbers, or decimals, the smaller the number (x value) the smaller the y value will be. Now, who has heard of the number *e*? Yes, believe it or not this is a number. When you see this, you need to remember that it is an actual number, not an x or a y or any other variable. It is a number. It represents 2.7182... etc... Similar to pi, it never repeats or terminates. The number *e* has an interesting history, so students can research that for a small bit of extra

credit towards their Glogster if they would like. This number is very special, and has some very interesting characteristics that are helpful when working with real world applications. So if we consider $y=e^x$, we know that it will fall somewhere between the functions $y=2^x$, and $y=3^x$, don't you agree? If we plug zero in for x, we know that it still has the same intercepts as 2^x and 3^x, and behaves the same. But now, let's consider the inverse of the function, $y=e^x$. It is the natural log of x, or ln(x). This is very similar to regular logarithmic functions. Let's graph y=ln(x), and see what it looks like. Some very interesting characteristics of it, ln(0)=undefined because it never touches 0, ln(1)=0. ln(e)=1. Why does this work? Let's remember what inverse functions look like. You are taking the x-axis and the y-axis and switching them. Do the two functions look similar now? To mathematically take the inverse of the function $y=e^x$, we switch x and y and get $x=e^y$. Remember I said that the natural log has the same properties of regular logarithms? So we can take the natural log of both sides of the function, because, what we do to one side we have to do to the other. Why is this helpful? Well, because we see we have $\ln(x)=\ln(e^y)$. Using the property that allows us to bring down the variable, y, we can now say: ln(x)=yln(e). Remember what ln(e) is? We now have ln(x)=y, because ln(e)=1. This is just a basic introduction to ln(x) and e^x. I am not too worries about their understanding of it at this point, although it is important to lay down the foundations of it as it will be used for expected value and other real world applications.
Where, Why , What, Hook Tailors: Visual, logical, intrapersonal, interpersonal

Students will know exponents, logarithms, log properties, e^x, ln(x). They will learn these things by working individually as well as in groups with the cooperative learning model and the checking for understanding. The cooperative learning model, pairs check, is a great way for students to work and help each other out. They will collaborate on answers with themselves and other pairs in the room after the prompt is over. I will propose several different logarithmic properties to them individually, and they will be given five minutes (a reasonable amount of time for the problems) at the most to work out the answers. From there, they will find a pair, and compare answers and work out the kinks. They will have another five minutes to do this. After that, I will give them several more problems to consider, and they, again, will have time to work alone, and then time to work with their peers. This should help to decrease "teacher teaching" and get it more in the hands of "student teaching," which is much more beneficial. Four Corners will make students think logically about the question given to them. I will need to ensure that students actually go to the corner that they think rather than following the heard. This will provide a good basis for students to reflect and talk to other classmates about the question and why they picked their respected corners. I will prompt them with such things as what is what is the log form of $y=x^3$. Each corner would have a specific answer, for example one corner might have the correct answer: $\log_x(y)=3$, another corner might have $\log_y(x)=3$, another: $\log_3(y)=x$, and another: log3(x)=y. I will call on random students to identify which part is the base, which part is the argument, and how it is properly set up. By doing that I am hoping to eliminate any students who just simply follow their friends. I will make it known to them that it is ok to say, "I don't know" we will go over it!
Equip, Explore, Rethink, Tailors: Interpersonal, intrapersonal, logical, kinesthetic

Students will be able to predict an exponential function and what it represents. They will do this through their summative assessment: Glogster. Individually, students will create a Glogster and show visuals about exponential functions and what they represent. The students will be expected to present their Glogster in some way to the class, although they will not be graded on their presentation, solely on the content within the Glogster. The Glogster should include animations, several graphics, and be aesthetically pleasing. Be sure that if this is on the internet for people to see that you give appropriate credit to other authors of information and graphics and state the permission status. Be creative--make your Glogster look the best. Anonymously students will submit who they think created the best Glogster. The winner will receive a prize! Students will meet with me, the teacher, and talk about their Glogster and its process. This will be a time for them to ask questions and make sure they understand how to predict an exponential function and what it represents.
Explore, Experience, Revise, Refine, Tailors: Visual, interpersonal, musical, intrapersonal

Students will use their checklist to make sure that they have all of the required information in their Glogster about the exponential functions and what they represent. The checklist will be online and available for students to access at any time. If they do not have internet access I will be able to print out the checklist for them so every student can have access to one. I will provide timely feedback by essentially grading each presentation as it happens. I will get a good understanding of whether or not the students have mastered the material through watching their presentations, seeing their Glogsters, and meeting with them individually. I will have their grade back to them no

later than the next class so they can learn from their mistakes, and make appropriate changes to their project if they need to. These topics will be connected into the next lesson. At this point, they will have a good understanding of the basics of exponential functions.
Evaluate, Tailors: Intrapersonal, interpersonal, visual

Content Notes
Students will know: Exponents: a base that is raised to some power. This power is representative of the base being multiplied by itself as many times as the exponent suggests. Logarithms: an exponential increase with the base of a specified number or variable to get a third number that is the answer: $\log_b(y)=x$. Log properties: see below for the list of logarithmic properties. $y=e^x$: the number, e, is a special number that is irrational, meaning non repeating and never ending. $y=\ln(x)$: similar to regular logs, the natural log ($\ln(x)$), is the inverse of $y=e^x$.
EXAMPLE 1
Log properties:
$\log_b(xy) = \log_b x + \log_b y$ Example: $\log_2(4*2)=\log_2(4)+\log_2(2)=8$
$\log_b(x/y) = \log_b x - \log_b y$ Example: $\log_2(8/2)=\log_2(8)-\log_2(2)=2$
$\log_b(xn) = n \log_b x$ Example: $\log_2(16^{.5})=.5\log_2(16)=2$
$\log_b x = \log_a x / \log_a b$ Example: $\log_2(9)=\log_3(9)/\log_3(2)=3.169$

$\log_b 1 = 0$ Example: $\log_2(1)=2^y=1$, $y=0$
$\log_b b = 1$ Example: $\log_5(5)=5^y=5$, $y=1$
$\log_b b2 = 2$ Example: $\log_3(3^2)=2\log_3(3)=2$
$\log_b bx = x$ Example: $\log_3(3^x)=x\log_3(3)=x$
$b\log_b x = x$ Example: $4^{(\log_4(2))}=2$
$\log_a b = 1/\log_b a$. Example: $\log_2(8)=1/\log_8(2)$

EXAMPLE 2
Practice problems

Handouts
Graphic organizer: tree chart
Rubric

Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale

Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Learning Styles

Clipboard: I will have an agenda written up on the board each day so that the clipboard can see a logical list of events that we will be discussing. Most of my discussion in class will be done on the board so that students, especially the clipboards, can see what is happening.

Microscope: Throughout my lesson, I will propose questions to the students to consider before I hint at what the answer may be. For example, I propose the questions: "Why does this work?" "Do these look similar? Why?" This will give them some time to consider the content and think for themselves, and hopefully come up with the answer before I get to it. They will also have the opportunity to look deeper into things that I may not cover for the whole class.

Puppy: Students in my classroom will feel safe because I will model a cohesive learning environment that is respectful and safe. When they work together, like with pairs check, I will be walking around to make sure that each group is getting along well, and make accommodations that I see fit if a situation were to arise. I want my

classroom to be one where all students feel comfortable answering questions and putting themselves out there.

Beach Ball: In this lesson students will have the opportunity to move around the room and make choices. For example, in the checking for understanding, four corners, after they consider a question, they will choose a corner to go to that represents their answer. This gives them some freedom to show that they know the content.

Rationale: All of my activities were chosen for a reason and were tailored to fit each student's needs. All of these types of students will be incorporated into the lesson so they all have an equal opportunity to learn.

Standard 6 - Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Formative: Four Corners will make students think logically about the question given to them. I will need to ensure that students actually go to the corner that they think rather than following the heard. This will provide a good basis for students to reflect and talk to other classmates about the question and why they picked their respected corners.

Summative: Glogster (23.333 points): Demonstrate what to look for in an exponential function and be able to create a mental picture of the function. The Glogster should include animations, several graphics, and be aesthetically pleasing. Be sure that if this is on the internet for people to see that you give appropriate credit to other authors of information and graphics and state the permission status. Be creative--make your Glogster look the best. Anonymously students will submit who they think created the best Glogster. The winner will receive a prize!

Rationale: Through the use of the formative assessment: four corners, and the summative assessment: Glogster, students will have many opportunities to show their knowledge of the content. I use the formative assessment because students will not feel stressed to get a grade on it, and likely get more out of it than if they were to take a quiz. Because I will have presentation for Glogster, students will continue to learn even after the lesson itself if over.

Standard 7 - Planning Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Content Knowledge: Students will know exponents, logarithms, log properties, e^x, ln(x).

MLR or CCSS or NGSS
Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function

Facet: Explanation

Rationale: Students are beginning to make connections between all of the types of functions covered in this unit. They have not quite mastered exponentials, although they have mastered linear functions and quadratic functions. Because they have a basic understanding of exponential functions at this point, it will be crucial moving forward with the standard. Next lesson they will tie everything together.

Standard 8 - Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

MI Strategies:
Logic: This is key for students in this section: to be able to look at a function and have a mental mindset of what it looks like.
Visual: The product, Glogster, will be a good visual aid for students to understand predicting exponential functions and what they represent.
Kinthestic: The checking for understanding will allow students to talk around the room to a corner that represents an answer, from there they will discuss.
Intrapersonal: Individual class work will be provided for students so they can work alone privately.
Interpersonal: Students will get together in groups and compare answers to questions proposed in class.
Naturalist: Students will take a concept of something that happens in nature, and relate it to an exponential function.

Musical: Students will be able to include music in their product which will add a powerful effect to auditory learners (depending on the music).

Type II Technology: Glogster: Interactive online poster that can include audio, video, animations, and text to appear appealing.

Rationale: I have differentiated my lesson to accommodate for multiple intelligences. By doing this, many different types of students with different learning abilities will have the opportunity to get involved in my lesson and get something out of it. It is all for the students, so making the lesson apply to them will help them get a better understanding of the content.

NETS STANDARDS FOR TEACHERS

1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.
a. Promote, support, and model creative and innovative thinking and inventiveness

b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources

c. Promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes

d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments

Rationale: I chose 1. a. because I am making my classroom a safe learning environment that will be available for students to come in at any time to get help during this lesson. I will propose many questions during instruction that will make students think about the ways to complete logs, exponents, and other exponential components. They will make more connections in the next lesson, but it is important for them to get the basics in this lesson, which they are getting.

2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S.
a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity

b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress

c. Customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources

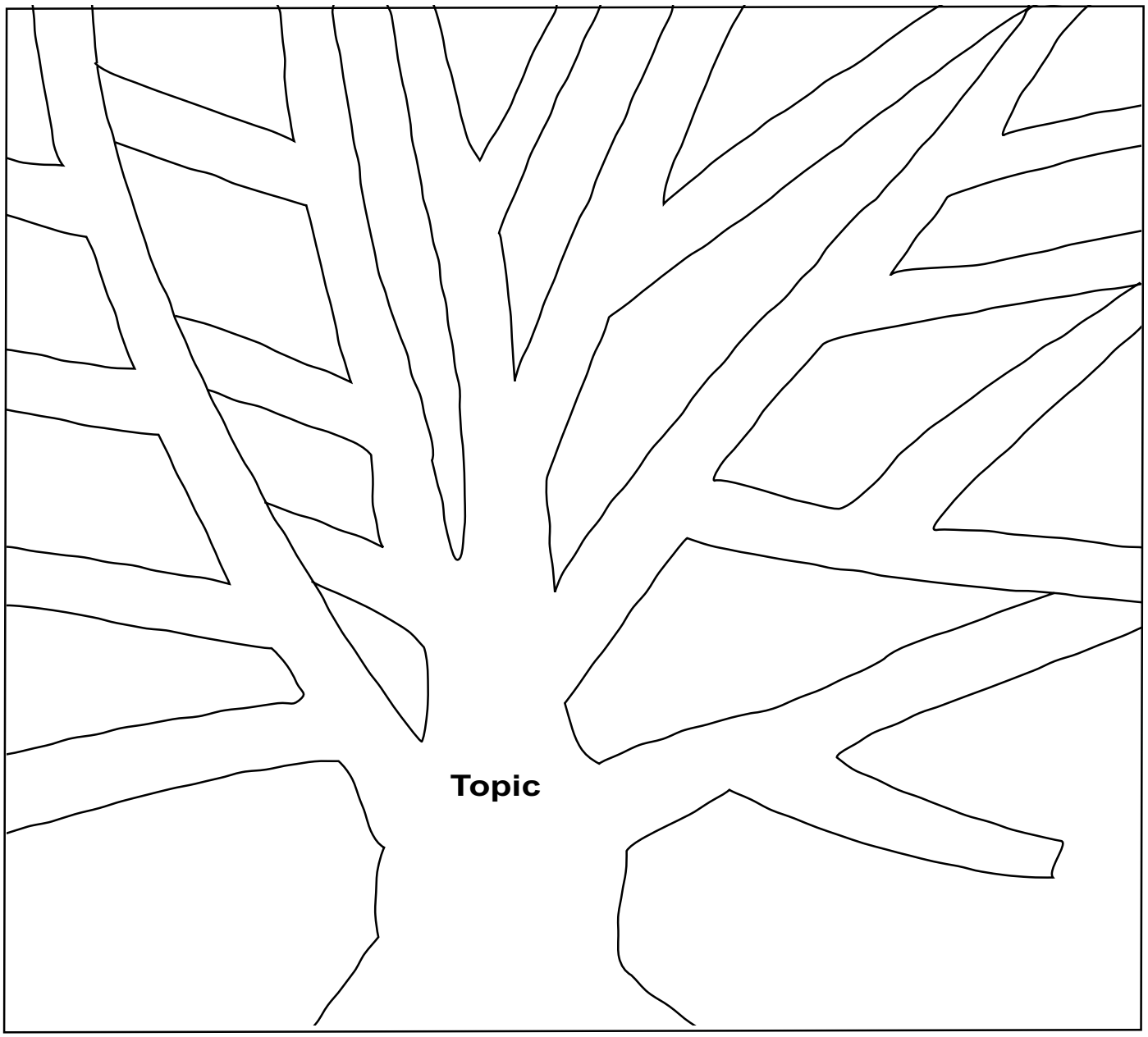
d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching

Rationale: I chose 2. c. because I am customizing my instruction to apply to many different types of students. Whether it is the beach ball, the clipboard, the puppy, the microscope, or any student with one intelligence better than another, I am differentiating my lesson to apply to them. This will give them a better opportunity to learn, and give them a chance to apply the learning to themselves.

Name _____ Date _____

Tree Chart

Write the details on the branches.



UNIVERSITY OF MAINE AT FARMINGTON
COLLEGE OF EDUCATION, HEALTH AND REHABILITATION

LESSON PLAN FORMAT

Teacher's Name: Mr. Cabaniss **Lesson #:** 6 **Facet:** Self-Knowledge
Grade Level: 11-12 **Numbers of Days:** 4
Topic: Students will be able to recognize the difference between exponential functions and other functions.

PART I:

Objectives

Students understand that exponential functions are different than other functions.
Students will know natural log, exponential growth and decay, graphing exponents, recognizing asymptotes.
Students will be able to recognize the difference between exponential functions and other functions.

Product: Virtual Jeopardy

Maine Learning Results (MLR) or Common Core State Standards (CCSS) or Next Generation Science Standards (NGSS) Alignment

Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function*

Rationale: I will meet this standard on this lesson by bringing everything together. This final lesson for this unit will show how increasing exponential functions will eventually exceed linear and quadratic functions. Through previous lessons they have gotten in-depth into linear and quadratic functions as well as dipped their toes into exponential functions. This lesson will immerse them into exponentials and show how they are graphed as well as how they relate to the real world.

Assessments

Formative (Assessment for Learning)

Section I – checking for understanding during instruction
The class will be asked questions that they are to answer on their individual white boards. This addresses many intelligences and is a good way for the teacher to see the understanding of the students. I will have students who have the wrong answer meet with students who got the correct answer so they can resolve the problem. This will promote peer help, which is a powerful tool. Students who teach each other will get more from the lesson. The students who teach to their peers will also gain much more from the experience.

Section II – timely feedback for products (self, peer, teacher)
The students will use Passalong to get constructive criticism of their jeopardy ideas. This will allow them to enhance it and make it better before they need to submit it for final use. Each group will meet with the teacher to make sure that there is no uncertainty before the project starts, and that each student in the group has a good understanding of how to recognize the differences between exponentials and other functions. The students will use their checklists to ensure that they have all of the necessary materials in their Jeopardy game.

Summative (Assessment of Learning):
Jeopardy (23.333 points): Students create a game to interact with students to show the differences between exponents and other functions. The class will be split up into groups of three and be asked to create a Jeopardy category for a specific exponential process. At the end, the class will collectively synthesize all of the Jeopardy categories into one game and they will play. The team who wins Jeopardy will win a prize.

Integration
Technology: Students will use their laptops for the summative assessment to create their virtual Jeopardy game.

Content Areas: This lesson applies to English because they will be writing down prompts for their specific portion of the summative assessment: Jeopardy.

Groupings
Section I - Graphic Organizer & Cooperative Learning used during instruction
Students will use a describing wheel in order to cover the key ideas of a total concept. They will be able to put any details they want in the sections of the wheel, as well as what I instruct them to put in. Cooperative play will engage the students to work with specific materials that I provide them with to think about exponentials and how they work. For example I could provide them with a website to play around with different components of an exponent. Also, a scenario by which they would need to model with the use of an exponent, or even a graphing calculator so they can graph their own functions and see what they look like.

Section II – Groups and Roles for Product
Students, in groups of two, will be responsible for creating a section in a virtual game of Jeopardy. They will be grouped by their love for Jeopardy. Students who love Jeopardy will be with students who are indifferent, students who are indifferent will be with students who do not have a love for Jeopardy. If they each make a section, the final product will be the whole game in which they can play among themselves in the class.

Differentiated Instruction

MI Strategies

Verbal: Using a white board quiz will allow students to write their answers down and demonstrate their knowledge on a white board.
Logic: Students will be able to decipher the difference between exponential functions and other functions by examining graphs, a table, and the function itself.
Visual: The hook will provide students with a good visual of exponential functions as they will be watching a video of the velocity vs. time of a roller coaster.
Kinthestic: I will have students get up and move around into different groups to separate them for Jeopardy.
Intrapersonal: The describing wheel will make students work together in order to write down important information that happened in class.
Interpersonal: The product will make students work together in class to win Jeopardy.

Modifications/Accommodations
From IEP's (Individual Education Plan), 504's, ELLIDEP (English Language Learning Instructional Delivery Education Plan) *I will review student's IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*

Plan for accommodating absent students: I will have screencasts available to students who are absent. They will be able to watch videos of the lesson that I did that day in class and come to me later with any questions and pick up papers. I will have an area in the back of the room for students to come in and grab the work that they missed. Ideally, students should come see me after school or during the school day when both of us are free so I can give them one on one attention.

Extensions

Technology (SAMR): Virtual Jeopardy would be a modification on the SAMR model because it is an interactive game that uses technology. Hyperlinks can be added in, and depending on the program that is used, video and audio could be additionally added. It is not quite at the redefinition phase, although it has some components to get it there.

Gifted Students: The topic of exponentials is a very difficult topic to grasp to begin with, so students who go above and beyond will be excelling quite a bit. I will have those students who are excelling help other students around the room during my instruction so that it will almost be like having teacher assistants. This will, again, promote peer teaching. I could also introduce more advanced concepts for the gifted students to consider, that the other students would not necessarily need to worry about.

Materials, Resources and Technology
Personal whiteboards for each students
Markers
Erasers

Source for Lesson Plan and Research
Graphic Organizer: http://www.eduplace.com/graphicorganizer/
Cooperative
Learning: http://edu221resources.wikispaces.com/file/view/cooperative_learning_strategies.pdf/426402320/cooperative_learning_strategies.pdf
Rubric: http://rubistar.4teachers.org/
CFU: http://nelearn.myelearning.org/pluginfile.php/439/mod_page/content/17/strategies.pdf
Checklist: http://scribbless.com/
Exponential practice
problems: http://www.uiowa.edu/~examserv/mathmatters/tutorial_quiz/log_exp/realworldappsexponential.html
Example 2 problems: http://www.regentsprep.org/regents/math/algebra/ae7/expdecayl.htm

PART II:

Teaching and Learning Sequence (Describe the teaching and learning process using all of the information from part I of the lesson plan)

Agenda

Day 1
Graphic organizer (5 min)
Hook (25 min)
Graphing exponentials (30 min)
Introduction to Jeopardy (20 min)

Day 2
Review/ Q&A (10 min)
Exponential growth and decay (30 min)
CFU (25 min)
Work time on Jeopardy (15 min)

Day 3
Review/ Q&A (10 min)
Graphing exponentials and seeing asymptotes (20 min)
Relating exponentials to linear and quadratic functions (25 min)
Cooperative Learning (25 min)

Day 4
Synthesizing Jeopardy into one game (15 min)
Play Jeopardy (65 min)

Teaching and Learning Sequence

The room will be set up in a horseshoe. This will get students out of the typical rows and columns, and allow them to work with a partner next to them. This will also open up the room, and make it more accessible for me to walk around and help students. Students will use a describing wheel in order to cover the key ideas of a total concept. They will be able to put any details they want in the sections of the wheel, as well as what I instruct them to put in. I will hook my students by bringing them outside and breaking the class up into several groups. I will be running, along with the help of other teachers/coaches, to show how an exponential function differs from other functions. I will start from standing and sprint, another teacher will run at a constant rate, and another teacher will start off slow, go faster, and then slow again. These will represent exponential, linear, and quadratic functions respectively. This hook should help students visualize the difference between the three functions. After that, we will go inside, graph what each teacher's function looked like, and then move forward with exponentials and graphing them.

We will take a look at this website to help us consider the creation of exponential functions. These exponential functions are based right from the real world. I will use the website to help facilitate the students learning the material--this is the toughest portion of the unit. In order to first visualize an exponential and see what it looks like on a graph, we should consider a table of points. We should be able to see an increase in the ys that is not consistent, but more "exponential." Meaning you can't add the same number from to y1 to get y2 to get y2. If we look at 5^x for x=0 to x=4, we see that the ys are 1, 5, 25, 125, 625. This case, we know that we can multiply the y by 5 to get to the next number. The students should not be able to start visualizing what this looks like. So if we take 5^{-x}, we can see from x=0 to x=4, that we have 1, 1/5, 1/25, 1/125/ 1/625. As x increases, y decreases, which is the opposite of the previous scenario. Each student will use their individual white board to graph this as part of their checking for understanding, which will happen consistently throughout this lesson. Throughout their time graphing by hand, I will have them check their work using a calculator so they can see what the actual function looks like if they were wrong.

An important real world application of exponentials is exponential growth and decay. Exponential decay is given by the function that looks like: $y=a(1-r)^x$, where "a" is the initial amount before any attrition, r is the rate, many times given as a percent, and x is generally time. This function would be a decreasing function because why? Well, because if we have a decimal for r, and we do 1-r, we would get a decimal. Any positive decimal raised to a power gives us an even smaller decimal. The higher the exponent the smaller the number. Eventually it will approach zero. As for growth, we will consider an increasing function. This is because we have $y=a(1+r)^x$. Notice that before it was 1-r, now it is 1+r, which will give us a number greater than zero, thus an increasing function. So let's give one a try: Find a bank account balance to the nearest dollar, if the account starts with $100, has an annual rate of 4%, and the money left in the account for 12 years. So if we plug these variables into the formula, we first know that our initial is 100, this will be our a. The rate is 4%, or 0.04, and the x, which is our time, will be 12 years. Setting up the equation looks like this: $y=100(1+0.04)^{12}$---> $y=100(1.04)^{12}$--->$y=100(1.601)$---> $y=160.10$, or $160.10. Is it better to have a higher or lower interest rate? You can see that after 12 years, there is only an extra 60 put into the account. Let's try it with a 6% interest rate. y=100(1+0.06)12. y=201.22, or $201.22. The more the interest rate, the more money you get. EXAMPLE 2.

I would like everybody to make a table of points for the function $y=2^x+5$. Use a bunch of points, use your calculator, do what you need to do. What do you notice when you plug in 0? We get 6. What about -.5, -.2, -.02? What do we notice is happening to the numbers? They are slowly getting closer and closer to 5. What if we had the function $y= -3^{-x}-6$. What happens when we plug in 0? We get -7. What about 1, 2, 10? What do we notice about y? It is getting closer and closer to -6. For visualizing exponential functions, if there is a constant without a variable, that is how much the function is going to be shifted up or down---similar to linear and quadratic functions.

So now let's see if we can tie everything together. What we learned about linear functions, is that they increase at a constant rate, and have a constant slope throughout. Quadratic functions have a power of 2, no more, no less, and are symmetrical. Depending on the coefficient in front of the variable, they may increase more quickly or more

slowly than linear functions. Exponential functions have the potential to increase the quickest over the shortest period of time (least amount of x values). So let's consider the graphs of y=2x, $y=x^2$, and $y=2^x$. Make a table of the first 5 x and y values of each. For y=2x: y(1)=2, y(2)=4, y(3)=3, y(4)=8, and y(5)=10. For $y=x^2$, y(1)=1, y(2)=4, y(3)=9, y(4)=16, and y(5)=25. For $y=2^x$, y(1)=2, y(2)=4, y(3)=8, y(4)=16, and y(5)=32. What do you suppose will happen if we keep going? Let's graph each one. We can see that the linear function is increasing the quickest, the quadratic is increasing quicker than the linear function but not as quick as the exponential, and the exponential is increasing quicker than both the linear and the quadratic functions.
Where, Why , What, Hook Tailors: Kinesthetic, interpersonal, intrapersonal, logical, verbal

Students will know exponential growth and decay, graphing exponents, recognizing asymptotes. They will get an understanding of these through their cooperative learning model and their checking for understanding. Cooperative play will engage the students to work with specific materials that I provide them with to think about exponentials and how they work. For example I could provide them with a website to play around with different components of an exponent. Also, a scenario by which they would need to model with the use of an exponent, or even a graphing calculator so they can graph their own functions and see what they look like. For the checking for understanding, the class will be asked questions that they are to answer on their individual white boards. This addresses many intelligences and is a good way for the teacher to see the understanding of the students. I will have students who have the wrong answer meet with students who got the correct answer so they can resolve the problem. This will promote peer help, which is a powerful tool. Students who teach each other will get more from the lesson. The students who teach to their peers will also gain much more from the experience. This checking for understanding will be more of a full lesson thing, as they will be allowed to use their whiteboards whenever they want, but there will be a specific time when I propose questions for them to complete on their whiteboards.
Equip, Explore, Rethink, Tailors: Interpersonal, intrapersonal, verbal

Students will be able to recognize the difference between exponential functions and other functions. They will be able to do this through my instruction and their summative assessment: Virtual Jeopardy. In groups of two, students will be responsible for creating a section in a virtual game of Jeopardy. They will be grouped by their love for Jeopardy. Students who love Jeopardy will be with students who are indifferent; students who are indifferent will be with students who do not have a love for Jeopardy. If they each make a section, the final product will be the whole game in which they can play among themselves in the class. This will be an interactive game for students to show the differences between exponents and other functions. The class will be split up into groups of three and be asked to create a Jeopardy category for a specific exponential process. At the end, the class will collectively synthesize all of the Jeopardy categories into one game and they will play. The number of categories will be determined by the number of students in my class. Some categories could include: Asymptotes, Logarithms, Natural Log, *e*, quadratics, vertex, linear functions, slope, tangent line, etc... I will have them brainstorm a list of words on the board that were relevant to the unit, and then decide which words they would like to make a category out of. The team who wins Jeopardy will win a prize. The students will use Passalong to get constructive criticism of their jeopardy ideas. This will allow them to enhance it and make it better before they need to submit it for final use. Each group will meet with the teacher to make sure that there is no uncertainty before the project starts, and that each student in the group has a good understanding of how to recognize the differences between exponentials and other functions. I will go around during their work time on the project and meet, informally, with each student so I can get a good understanding of where they are with the information.
Explore, Experience, Revise, Refine, Tailors: Interpersonal, logical, verbal

The students will use their checklists to ensure that they have all of the necessary materials in their Jeopardy game. This online checklist will allow them to add things they see necessary, as well as check off things that they have completed that I have on there. I will be able to have each student's project graded and back to them before they play the game because they will need to check with me to make sure all of their math is correct before they synthesize it with the rest of the class. This type of timely feedback will ensure that the students know the material, and will help them learn from any mistakes they may have made before we move on.
Evaluate, Tailors: Intrapersonal

Content Notes
Students will know: Exponential growth and decay: A function that is either increasing exponentially, or decreasing

exponentially, usually based on a real life scenario. Graphing exponents: . Recognizing asymptotes:
EXAMPLE: 1 CFU Graph the following functions:
$y=2^x$
$y=10^x$
$y=-4^x$
$y=-2^{-x}$
$y=6^{-x}$
$y=\ln(x)$
$y=2^x+1$
$y=2^{-x}+1$

EXAMPLE 2
In 1985, there were 285 cell phone subscribers in the small town of Centerville. The number of subscribers increased by 75% per year after 1985. How many cell phone subscribers were in Centerville in 1994? Answer: We know that time will equal 9 years, so that is what we will plug in for x with the function. $y=285(1+0.75)^x$---> $y=285(1+0.75)^9$--->$y=43871$ subscribers

Bacteria can grow at an alarming rate. If bacteria doubles every hour, and we start off with one cell at one hour, how many bacteria cells will there be after 10 hours? Answer: Because the bacteria doubles every hour, the rate of increase is 100%. $y=1(1+1)^x$---> $y=2^x$---> $y=2^{10}$---> $y=1024$.

Each year the local country club sponsors a tennis tournament. Play starts with 128 participants. During each round, half of the players are eliminated. How many players remain after 5 rounds? Answer: Because half of the players are eliminated after each round, we know that the rate is 50%, or 0.5. $y=128(1-0.5)^x$---> $y=128(1-0.5)^5$---> $y=4$ participants.

Handouts
Graphic organizer
Rubric

Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale

Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Learning Styles

Clipboard: I will have an agenda written up on the board each day so that the clipboard can see a logical list of events that we will be discussing. Most of my discussion in class will be done on the board so that students, especially the clipboards, can see what is happening.

Microscope: Throughout my lesson, I will propose questions to the students to consider before I hint at what the answer may be. This will give them some time to consider the content and think for themselves, and hopefully come up with the answer before I get to it. They will also have the opportunity to look deeper into things that I may not cover for the whole class.

Puppy: Starting with my syllabus, I will ensure that each student is given respect and a safe learning environment. I will make sure that they know every question will be taken seriously, and their peers are here to help, not hurt. This will definitely happen in my classroom because I will start from day one supporting these theories.

Beach Ball: Throughout my lesson I will have a variety of activities and choices for students (beach balls) to grasp. These activities include the cooperative learning model, the checking for understanding, and the freedom to choose

which category their summative assessment will be about.

Rationale: I am accommodating for all of the different types of learners in this lesson through multiple activities, strategies, and guarantees. Students will know that my classroom is a safe place to be for both learning and friendship. They will also know that my classroom is one that they will be pushed in, although, they will have freedoms that will ideally benefit their learning.

Standard 6 - Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Formative: The class will be asked questions that they are to answer on their individual white boards. This addresses many intelligences and is a good way for the teacher to see the understanding of the students. I will have students who have the wrong answer meet with students who got the correct answer so they can resolve the problem.

Summative: Jeopardy (23.333 points): Students create a game to interact with students to show the differences between exponents and other functions. The class will be split up into groups of three and be asked to create a Jeopardy category for a specific exponential process. At the end, the class will collectively synthesize all of the Jeopardy categories into one game and they will play. The team who wins Jeopardy will win a prize.

Rationale: These two types of assessments will be very beneficial to students' learning. The formative assessments are important because they will not intimidate the students into thinking they will need to study really hard for it, or it will be reflective of their grade. This will be for both the students as well as my benefit to see where they are. The summative assessment, Jeopardy, will teach the students even after the official lesson is over. Hopefully they will not even think of this as a learning tool, and will have fun, while still getting a lot out of it.

Standard 7 - Planning Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Content Knowledge: Students will know exponential growth and decay, graphing exponents, recognizing asymptotes.

MLR or CCSS or NGSS
Common Core State Standards
Content area: Algebra
Grade level: High school
Domain: Linear, Quadratic, and Exponential Models
Cluster: Construct and compare linear, quadratic, and exponential models and solve problems
Standard: 3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function

Facet: Self-Knowledge

Rationale: Because this is the 6th and final lesson of the unit, I can say that I have successfully achieved standard 3 in the Common Core State Standards. I have instructed students about linear equations, quadratic equations, as well as exponential equations; however, at the end--in this lesson--I tie everything together. The standard states: "Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function." That is exactly what I did in my teaching and learning sequence in this lesson.

Standard 8 - Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to

apply knowledge in meaningful ways.

MI Strategies:
Verbal: Using a white board quiz will allow students to write their answers down and demonstrate their knowledge on a white board.
Logic: Students will be able to decipher the difference between exponential functions and other functions by examining graphs, a table, and the function itself.
Visual: The hook will provide students with a good visual of exponential functions because they will be outside watching real world examples of different functions.
Kinthestic: I will have students get up and move around into different groups to separate them for Jeopardy. They will also go outside for the hook to see different types of functions at work.
Intrapersonal: The describing wheel will make students work together in order to write down important information that happened in class.
Interpersonal: The product will make students work together in class to win Jeopardy.

Type II Technology: Virtual Jeopardy: A way for students to play a fun game that is in a technological setting.

Rationale: Through a variety of different activities and strategies, I have met several intelligences that students have. Because I have met these, I have made it easier for students to understand the content that I am teaching far better. Because I am making these accommodations in my teaching, students will have the opportunity to get more involved into this lesson on exponentials.

NETS STANDARDS FOR TEACHERS
1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.
a. Promote, support, and model creative and innovative thinking and inventiveness

b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources

c. Promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes

d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments

Rationale: I chose 1.c. because I will have students use their peers, me, and themselves to reflect upon the content they have learned, as well as their product they will be constructing. Through the use of Passalong, the students will work together to give positive and constructive feedback to each other on their products. With the use of the checklist, they will be able to self-reflect to ensure that they have all of the necessities for their product. When they meet with me, I will help them to see if they really have a true understanding of the content, and whether or not they think they need more work on what they have learned.

2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S.
a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity

b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress

c. Customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources

d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching

Rationale: I chose 2.d. because I have adapted both a formative and summative assessment into my lesson, and the formative assessment will practically be used throughout the entire lesson. I will constantly propose problems for them to try, and they will use their whiteboards to demonstrate their knowledge of the content to me. The summative assessment will be a virtual game of Jeopardy that students in groups of two will create. Through the use of technology to create the game, they will have the opportunity to get more creative with the content and presentation of their information.

Name _____ Date _____

Describing Wheel

Add describing words about your topic between the spokes.