NAME **Melissa Bechtold** **DATE: February 20, 2014**

SINGLE SUBJECT DAILY LESSON DESIGN FORMAT

TITLE OF LESSON	CURRICULUM AREA & GRADE LEVEL	DATE OF LESSON
Exploring Exponential Functions using the Olympics	Algebra II: High School 9-12	Day 3 of 5 day Olympics integrated Thematic Unit

CA CONTENT STANDARD(S) (Common Core)

- *HSF – IF.C.7 Analyze functions using different representations:* Graph exponential and logarithmic functions, showing intercepts.

CA ELD STANDARD(S)

- English Language Development grades 9-10: Listening actively
  - Emerging: Demonstrate comprehension of oral presentations and discussions on familiar social and academic topics by asking and answering questions with prompting and substantial support.
  - Expanding: Demonstrate comprehension of oral presentations and discussions on a variety of social and academic topics by asking and answering questions that show thoughtful consideration of the ideas or arguments with moderate support.
  - Bridging: Demonstrate comprehension of oral presentations and discussions on a variety of social and academic topics by asking and answering detailed and complex questions that show thoughtful consideration of the ideas with light support.

BIG IDEA ADDRESSED/ENDURING UNDERSTANDING: Why this material is important to teach; how it fits in with the unit or theme

This will be the second day of exploring exponential functions which model a constant percent increase or constant percent decrease. Students will use this knowledge to model the competitive brackets of hockey in the Olympics.

ESSENTIAL QUESTIONS

How can we use technology to help us solve problems?

What are exponential functions?

How do we graph and write an equation for exponential functions?

OBJECTIVE

- Cognitive: After learning about graphing exponential growth and graphing an exponential function, students will be able to analyze the Olympic hockey competitive brackets by graphing and solving problems.

ASSESSMENT(S)

- Formal & Formative: Students will analyze the Olympic hockey competitive brackets by graphing and solving problems. Students will demonstrate comprehension of the notes (oral presentation) and discussions on the Olympics (social topics) by asking and answering detailed and complex questions that show thoughtful consideration of the ideas with light support. They will receive a grade for their participation in the assignment. (Bridging level)
  - Wilson: will have the same assignment but at the expanding level: Wilson will demonstrate comprehension of the notes (oral presentation) and discussions on the Olympics (social topics) by asking and answering questions that show thoughtful consideration of the ideas with moderate support. He will receive a grade for their participation in the assignment.

PREDICTION OF LIKELY DIFFICULTIES STUDENTS MAY ENCOUNTER WITH THIS MATERIAL

Content: Some students may have difficulty grasping the concept of exponential functions and be tempted to revert to linear equations since they are already familiar with them. The goal is to create a deep level of understanding so that students see why an exponential graph is different than a line.

Content: English learners may need help understanding the words *growth, decay, and exponential* but they were exposed to these words in the previous lesson. They also may need clarification with the *Olympics* and *hockey*. They are encouraged to use their translators or may need some additional descriptions from myself or their peers.

INSTRUCTIONAL STRATEGIES	STUDENT ACTIVITIES:
1. There will be a warm-up activity on the board for students when they enter the classroom. As usual, students are expected to begin working on this warm-up immediately and may use the help of their classmates. Also, the teacher will be walking around to observe the progress of the class for both timing to determine when she may move on and to informally perform a diagnostic assessment of the students' mathematical accuracy. The teacher will go through the warm up with the students (7 minutes): a. Write an equation for $y=x^2$, 2 units up and 1 unit to the right. $y=(x-1)^2+2$ b. Write an equation for $y=\|x\|$, 1 unit up and 2 units left. $y=\|x+2\|+1$ c. Simplify $y=(x^{-3/4})^4$ x^{-5} or $1/x^5$	1. Students will enter the classroom and start working on their warm up. They have done translations of these graphs before, this warm up will serve as a reminder. (7 minutes)
2. Teacher will begin a traditional lecture by asking students to get out their notes. Titled "Exploring Exponential Models". See attachment for copy of notes with some talking points. Teacher will cover graphing exponential growth, determining growth or decay, and introductory word problems. (30 minutes)	2. Students will take notes on "exploring exponential models" (30 minutes)
3. The teacher will ask students to partner up for our cooperative activity by choosing their own partner. We will propose some questions about the Olympics hockey bracket and how it relates to exponential functions. The teacher should only reveal one question at a time and should try to keep all teams on the same page. Show the students the rubric and let them know that their participation in this activity will be earning a grade. [resource required: Activity projected on screen, check out a class set of Chrome books with internet access, graph paper]. (45 minutes).	3. Students will pick a partner and answer questions about a competitive bracket using the knowledge they just got from the notes. They will need to use their Chrome Book to do some research and to make a graph on desmos.com. (45 minutes)
4. Teacher can let class know that any remaining time should be used to practice problems on page 442 of their text book. The teacher should determine how many problems to give based on the amount of time remaining. As always, teacher will be observing that the students are doing the problems correctly and answering questions. (Time remaining)	4. Students can practice problems while still in class to make sure they are on the right track. (whatever time is left over)
INFO ABOUT ENGLISH LANGUAGE LEARNERS*: Wilson* • Readiness level: CELDT 2: Beginner intermediate • Learning profile: strengths and challenges: Wilson has enough vocabulary to get his message across in conversation but lacks a lot of subject specific vocabulary necessary in an Algebra II class, in other words he needs improvement with his academic language. His reading skills are fair but has more difficulty with writing. Granted, in math less writing is required. • Prior successful differentiation strategies: If the teacher can translate some information in advance, that is great for Wilson so that he does not have to spend time translating on his own, especially if there are extensive amounts of reading or listening. Wilson loves working with other people. • Interests— Wilson likes to be funny and the center of attention. He likes to watch movies and hang out with friends.	INFO ABOUT STUDENTS W/ SPECIAL NEEDS: Pamela • Readiness level: Auditory processing difficulties, attention focusing • Learning profile: strengths and challenges: Pamela has her good days and bad days. On the whole, she is strong in math skills but lacks the ability to focus for longer periods of time. Writing is more difficult for Pamela and she usually receives lower grades in English class. She asks for help from the teacher, aid, or peers most of the time and other days she quietly pretends to understand. For this reason, it is important to watch to make sure she is actually making progress and attempting the work instead of zoning out. • Prior successful differentiation strategies: Keep lecturing to a maximum of 15 minutes for maximum effectiveness. Giving directions in stages is more effective than chunking all directions together at one time. • Interests—academic and/or personal: Math is one of Pamela's stronger subjects. She is on the school basketball team.
DIFFERENTIATION FOR ENGLISH LANGUAGE LEARNERS *choose area(s) as necessary based on information above*	DIFFERENTIATION FOR STUDENTS WITH SPECIAL NEEDS • Process – The notes will be uploaded to our class website

• Content - ***what*** *material - including key vocabulary - is learned:* Wilson will need the new math vocabulary of *growth, decay, and exponential* that we learned the day before. He may also struggle to understand some concepts like the Olympics or hockey. He can use his translator to help. • Assessment: Wilson will be graded on the expanding level whereas the rest of the class will be graded on the bridging level. The goal is to increase Wilson's language abilities to the expanding level since he is Beginner Intermediate. If he is not able to get to this level, then we will need to work on his "listening actively" skill by having more listening activities with more scaffolding integrated.	with audio so that Pamela may go back and review the lecture at home if she was not able to focus in class. She will probably enjoy the activity since she is able to work with a partner and the activity is related to sports. • If Pamela is not able to complete the Olympic competitive bracket activity, it is most likely because of her audio processing and difficulty focusing. I can ask the aid to take her to the resource room so that she can work on it individually if necessary.
RESOURCES: *Attach materials needed to implement the lesson - e.g., power point presentation, text, graphic organize* • Activity: Olympic Hockey Competitive Brackets • Projector • Chrome books with internet access • Textbook: Prentice Hall Mathematics, California Algebra 2 (2008)	REFLECTION: The class responded well to this lesson. I feel like the vampire introductory activity really helped them understand what was going on with the graph and equation. Furthermore, tying in the real life examples of interest, world population, and the Olympics makes the students more interested. Some students want to draw decay in the wrong direction and needed assistance toward the end of the Olympic activity as the questions became more challenging. This type of confusion was expected and is part of the learning process. This is not the end of the exponential unit and students should be able to continue their learning as the next few lessons continue.

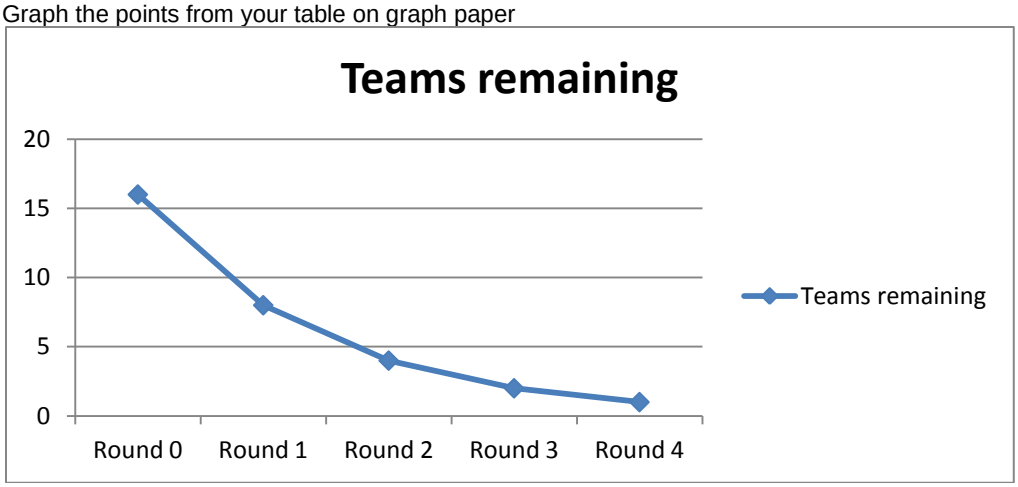
Activity: Olympic Hockey Competitive Brackets

Every four years for the winter Olympics, countries play against each other for the gold medal in ice hockey. The basic idea is that the top 16 teams will enter into the brackets. When a team loses, it is out of the tournament.

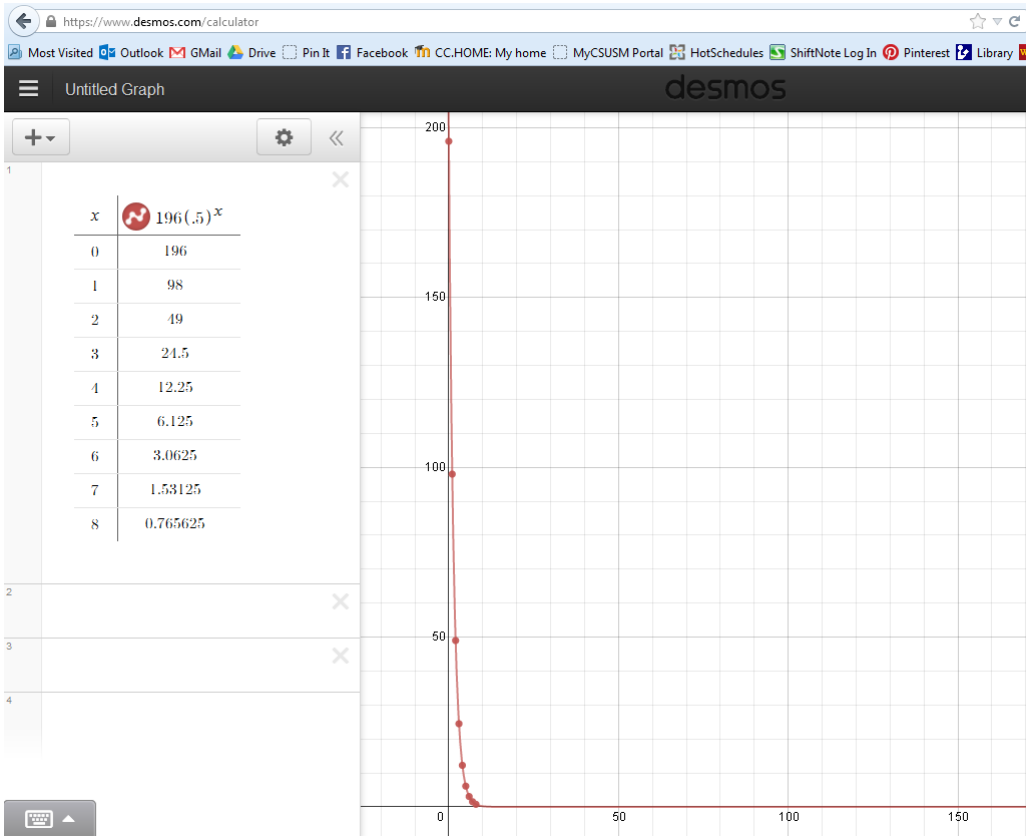
1. How many teams are left in the tournament after the first round of hockey games? 8 because half of the teams lose and half will win and go on.
2. Copy, complete, and extend the table until only one team is left.

After round x	Number of teams left in tournament (*y*)
0	16
1	8

3. Graph the points from your table on graph paper



4. How many rounds are played in the tournament? 4 rounds
5. Does the graph represent a linear function? No
6. How does the number of teams left in each round compare to the number of teams in the previous round? There are half as many teams as in the previous round.
7. Write an equation representing the number of teams remaining (*y)* at any given round (*x*). $y=16(.5)^x$
8. Some people believe that every country should be able to compete so long as they can transport a team to the Olympics. Do some research to find, how many countries are in the world? Sources have different answers from 189-196.
9. Write an equation representing the number of teams remaining (*y)* at any given round (*x)* if all the countries in the world entered. $y= 196(.5)^x$
10. Use desmos to make a graph representing your function.



11. Using your graph, determine how many rounds it would take to find the gold member winner. About 8.
12. What number of teams would be ideal to end perfectly at one winner? What is required?
    - There must be an *even* number of teams.
    - The number of teams (*y*) to have a perfect bracket system must be $y=2^x$. See chart at right.
    - Therefore, it would be ideal for 128 teams or 256 teams to enter to make a perfect bracket system.

x	$y=2^x$
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256

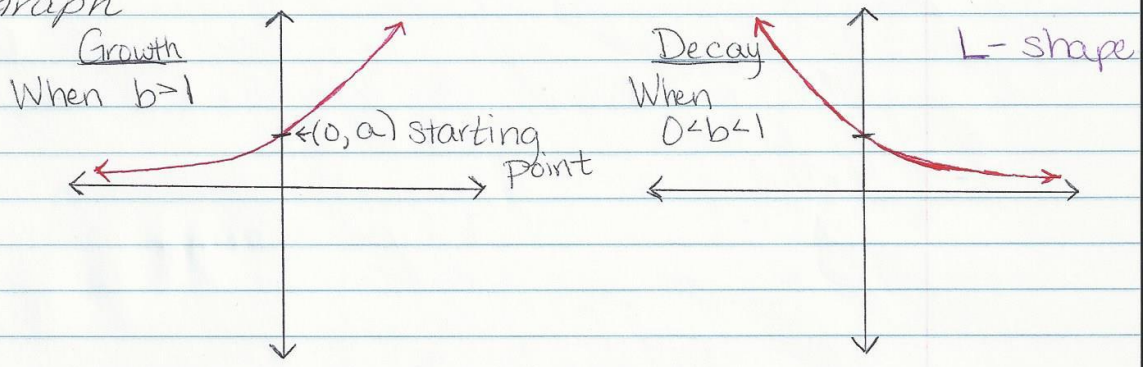
Rubric

Points received	Level of participation in activity
10	Student was actively working toward answering questions, helping their partner, and continually seeking more information (not stopping when you think you've found the answer
5	Student may not be 100% focused, not helping their partner, or using downtime ineffectively
0	Student was not focused on the activity.

Exploring Exponential Models

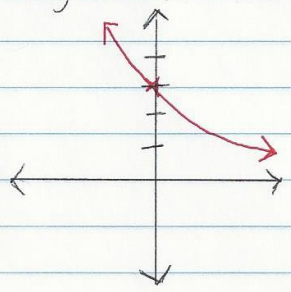
Graphing exponential growth

- Equation $y = a \cdot b^x$ (vampires, time) → $y = 2^x$ (# of weeks)
  - ~~start~~ ending value
  - a: starting value
  - b: growth
  - y: # of vampires
  - x: growth factor
- Where is a in our vampire problem? $a = 1$, our starting value of 1 vampire (our initial vampire population).
- Graph



- Examples: Growth or decay?

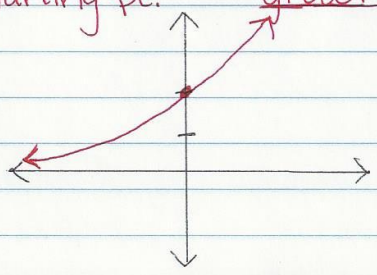
1. $y = 3(1/4)^x$



3 is our starting point: (0,3)
1/4 means decay, it is more than 0 & less than 1
You can also plot points by plugging in #s for x to find y.

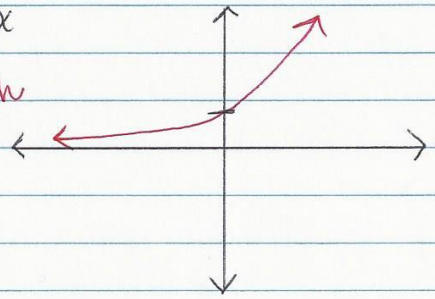
x	y
0	3
1	3/4
2	3/16

2. $y = 2(3)^x$
   - 2: Starting pt.
   - 3: growth (more than 1)



Notes:

3. $y = 6^x$ (6 = growth)



Where is our y-intercept?
* (0,1) because our a value is 1 here.

x	y
-1	1/6
0	1
1	6

Word problems

We will use the equation $y = a \cdot b^x$ → see the similarity?

$\boxed{y = IV \cdot (1 \pm \%)^t}$

where • IV = initial value → our "a" value
• $(1 \pm \%)$ is similar to our "b" value, represents our % growth or decay.
• t, our "x" in the equation, represents time.

- Growth would use + some percent
- Decay would use − some percent

• Examples ① You buy a car for $12,000 (initial value) that depreciates (minus) at a rate of 3.5% (%) per year. How much is the car worth in 5 years (time)?

$y = \$12{,}000(1 - 0.035)^5$
$y = \$12{,}000(0.965)^5$ Plug into calc.
$\boxed{y = \$10{,}041.94}$

② The population of the world in 1994 was 260 million (initial value). The growth rate is 0.7% (rate). How many people were there in 2001? (time - sort of) made up #

$y = 260(1 + 0.007)^7$ → 2001 − 1994 = 7 years
$y = 260(1.007)^7$
$y \approx 273$ million

Homework: page 442, #1-9 odd, 17-23 odd, 35-39, 55, 57, 60, 61, 67, 68

Single Subject Lesson Design Rubric

Name Melissa Bechtold Lesson Title: Exploring Exponents Date March 1st, 2014

See Lesson Design Resources Website for more details: https://sites.google.com/site/lessondesignresources/

Design Component & Criteria	Approaching	Meets (includes the criteria for Approaching)	Exceeds (includes the criteria for Approaching & Meets)	Evidence
Title, Curriculum Area & Grade Level 5%	Provides a title that is related to the lesson activity	& addresses the unit it belongs to and in what curriculum area and grade	& describes where it fits within a unit plan, i.e. Third lesson in a 4-week unit on Colonization.	Yes, it says where the lesson takes place in the unit
Rationale: Big Ideas & Essential Questions 10%	Describes the rationale for teaching this lesson (*big ideas, enduring understandings, essential questions*) …	& addresses how the instructional strategies and the student activities are suited to meet the standard and objective of the lesson…	& explains how the assessment is a valid (authentic) and reliable (consistent) way to assess student learning.	Assessment is directly correlated to the objective and has differentiation for English standard described.
Standards, Objectives & Assessments 25%	Both CA Content and ELD Standards are identified and each is addressed in an objective that contains a condition, verb, and criteria and is assessed	& each objective is labeled by the type (*cognitive, affective, psychomotor or language*), the number of the standard it addresses and the type of assessment is labeled (diagnostic, formative or summative)	& expectations are clearly communicated to students via rubric, model or sample student work.	Objectives are labeled and rubric is included.
Prediction of Likely Difficulties 5%	Possible misconceptions or assumptions are identified	& the misconception or assumptions are identified as being in the content, process or product of the lesson	& the instructional strategies, student activities &/or the differentiation strategies work to avoid these misconceptions or assumptions.	Misconceptions are identified with solutions.
Instructional Strategies 15%	Provides an *into*, *through* and a *beyond* activity for lesson…	& describes in detail the steps the teacher will take to implement the lesson and instructional materials (i.e. graphic organizer, ppt, model, rubric)…	& provides a written script for teacher and times for each activity.	All materials are included. Instructional strategies are detailed including approximate times.
Student Activities 10%	Describes what the students will do during the *into*, *through* and *beyond* activity of the lesson…	& each activity is student centered with multiple opportunities for the instructor to check for understanding…	& provides criteria for the student activities and times for each activity.	Student activities are included with times.
Student Information 10%	Identify the names of the students that need differentiation (both ELL & Students w/ Sp Ed needs)	& describe each of the students readiness level, learning profile and interests	& includes prior successful differentiation strategies for each student.	Students' readiness levels are described, learning profiles and interests in addition to the prior successful differentiation strategies.
Differentiation 10%	Describes the differentiation strategy for the ELL and the students with special education needs …	& labels the strategy (*content, process or product*) and the way it addresses the students identity and developmental needs (*readiness, interest or learning profile*)…	& provides how the strategy will be assessed for effectiveness and altered if needed.	Differentiation processes are described, strategies are assessed based on the students' ability to meet the objectives. Back up differentiation strategies are also included.
Resources 5%	All instructional materials needed to implement the lesson are listed.	All instructional materials that are needed to implement the lesson are listed and described.	& all materials listed for the unit are listed and provided, such as power point, graphic organizer, sample student work, assignment rubric, quiz…	Yes, notes, rubrics, and an answer guide are included.
Reflection 5%	Reflection is provided on the strengths, limitations, assessment and differentiation plan.	The reflection addresses all prompts and identifies what would be done next based on this reflection.	Reflection is complete and a new lesson is provided to address the concerns in the reflection.	Reflection is complete but no new lesson was necessary.
Self-Evaluation (10% will be deducted if not included)	Provides a copy of the rubric with the lesson plan…	& highlights or circles the evaluated criteria for each lesson component…	& provides evidence for each criteria marked.	This form ☺