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Modeling Real World Problems with Equations

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CMST SCOLLARCITY Lesson Plan Template-Lesson Plan using **TI Technologies** (Due Tuesday, July 27th)

Submit as hard copy AND electronically through ANGEL

Name: Kim Meek
Grade level(s)/Subject taught: 11th, Algebra II
Objectives: (Remember…*How will the modeling tool help the student better learn the objective?)* The students use the TI-84 to create graphs and tables for several power models ($y = ax^2$, $y = ax^3$ …etc) to learn the general shape of the curves and identify the patterns in the tables. In addition, they compare and contrast these tables and graphs to linear and exponential models. Then, students draw conclusions about the symbolic rules and the patterns found in the graphs and tables.

Items to include in your TI Technologies lesson plan: (use *your* area/discipline/concepts).

For the math teacher:

1. *Write* the Mathematical Concept or "key idea" that TI Technologies will be used to teach: (e.g. Students use mathematical modeling/ multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships)

The students use the TI –84's graphing abilities to create and explore algebraic models. They model real-world problems with power equations.

and/or…

For the Science teacher:

1b. *Write* the Science Concept or "key idea" that TI Technologies will be used to teach: (e.g. Organisms maintain a dynamic equilibrium that sustains life).

For your **TI Technologies** lesson and using the following prompts, please provide a rich **one-page, single-spaced** description or a *vision* of your best thinking on a way or ways you might teach the planned lesson using the TI technology. Pay special attention to the modeling package in your description. Also, construct and submit a tentative rubric that you might use with your students. ** see example page 5

"...a rich **one-page, typed, single-spaced**, description or a *vision* of your best thinking…"

Prompts:

1. How will you assess the prior knowledge of the student?
2. How will you begin the lesson?
3. What are the teacher and students doing every 5-10 minutes? (Teacher Actions and Student Actions
4. How will you assess the learning for the lesson?
5. How will TI be integrated into your teaching? (i.e. you may want to discuss a problem or describe how you might use the chosen modeling package in your plan. How does the model/tool help the concept(s) to be taught)?

Using _the Ti-84__________________, I plan on having my students…
(software / modeling package(s))

The students were introduced to a real-world application of power models the day before this lesson. I informally assess their comprehension as I walk around the room and check their homework. I ask a student to pass out the rubric so students know what I expect of them. I briefly discuss the rubric, review yesterday's lesson and address any concerns or misconceptions I observed while viewing their papers (10 minutes). The students work together in groups everyday, so they begin immediately after I give the assignment.

Each group must complete one of the four experiments and write their solutions on chart paper, which they will share during the summary class discussion. Experiment 1 asks the students to compare the charts and graphs of $y = x^2$ to $y = 2x$ and then to $y = 2^x$. Experiment 2 asks the students to compare the charts and graphs of $y = x^3$ to $y = x^2$ (introducing "cubing" and "squaring" vocabulary) and then to $y = 3x$ and $y = 3^x$. Experiment 3 requires that students apply power models to a real-world situation (similar to yesterday's activity) and then analyze the effects of changing the leading coefficient in the equations $y = ax^2$ and $y = ax^3$ (positive, negative and fractional values for a). Experiment 4 extends power models from $y = x^2$ and $y = x^3$ to higher orders through $y = x^7$. Then students predict the shape of the models for $y = x^8$ and $y = x^9$. Each experiment demands that the students discover and distinguish between the patterns of linear, power and exponential models. Yet, they address slightly different concepts that students discuss during the summary wrap up.

During the 20-30 minutes while the students answer the questions I walk around the room, make observations and listen to their discussions. As needed, I encourage them to extend their thinking and I monitor their effectiveness and on-task behavior.
As students finish up they help themselves to chart paper and markers and proceed to make their posters. Student hang their posters so that the Experiments are hanging by each other (I wrote, "experiment 1 here" etc. on the board).

As time allows we discuss the patterns and behavior of linear, power and exponential models. Linear equations produce straight lines that increase (or decrease) at a constant rate. Quadratic models open upward for all x if $a > 0$, and open downward for all x if $a < 0$. When $a > 0$, and when $x > 0$ they increase at an increasing rate and when $x < 0$ they decrease at a decreasing rate. Vise versa for when $a < 0$. We discuss symmetry and that the curve becomes closer together when a increases and farther apart when a decreases. A similar conversation takes place for cubic models and students see that even exponents produce "squared"-like graphs and odd exponents produce "cubed "-like graphs. Exponential models do not have a constant rate of change, or any symmetry. Depending on the values in the equation, the exponential model continues to increase at an increasing rate (as x gets larger) or it continues to decrease at a decreasing rate (as x gets larger). Depending on the amount of time this requires we may continue the lesson and group discussion tomorrow. It is important that the discussion flows, and that the conclusions come from the students' logical train of thought.

Rubric

GROUP ACTIVITY RUBRIC

How many of the questions did your group complete correctly?	All	Most	A couple	One or none
How many group members shared the work evenly?	All	Most	A couple	One or none
How many of the graphs, tables, equations and conclusions did your group put on the poster neatly?	All	Most	A couple	One or none
How many group members constructively contributed to the class discussion?	All	Most	A couple	One or none

Names: ____

Class Period: _____________
Date: ____________________

Assignment Information
Page: _________________________________
Problems: ______________________________

*****Example:***“I was thinking about beginning the class on [modeling X] by using the overhead to ask students what they know about X. From this brainstorming session, I might ask them to get into groups and discuss one or more of the ideas they gave me. After about ten minutes, I would have the students give their ideas on X and write them down on a transparency so they would be able to see them for the entire hour. From here, I would provide a 10 to 15 minute demonstration of the basics of using ___________________modeling software. I would use an conceptual example that they would find familiar with such as getting a cold and how it is transmitted. From here, I would have students at the computer stations using a prepared guide or tutorial to get them started on basic software usage. I expect that in a short time a number of students would “catch on” rather quickly and be able to help others. ……………….. By the third lesson, I suspect that most would be well on their way to development of their own or small group models using the ___________________software. My plan of assessment would probably be a group model so they would gain more confidence in using the software in a meaningful way. After the second or third lesson, I would ask them to choose from a list of thematic or topic areas that fit the software nice and develop a model using the technology. As a product, I may have partners share their model and describe to other small groups how it works. The rubric I design would be general at first so that I might see the kinds of the products the student were capable of creating. From the prototypes, I would hone my rubric to make the modeling product as challenging as possible without making it too difficult.” Etc…

For all lesson plans and within the context of the lesson plan(s) you develop, <u>design (add) a rubric</u> that addresses your objectives AND “guides” your students to success in the modeling arena you choose (AS, Stella, GSP, TI, IP). The rubric should have three or four levels or mastery with the highest level [TARGET], which should detail what you might initially expect of the capabilities from a student doing the best s/he can do. **(etc…)**

Ex:

Target	**Acceptable**	**Unacceptable**
Model *uses at least 5 functions* of Agent Sheet Software.	?	?
Math / Science Concept thoroughly addressed. Described (*written*) in rich detail.		
Graphs are neat, accurate and based on data from the model.	?	?
Student is very capable of *describing the model to a small group of peers* and is able to respond meaningfully to questions about the model.	?	?
Defines exactly how the modeling software “helped” solve the problem.		