

Exponential Growth and Decay

Day 1

Grade: 9 th		Subject: Algebra I; Exponents	
Materials: everyday classroom essentials		Technology Needed: computer or smart device	
Instructional Strategies: <ul style="list-style-type: none"> <input type="checkbox"/> Direct instruction <input type="checkbox"/> Guided practice <input type="checkbox"/> Socratic Seminar <input type="checkbox"/> Learning Centers <input type="checkbox"/> Lecture <input type="checkbox"/> Technology integration <input type="checkbox"/> Other (list) 		Guided Practices and Concrete Application: <ul style="list-style-type: none"> <input type="checkbox"/> Large group activity <input type="checkbox"/> Independent activity <input type="checkbox"/> Pairing/collaboration <input type="checkbox"/> Simulations/Scenarios <input type="checkbox"/> Other (list) Explain:	
Standard(s) HS.F-IF.8* Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function b. Use the properties of exponents to interpret expressions for exponential functions		Differentiation Below Proficiency: Students will be given notes and placed in groups where students will help them. Above Proficiency: These students will need to lead the groups and teach others the problem they have chosen. Approaching/Emerging Proficiency: These students need to be good teammates and will not need much accommodation. Modalities/Learning Preferences: visual, social, auditory	
Objective(s) Students will understand and apply their knowledge to exponential growth and decay functions. Bloom's Taxonomy Cognitive Level: knowledge, analysis			
Classroom Management- (grouping(s), movement/transitions, etc.) I will place colored cards on their desks to assign their groups for after lecture. Again, I will incorporate humor, proximity, and monitor groups and assisting when needed.		Behavior Expectations- (systems, strategies, procedures specific to the lesson, rules and expectations, etc.) Students should work well in groups and be able to present as a team and communicate their ideas to the class.	
Minutes	Procedures		
5	Set-up/Prep: Set up notes, prepare colored cards, prepare video		
5	Engage: (opening activity/ anticipatory Set – access prior learning / stimulate interest /generate questions, etc.) I will start the class by showing a short film that has a real application to exponential growth. https://www.youtube.com/watch?v=VcSX4ytEfcE I will demonstrate that this is exactly what we are talking about today. (exponential growth and decay).		
25	Explain: (concepts, procedures, vocabulary, etc.)		

	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; text-align: center;"> Growth: $y = a(1+r)^x$ </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> Decay: $y = a(1-r)^x$ </div> </div> <p style="margin-left: 40px;"> a = initial amount before measuring growth/decay r = growth/decay rate (often a percent) x = number of time intervals that have passed </p> <p>I will give the students the following handout. We will go over both growth and decay problems and how to use the handout out. So, we will start with an exponential growth problem:</p> <p>Mr. Doll is getting ready to go on vacation. The day before he leaves he makes an incredible dish of Mac N Cheese. However, he forgets it on the counter. While Mr. Doll is away, there were 5 bacteria on the pasta to begin. Then, they increased by 200% in number every twelve hours. If Mr. Doll was gone for seven days, how many bacteria were on his Mac N Cheese when he returned.</p> <p>With this example, the class and I will identify $a=5$ $r=200\%$ which I will emphasize needs to be a decimal (so in this case 2). Now x is a little tricky. Since it happens every 12 hours and there are 24 hours, it happens twice a day for seven days. So, $x=14$. Then we will solve.</p> <p>For Decay: Mr. Doll buys a new car while on vacation. However, his car depreciates in value by 10% every 6 months. He bought his car for \$32,000. How much would it cost after 5 years. Again, go through the same process and identify variables and walk the students through this problem.</p>
15	<p>Explore: (independent, concrete practice/application with relevant learning task -connections from content to real-life experiences, reflective questions- probing or clarifying questions)</p> <p>This is when I will let the students get into groups of 2 or 3 and research or come up with an exponential growth or decay problem. I will explain that tomorrow they will have to present to the class and identify the different variables and walk the class through the calculations and how it applies to the problem.</p>
5	<p>Review (wrap up and transition to next activity):</p> <p>I will have the students pack up and tell them they will present their problems tomorrow in class. Also, they may have time to continue to work tomorrow before they present.</p>
<p>Formative Assessment: (linked to objectives) Progress monitoring throughout lesson-clarifying questions, check- in strategies, etc. I will be prepared to use clarifying questions, or have students repeat to me what their task is when is to comes to the research part.</p> <p>Consideration for Back-up Plan: I can lecture for longer if I feel the students are confused about the concept.</p>	<p>Summative Assessment (linked back to objectives) End of lesson: The assessment will be the way the groups teach their specific problem.</p> <p>If applicable- overall unit, chapter, concept, etc.: The content of this lesson will be on the test.</p>
<p>Reflection (What went well? What did the students learn? How do you know? What changes would you make?): How quick did students create or find a problem? Did they understand the problem and were able to explain it to the class?</p>	

Day 2

Grade: 9th		Subject: Algebra I; exponents	
Materials: Everyday classroom essentials		Technology Needed: smart board, computers or smart device	
Instructional Strategies: <ul style="list-style-type: none"> <input type="checkbox"/> Direct instruction <input type="checkbox"/> Guided practice <input type="checkbox"/> Socratic Seminar <input type="checkbox"/> Learning Centers <input type="checkbox"/> Lecture <input type="checkbox"/> Technology integration <input type="checkbox"/> Other (list) 		Guided Practices and Concrete Application: <ul style="list-style-type: none"> <input type="checkbox"/> Large group activity <input type="checkbox"/> Independent activity <input type="checkbox"/> Pairing/collaboration <input type="checkbox"/> Simulations/Scenarios <input type="checkbox"/> Other (list) Explain: <input type="checkbox"/> Hands-on <input type="checkbox"/> Technology integration <input type="checkbox"/> Imitation/Repeat/Mimic 	
Standard(s) HS.F-IF.8* Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function b. Use the properties of exponents to interpret expressions for exponential functions		Differentiation Below Proficiency: I will be sure to help these students and make sure they are prepared to share when called upon by checking that they have their portion correct which will lead to success. Above Proficiency: These students should take the lead and be able to teach their problems. Approaching/Emerging Proficiency: These students should be able to contribute and be challenged by the students teaching their problems. Modalities/Learning Preferences: visual, auditory, hands-on	
Objective(s) Students will understand and apply their knowledge to exponential growth and decay functions. Bloom's Taxonomy Cognitive Level: synthesis			
Classroom Management- (grouping(s), movement/transitions, etc.) I will use purposeful proximity, be sure to control what students are saying and doing during someone's presentation. I will use the attention getter if need be between students' problems.		Behavior Expectations- (systems, strategies, procedures specific to the lesson, rules and expectations, etc.) Students should be respectful and taking notes when their classmates are presenting	
Minutes	Procedures		
5	Set-up/Prep: Have groups and computers ready		
3	Engage: (opening activity/ anticipatory Set – access prior learning / stimulate interest /generate questions, etc.) Welcome the students to class remind them of the project they were working on and let them get into their groups to begin working.		
5	Explain: (concepts, procedures, vocabulary, etc.) I will be sure to remind students the proper way to give a presentation. I will explain in between groups presenting to clarify and summarize what they presented.		
40	Explore: (independent, concrete practice/application with relevant learning task -connections from content to real-life experiences, reflective questions- probing or clarifying questions) I will have 5-10 minutes for the groups to finish researching and getting their problems ready to present. Then with the remaining 30-35 minutes the groups will present their exponential growth or decay problems.		

<p>2</p>	<p>Review (wrap up and transition to next activity): I will take two minutes to wrap up and thank the students for doing this. I will remind them that we are reviewing tomorrow and then taking the test the following day.</p>
<p>Formative Assessment: (linked to objectives) Progress monitoring throughout lesson- clarifying questions, check- in strategies, etc. I will be sure to ask groups to touch on things they didn't cover or that I would like them to explain more about. I will require the students to be taking notes during the presentations.</p> <p>Consideration for Back-up Plan: If students aren't paying attention, then I will ask for the notes and the problems from each group.</p>	<p>Summative Assessment (linked back to objectives) End of lesson: The presentation.</p> <p>If applicable- overall unit, chapter, concept, etc.: These skills will be needed for the test.</p>
<p>Reflection (What went well? What did the students learn? How do you know? What changes would you make?): How long did the presentations take? Did the students learn from this? Did the students listening to the presentation gain knowledge from the many different examples?</p>	