(A) Lesson Context

BIG PICTURE of this UNIT:	• Do mathematical operations transfer to polynomials? • How can we apply polynomials to area and perimeter?		
CONTEXT of this LESSON:	**Where we've been** Working with linear functions and polynomials.	**Where we are** Exploring exponent laws and linear vs. exponential data.	**Where we are heading** Being able to distinguish between linear and exponential by looking at data, graphs, etc.

(B) Lesson Objectives:

a. Practice product rule for exponents.
b. Review quotient rule for exponents.
c. Comparing Linear vs Exponential data.

(C) Warm-up

Multiply the following:

$x^3 \cdot x^7 \cdot x^{-2}$

$x^{-6} \cdot x^2 \cdot y^3 \cdot y^9$

$(2x^{12})(5x^{17})$

$(4x^6y^9)(7x^{-3}y^{-1})$

(D) Exponent Rules – Quotient Rule Exploration

What does x^2 mean?

What does x^5 mean?

Using this idea of "expansion"…

Simplify $x^2 \div x^3$ by first expanding x^2 and x^3.

Simplify $\frac{x^7}{x^5}$ by first expanding x^7 and x^5.

Simplify $\frac{x^4}{x^9}$ by first expanding x^4 and x^9.

Simplify $\frac{x^{14}}{x^8}$ by first expanding x^{14} and x^8.

What do you notice?

What relationship do you notice between the exponents of the quotient and the exponents of the answer?

Based on your observations, predict a rule for the **exponents** when you multiply.

$$x^a \div x^b = \frac{x^a}{x^b} =$$

(E) Comparing Linear and Exponential Situations

Model 1: A prize will be awarded that begins with $10 and increases by $5 each week for 20 weeks

Model 2: A prize will be awarded that begins with $0.01 and doubles each week for 20 weeks.

1. In the space below, make a prediction about which model you believe will generate the greatest amount of money. Explain your reasoning:

Complete the chart below for the first 6 weeks:

Week #	Model 1 Amount of Prize Money Awarded	Model 2 Amount of Prize Money Awarded
0		
1		
2		
3		
4		
5		

2. After computing the prize money awarded for more and more weeks, Jordan begins to believe that the method for awarding the prize described in Model 2 (begins with $0.01 and doubles each week) will result in a prize of a greater amount of money. How could Jordan verify this belief?

Complete the chart below for weeks 6-10:

Week #	Model 1 Amount of Prize Money Awarded	Model 2 Amount of Prize Money Awarded
6		
7		
8		
9		
10		

3. Describe the patterns that are displayed in the "Amount of Prize Money Awarded" by:

Model 1

Model 2

Complete the chart below for the next 10 weeks:

Week #	Model 1 Amount of Prize Money Awarded	Model 2 Amount of Prize Money Awarded
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

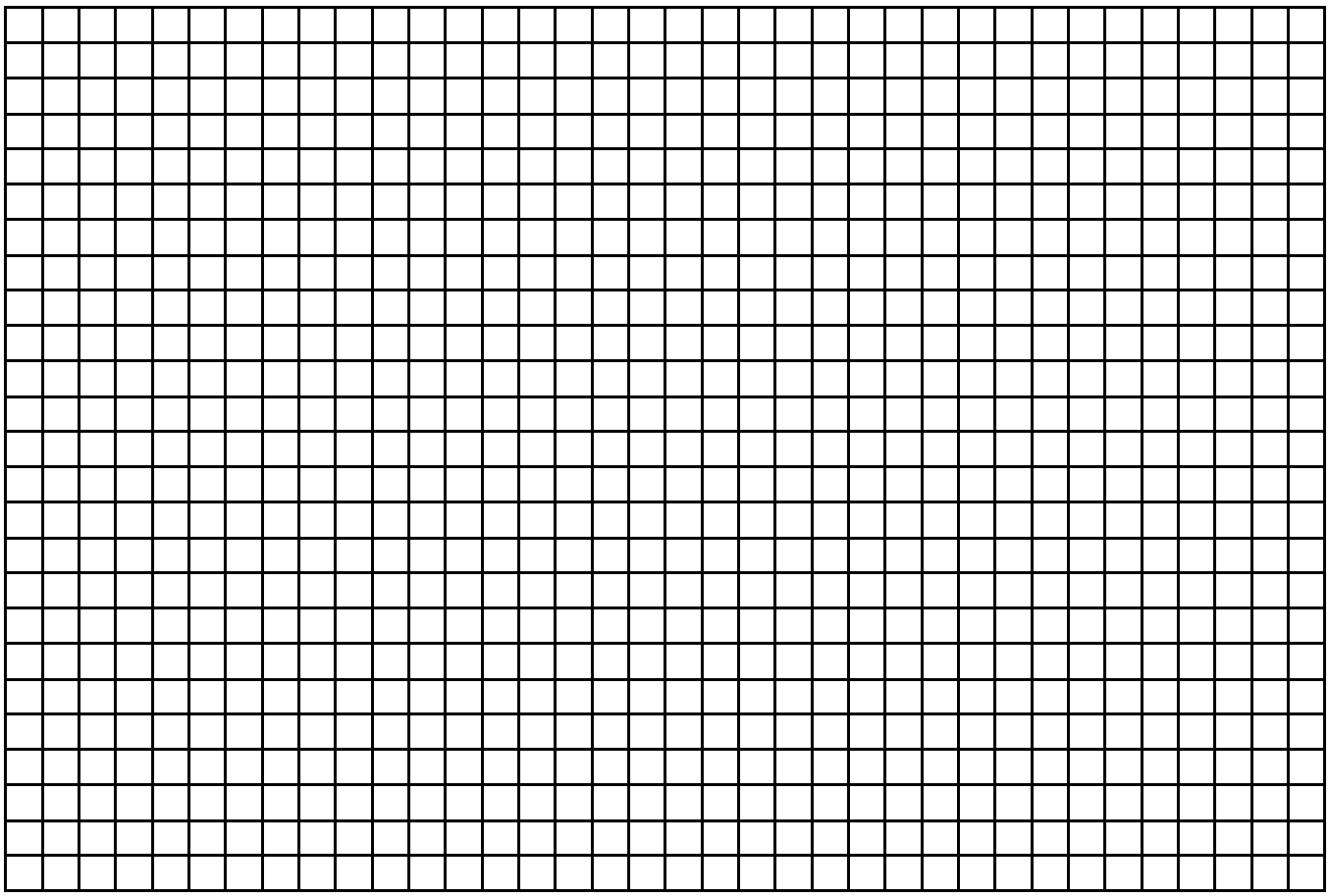
4. Use the "Prize Money Awarded" data to determine after how many weeks does Model 2 award more money than Model 1.

5. Predict how much prize money would be awarded at the end of 25 weeks for each model.

Model 1:

Model 2:

6. Graphing
   - Using two different colors, plot the week versus Amount of Prize Money Awarded data for each model. Label the axes, scales and title of the graph appropriately.



7. Connect the dots in each scatter plot to form a curve. Approximate the coordinates of the point of intersection of the two curves. What does this point represent in the context of this problem?

8. Describe the differences between how quickly the "Amount of Prize Money Awarded" changes for the two models.

9. Put the data from Week 0 to Week 20 into a table on Desmos and use Desmos to determine the equations for the regression lines.

10. Use the graph and the regression equations on Desmos to determine when the two prizes are worth the same amount of money.

(F) Graphing and Regressions on Desmos

For the following sets of data:
1. Put the information into a table on Desmos. (Adjust the window so you have a nice view of the data.)
2. Based on the graph, determine whether the data is linear or exponential.
3. Create and write down a regression equation for the set of data on Desmos.

8.

x	–3	–2	–1	0	1	2	3
y	$\frac{1}{27}$	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9	27

5.

x	–3	–2	–1	0	1	2	3
y	–14	–9	–4	1	6	11	16

c.

7.

x	–3	–2	–1	0	1	2	3
y	4	8	16	32	64	128	256

x	$f(x)$
1	20
2	40
3	80
4	160
5	320