

Lesson 3: Linear vs Exponential | Unit 5 – Exponentials

(A) Lesson Context

BIG PICTURE of this UNIT:	<ul style="list-style-type: none">• 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:

- Practice product and quotient rule for exponents.
- Review power rule for exponents.
- Comparing Linear vs Exponential data.
- Linear and Exponential regression equations from GDC.

(C) Warm-up

Simplify the following:

$$\frac{x^{15}}{x^8}$$

$$\frac{x^6 y^3}{x^2 y^9}$$

$$\frac{35x^{17}}{7x^{12}}$$

$$\frac{(2x^6 y^9)(2x^3 y^5)}{12x^5 y^2}$$

(D) Exponent Rules – Power Rule Exploration

What does $(xy)^2$ mean?

What does $(xy)^5$ mean?

Using this idea of “expansion”...

Simplify $(x^2)^3$ by expanding.

Simplify $(x^5)^4$ by expanding.

Simplify $(y^6)^9$ by expanding.

Simplify $(x^2y^3)^5$ by expanding.

What do you notice?

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

Based on your observations, predict a rule for the **exponents** when you have an exponent to an exponent.

$$(x^a)^b =$$

(E) Comparing Linear and Exponential Relationships and Regressions on a GDC

1. The relationship between the distance driven and total cost when a taxi driver charges \$2.50 for the first mile and \$1.50 for each additional mile.
 - a. State whether each relationship can be modeled by a linear function or an exponential function and justify your choice.

b. Create a table:

x										
y										

- c. Put table into GDC (STAT -> Edit) and graph scatter plot. Confirm whether the relationship is linear or exponential.
- d. Determine and write down the regression equation. (STAT -> CALC -> LinReg or ExpReg)

2. The relationship between the number of bacteria and time when a culture of 6000 bacteria is reduced by 50% every four hours.
 - a. State whether each relationship can be modeled by a linear function or an exponential function and justify your choice.

b. Create a table:

x										
y										

- c. Put table into GDC (STAT -> Edit) and graph scatter plot. Confirm whether the relationship is linear or exponential.
- d. Determine and write down the regression equation. (STAT -> CALC -> LinReg or ExpReg)

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3. The relationship between the volume of a landfill and time given that the volume doubles every three years.

a. State whether each relationship can be modeled by a linear function or an exponential function and justify your choice.

b. Create a table:

x										
y										

c. Put table into GDC (STAT -> Edit) and graph scatter plot. Confirm whether the relationship is linear or exponential.

d. Determine and write down the regression equation. (STAT -> CALC -> LinReg or ExpReg)

4. The relationship between the altitude of a hot air balloon and time when the hot air balloon takes off at 5500 feet above sea level and rises 120 feet every minute.

a. State whether each relationship can be modeled by a linear function or an exponential function and justify your choice.

b. Create a table:

x										
y										

c. Put table into GDC (STAT -> Edit) and graph scatter plot. Confirm whether the relationship is linear or exponential.

d. Determine and write down the regression equation. (STAT -> CALC -> LinReg or ExpReg)

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5. You and your friends go to the state fair. It costs \$5 to get into the fair and \$3 each time you go on a ride
- State whether each relationship can be modeled by a linear function or an exponential function and justify your choice.

b. Create a table:

x										
y										

- Put table into GDC (STAT -> Edit) and graph scatter plot. Confirm whether the relationship is linear or exponential.
- Determine and write down the regression equation. (STAT -> CALC -> LinReg or ExpReg)

6. Marissa has saved \$1000 in a jar. She plans to withdraw half of what's remaining in the jar at the end of each month.
- State whether each relationship can be modeled by a linear function or an exponential function and justify your choice.

b. Create a table:

x										
y										

- Put table into GDC (STAT -> Edit) and graph scatter plot. Confirm whether the relationship is linear or exponential.
- Determine and write down the regression equation. (STAT -> CALC -> LinReg or ExpReg)

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7. The number of cell phone users in Centerville if the number of users is increasing by 75% each year.
- State whether each relationship can be modeled by a linear function or an exponential function and justify your choice.

b. Create a table:

x										
y										

- Put table into GDC (STAT -> Edit) and graph scatter plot. Confirm whether the relationship is linear or exponential.
- Determine and write down the regression equation. (STAT -> CALC -> LinReg or ExpReg)

8. You are filling a swimming pool with water. You notice it fills with 2 gallons of water every minute.
- State whether each relationship can be modeled by a linear function or an exponential function and justify your choice.

b. Create a table:

x										
y										

- Put table into GDC (STAT -> Edit) and graph scatter plot. Confirm whether the relationship is linear or exponential.
- Determine and write down the regression equation. (STAT -> CALC -> LinReg or ExpReg)