

Unit 12 Review - Exponential Functions

Station A

1) $f(-3) = 5^{-3} = .008$ (or $\frac{1}{125}$)

Or put the equation $y = 5^x$ in your calculator and look at the table of values. Find the y term when $x = -3$.

2) $f(-2) = 7(1/3)^{-2-1} = 189$

Or put the equation $y = 7(1/3)^{x-1}$ in your calculator. Look at y in table when $x = -2$.

3) An exponential equation uses the y intercept (when $x = 0$) and the base (common ratio)

| x | -2 | -1 | 0 | 1 | 2 | 3 |
|---|----|----|---|---|---|-----|
| y | 81 | 27 | 9 | 3 | 1 | 1/3 |

y-int: 9 base: $9 \div 27 = 1/3$

equation: $y = 9(1/3)^x$

Make sure to type your equation in the calculator and check the table of values to see if it matches.

4) Which equation shows a **decreasing** function that includes the point (1,4)?

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

b) $y = 6(4)^x$

c) $y = 4(1/2)^{x-1}$

d) $y = 2x + 2$

decreasing

increasing

decreasing

increasing

but (1,4) doesn't work

$4 > 1$

point works!

slope $2 > 1$

5) Is it **L** (linear) or **E** (exponential) or **N** (neither)? Explain.

| A | | B | | C | |
|---|----|---|--------|---|----|
| x | y | x | y | x | y |
| 1 | 5 | 1 | 6 | 1 | 3 |
| 2 | 7 | 2 | 9 | 2 | 12 |
| 3 | 9 | 3 | 13.5 | 3 | 27 |
| 4 | 11 | 4 | 20.25 | 4 | 48 |
| 5 | 13 | 5 | 30.375 | | 75 |

A. Linear common difference = 2

B. exponential common ratio = 1.5

C. Neither (does not add the same amount or multiply by the same amount)

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Station B

- 1) The exponential function $g(x) = 725(1.09)^x$ models the amount of money in a savings account compounded annually. Explain the meaning of each part of the function.

725 The initial amount of money in the account was \$725.

1.09 Each year, the money in the account is 109% of the previous year.

0.09 The money is growing at a rate of 9% per year.

x the number of years

$g(x)$ the final amount of money in the bank

- 2) Given the function $f(x) = 45025(0.96)^x$, identify the following:

Decay Rate **4% (or .04)**

Initial Amount **45,025**

Decay Factor **.96 (or 96%)**

Common Ratio **.96**

- 3) The equation $M = 155(0.94)^x$ represents the depreciation of the value of a calculator over a 4 year period. Which of the following statements describes how the value of the calculator changes each year?

- a) The value of the calculator decreases by \$155 each year.
- b) The value of the calculator decreases by 94% each year.
- c) The value of the calculator decreases by 6% each year.**
- d) The value of the calculator decreases by \$94 each year.

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Station C

1) Consider the functions numbered 1 – 4. Match each description to the function it describes.

1. $f(x) = 0.9 (1.07)^x$

D. exponential growth function $1.07 > 1$

2. $f(x) = 3x - 7$

B. linear function with a positive ROC slope is 3

3. $f(x) = 7(0.98)^x$

C. exponential decay function $.98 < 1$

4. $f(x) = 6 - 4x$

A. linear function with a negative ROC slope is -4

2) Started with 128 people at the beginning $a = 128$

Every match played, half the players are eliminated common ratio = $1/2$
number of people left, P , after m , matches are played. Use P and m for variables

$$P(m) = 128(.5)^m$$

3) The amount of books in a library, B , over t years can be modeled by the 5 equations below. Each equation, numbered 1 – 5, models the amount of books in a different library.

1) $B = 4500(1.06)^t$

2) $B = 1600(0.92)^t$

3) $B = 22000(0.75)^t$

4) $B = 1500(1.173)^t$

5) $B = 4000(0.87)^t$

a. Which libraries are growing in size? Growth factor must be > 1 **1 and 4**

b. Which library is growing the fastest in size? Larger growth factor **4**

c. Which libraries are shrinking in size? Decay factor must be < 1 **2, 3 and 5**

d. Which library is shrinking the fastest in size? Smallest decay factor **3**

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Station D

- 1) A painting was \$12,356 in the year 2005. It is increasing in value at an annual rate of 2.4%.

a) exponential model $R(t)$ that represents the value of the painting t years after 2005.

$$R(t) = 12,356 (1 + .024)^t$$

b) In 2018, the time passed is 13 years (2018 – 2005)

$$\begin{aligned} R(13) &= 12,356(1 + .024)^{13} \\ &= 680,097 \\ &\quad 16,818 \end{aligned}$$

or put $y = 12,356(1.024)^x$ in calculator
and look at table of values when $x = 13$

| x | y |
|----|----------------|
| 13 | 680,097 16,818 |

- 2) , $P(h) = 5600(0.65)^h$ determines the approximate amount of Styrofoam cups, $P(h)$, needed to order each month starting in January (1^{st} month).

a) By what percent has the shop decided to reduce the amount of cups ordered per month?

35% (how far from 1 is .65)

b) How many more cups were ordered in month 5 than in month 6?

Algebraic method

| | |
|---------------|---------------|
| Month 5 | Month 6 |
| $5600(.65)^5$ | $5600(.65)^6$ |
| 649.76 | 422.35 |

Calculator Method

put in $y = 5600(.65)^x$
look at table of values

| x | y |
|---|--------|
| 5 | 649.76 |
| 6 | 422.35 |

$$\begin{aligned} 649.76 - 422.35 \\ 227.41 \end{aligned}$$

Approximately 227 cups less

- c) The company will stop ordering Styrofoam cups when they reach an amount less than 100 using the above model. What will be the last month the company orders cups?

Must use calculator. Write what you typed in calculator $y = 5600(.65)^x$
And the table of values you looked at

| x | y |
|----|--------|
| 9 | 115.99 |
| 10 | 75.391 |

The company will stop ordering at 10 months

- 3) Is it L (linear) or E (exponential)? Linear adds the same #, exponential multiplies the same #

A. A virus that **quadruples** in size every hour (**times 4 E**)

B. A bank account that accumulates **5% interest, compounded annually** (**times 1.05 E**)

C. A cell phone plan that charges \$50 initially and **\$35 per month** (**adds \$35 L**)