Blackline Masters Table of Contents

Matching Descriptions to Graphs

Card 1

The value of a company's stock doubles approximately every 4 years.

The relationship between the number of years since purchasing the stock and the stock value.

Matching Descriptions to Graphs

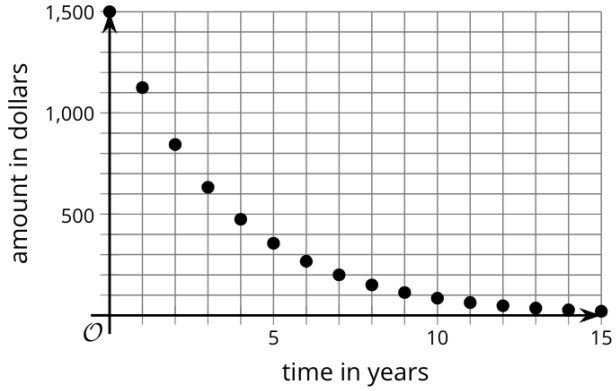
Card 2

A car loses $\frac{1}{4}$ of its value every year after purchase.

The relationship between the number of years since purchasing the car and the value of the car.

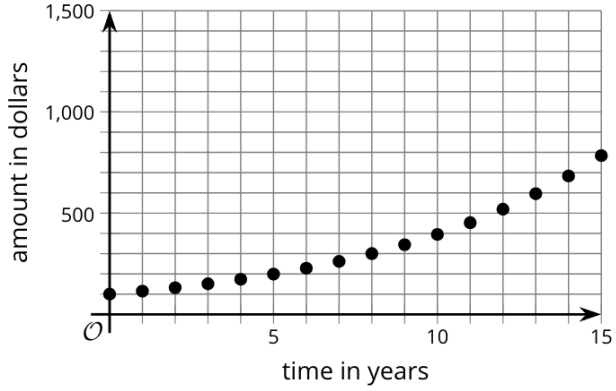
Matching Descriptions to Graphs

Card 3



Matching Descriptions to Graphs

Card 4



Matching Descriptions to Graphs

Card 5

The value of a company's stock triples roughly every 8 years.

The relationship between the number of years since purchasing the stock and the stock value.

Matching Descriptions to Graphs

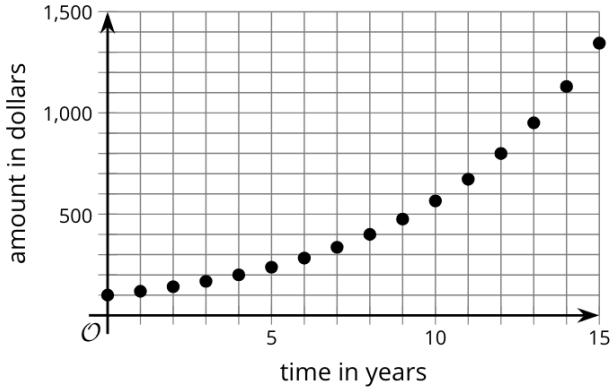
Card 6

A laptop loses $\frac{2}{5}$ of its value every year after purchase.

The relationship between the number of years since purchasing the laptop and the value of the laptop.

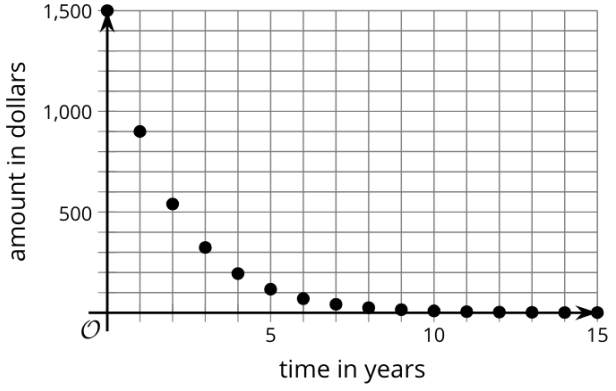
Matching Descriptions to Graphs

Card 7



Matching Descriptions to Graphs

Card 8



What's the Rate? Card 1 The function rule $b(x) = 200(1.32)^x$ represents the amount of bacteria in a petri dish as a function of every quarter hour.	What's the Rate? Card 2 The function rule $g(x) = 8(2)^x$ represents the number of insects in a colony as a function of the number of weeks.	What's the Rate? Card 3 The function rule $m(x) = 10,000(0.5)^x$ represents the amount of money won by an athlete during a tournament as a function of where the athlete placed at the end of tournament.
What's the Rate? Card 4 The function rule $d(x) = 15(0.77)^x$ represents the amount of a medicinal drug in the bloodstream as a function of the number of half hours since taking the medication.	What's the Rate? Card 5 The function rule $v(x) = 12,560(0.85)^x$ represents the value of a car in dollars as a function of the number of years since being purchased.	What's the Rate? Card 6 The function rule $p(x) = 1.7(1.06)^x$ represents the population in thousands of a small town as a function of the number of years since 1970.

Modeling Rubric[1]

Skill	Score			Notes or Comments
	Proficient	**Developing**	**Needs Revisiting**	
1. Decide What to Model	• Assumptions made are clearly identified and justified. Resulting limitations are stated when appropriate. • Variables of interest are clearly identified and chosen wisely, and appropriate units of measure are used.	• Assumptions are noted but lacking in justification or difficult to find. • Variables of interest are noted, but may lack justification, be difficult to find, or not be measured with appropriate units.	• No assumptions are stated. • No variables are defined.	
	To improve at this skill, you could: • Ask questions about the situation to understand it better • Check the assumptions you're making to see if they're reasonable (Try asking a friend, or imagining that you're a person involved in the scenario. Would those assumptions make sense to you?) • Double-check the variables you've identified: Are there other quantities in the situation that could vary? Is there something you've identified as a variable that is actually fixed or determined? (Remember that more abstract things like time and speed are also quantities.)			
2. Formulate a Mathematical Model	• An appropriate model is chosen and represented clearly. • Diagrams, graphs, etc. are clear and appropriately labeled.	Parts of the model are unclear, incomplete, or contain mistakes.	No model is presented, or the presentation contains significant errors.	
	To improve at this skill, you could: • Check your model more carefully to make sure it really fits well • Consider a wider variety of possible models, to find one that fits the situation better • Think about the situation more deeply before trying to find a model • Convince a skeptic: Pretend that you think your model is inadequate, or ask a friend to pretend to be skeptical of it. What would a skeptic find wrong with your model? Try to fix those things, or explain why they're not actually problems.			

[1] Adapted from IM 9-12 Math Algebra 1 Modeling Prompts https://curriculum.illustrativemathematics.org/HS/teachers/index.html, copyright 2019 by Illustrative Mathematics. Licensed under the Creative Commons Attribution 4.0 license https://creativecommons.org/licenses/by/4.0/.

Skill	Score			Notes or Comments
	Proficient	**Developing**	**Needs Revisiting**	
3. Use Your Model to Reach a Conclusion	● Solution is relevant to the original problem. ● Reader can easily understand the reasoning leading to the solution. ● Relevant details are included like units of measure.	Solution is not well-aligned to the original problem, or aspects of the solution are difficult to understand or incomplete.	No solution is provided.	
	To improve at this skill, you could: ● Double-check your calculations: Show them to someone else to see if they agree, or take a break and look at your calculations again later ● Make sure your calculations are justified by your model: Ask yourself how you decided what to calculate, and see if your reasoning matches up with your model ● Think more deeply about what your conclusions mean in the original scenario: Imagine you're a person involved in the scenario, or explain your conclusions to someone else and see if they have questions			
4. Refine and Share Your Model	● The model's implications are clearly stated. ● The limitations of the model and solution are addressed.	The limitations of the model and solution are addressed but lacking in depth or ignoring key components.	No interpretation of model and solution is provided.	
	To improve at this skill, you could: ● Think more creatively about what your conclusions mean: Ask yourself "If I was involved in this situation, what would I understand better because of these conclusions? What would I want to do next?" ● Be skeptical of your model: What don't you like about it, and what can you do to fix those things? ● Explain your model to someone else: Tell them how it works and why it's good. If you're not sure how it works or why it's good, you might need to change it.			

Modeling Prompt 5A

Giving Bonuses

A project at a large company was very successful, and the company made more money than expected as a result. Your boss has given you the task of coming up with different methods to distribute bonuses to the 5 employees that directly worked on the project. There is a total of $8,000 available to distribute.

The method for distributing the money will be shared with the entire company, so it is important that the employees feel the distribution is fair.

1. Make a proposal with at least two different methods for your boss to choose from. Describe the advantages and disadvantages of each method. Then give your recommendation and provide an argument in its support.

2. For each of the methods you propose, which of the five employees is most likely to complain about the method being unfair? How would you justify the method to this employee?

Modeling Prompt 5B

Giving Bonuses

A project in a large company was very successful, and the company made more money than expected as a result. Your boss has given you the task of coming up with different methods to distribute bonuses to the 5 employees that directly worked on the project. There is a total of $8,000 available to distribute.

Here is some information about the employees:

employee	job description	hours working on project (per week)	annual salary	job experience
A	receptionist	40	$30,000	1 year
B	administrative coordinator	30	$30,000	5 years
C	manager	40	$80,000	3 years
D	sales representative	40	$50,000	10 years
E	sales representative	20	$20,000	2 years

1. Make a proposal with at least two different methods for your boss to choose from. Outline the advantages and disadvantages of each method. Then give your recommendation and support your argument.

2. For each of the methods you propose, which of the five employees is most likely to complain about the method being unfair? How would you justify the method to this employee?

Modeling Prompt 6A

- Students using this prompt can use the internet to research an appropriate geographical location.

Shoulder to Shoulder

If all the people in the world huddled together shoulder to shoulder, without any extra space, how much area would we all cover? What geographical location (e.g., a city, country, continent) could theoretically host the entire human population without much space left over?

Modeling Prompt 6B

- Students completing this prompt should access the following location data sheet: https://bit.ly/LocationData6B.

Shoulder to Shoulder

If all 8 billion (8,000,000,000) people in the world huddled together shoulder to shoulder, without any extra space, how much area would we all cover? What geographical location (e.g., a city, country, continent) could theoretically host the entire human population without much space left over?

Muse Concert in Paris, France (June 23, 2007)

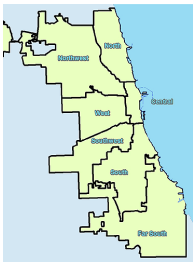
Women's Rights March (January 21, 2017)

Rio de Janeiro, Brazil: England vs. Brazil soccer match (January 2, 2010)

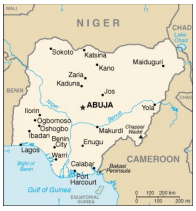
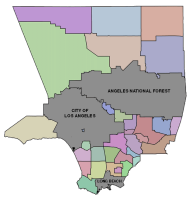
Chicago, IL: Obama Rally in Grant Park (November 4, 2008)

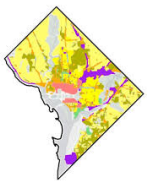
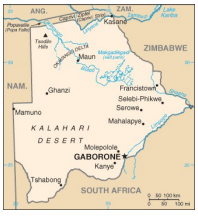
Guangzhou, China train station (February 2, 2008)

Modeling Prompt 6B: Shoulder to Shoulder[1]
Location Data Sheet: List of Cities, States, and Countries

City	State	Country	Continent	Land Area (mi^2)	Land Area (km^2)	Photo (w/ link to Google Maps)
Beijing		China	Asia	1611	4172	
Calgary		Canada	North America	327	848	
Caracas		Venezuela	South America	114	294	
Chicago	Illinois	USA	North America	228	590	
Galway		Ireland	Europe	21	54	

[1] Developed with MathAction ©2021. Materials are intended for classroom use only; distribution or use beyond individual classrooms is prohibited. For more problem based lessons visit www.mathaction.org.

Indianapolis	Indiana	USA	North America	361	935	
Lagos		Nigeria	Africa	386	1000	
Los Angeles	California	USA	North America	469	1215	
Louisville	Kentucky	USA	North America	325	842	
New York City	New York	USA	North America	303	785	
Philadelphia	Pennsylvania	USA	North America	134	347	
Sydney		Australia	Australia	10	27	

Tucson	Arizona	USA	North America	227	588	
Washington D. C.	District of Columbia	USA	North America	61	158	
	Florida	USA	North America	53,625	138,887	
	Ohio	USA	North America	40,861	105,829	
	Rhode Island	USA	North America	1,034	2,678	
	Texas	USA	North America	261,232	676,587	
		Botswana	Africa		566,730 sq km	
		Brazil	South America		8,358,140 sq km	

		Jamaica	North America		10,831 sq km	
		Monaco	Europe		2 sq km	
		Singapore	Asia		709.2 sq km	
		Tonga	Australia		717 sq km	

Name: Period: Date:

End-of-Unit 6 Student Survey

1. Ending this unit I <u>feel</u> … (this question could be answered with pictures, words, etc.)

2. How much did you know about the content of this unit before starting?

   a. A great deal b. A little c. Not much

   Feel free to share more:

3. After finishing the unit did your knowledge in the content:

   a. Increase greatly b. Increase a little c. Stay the Same

   Feel free to share more:

4. What was most frustrating for you while learning during this unit?

   a. Materials Used b. Teacher strategies c. Technology d. Other: _____

   Feel free to share more:

5. What boosted your confidence in math during this unit?

   a. Materials Used b. Teacher strategies c. Technology d. Other: _____

   Feel free to share more:

6. What connections do you think the concepts from this unit make to the world around you?

7. What did your level of engagement and participation during the unit tell you about yourself and the way you see yourself and your abilities in math?

8. How would you like to improve in the next unit?

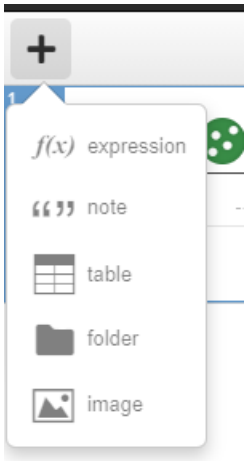
9. How can your teacher support your goals for improvement in the next unit?

10. I'd like my Math 1 teacher(s) to know that I want them to continue _____

11. Please share anything else you'd like regarding your experiences in this unit and your feelings about the upcoming unit.

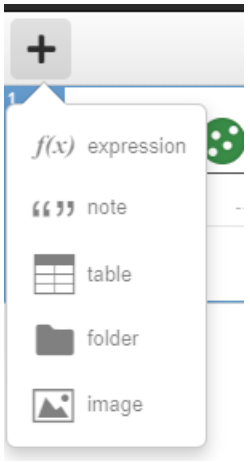
Desmos Regression Steps

Linear Regression



- Access the Desmos graphing calculator (www.desmos.com/calculator), click the + icon in the top left corner, and select "table."
- Enter the data into the table. The points will be graphed, creating the scatter plot. Adjust the graph settings manually or by using the "zoom fit" feature.
- To calculate the equation for the line of best fit (the regression equation), go to the next line. Type "y1~mx1+b". This will appear as $y_1 \sim mx_1+b$, as shown.
- The following will be displayed:
  - the statistics: in which the correlation coefficient, r, can be found
  - the parameters of m (the slope) and b (the y-intercept)
  - the graph of the equation displayed with the scatter plot
- Substitute the values of the parameters determined by Desmos into the slope-intercept form for a linear function.

Exponential Regression



- Access the Desmos graphing calculator (www.desmos.com/calculator), click the + icon in the top left corner, and select "table."
- Enter the data into the table. The points will be graphed, creating the scatter plot. Adjust the graph settings manually or by using the "zoom fit" feature.
- To fit an exponential function to your data, go to the next line and type "y1~a*b^x1." This will appear as $y1 \sim a \cdot b^{x_1}$, as shown.
- Select "Log Mode" when the option appears.
- The following will be displayed:
  - the statistics: in which the correlation coefficient, r, can be found, along with the determination coefficient, r^2.
  - the parameters of a (initial value) and b (multiplier).
  - the graph of the equation displayed with the scatter plot.
- Substitute the values of the parameters determined by Desmos into the exponential equation $y = a \cdot b^x$.