LC MATH I

Final Review #3: Exponential Equations

Percent Increase or Decrease ← always exponential

Percent Increase:	Percent Decrease:
to find growth factor b, $100\% + \_\_\_\% = \_\_\_\%$ ↑ b-value in function ex "increase by 5%" $100\% + 5\% = 105\%$ $= 1.05 \leftarrow b$ ex "increase by 107.2%" $100\% + 107.2\% = 207.2\%$ $= 2.072 \leftarrow b$	To find decay factor b, $100\% - \_\_\_\% = \_\_\_\%$ ↑ b-value in function ex "decrease by 5%" $100\% - 5\% = 95\%$ $= 0.95 \leftarrow b$ ex "decrease by 23.5%" $100\% - 23.5\% = 76.5\%$ $= 0.765 \leftarrow b$

Linear vs. Exponential

Linear:	Exponential:
Graph: line Equation: $y = mx + b$ (m ↑ slope, b ↑ y-int.) Growth pattern: "constant rate of change" "increase/decrease by the same amount" Table: add/subtract same # to y-values each time you increase x.	Graph: curve w/ asymptote Equation: $y = a \cdot b^x$ (a ↑ y-int, b ↑ growth/decay factor) Growth pattern: "doubling" "tripling" "divide by 2" "multiply by 10" "percent increase" Table: multiply/divide by the same # to y-values each time you increase x.

Examples

1. At 2 pm, the population in the sample is 700. It increases by 200 bacteria every hour. How many bacteria will be in the sample at 11 pm? ← X = 9
y-int
LINEAR: $y = mx + b$
$y = 200x + 700$
x = # hrs after 2 pm
y = # bacteria
$y = 200(9) + 700$
$y = 1800 + 700$
$y = \boxed{2500 \text{ bacteria}}$
	2. At 2 pm, the population in the sample is 1000. It triples every hour. How many bacteria will be in the sample at 5 pm? ← X = 3
	y-int
	EXPONENTIAL: $y = a \cdot b^x$
	$y = 1000 \cdot 3^x$
	x = # hrs since 2 pm
	y = # bacteria
	$y = 1000 \cdot 3^3$
	$y = 1000 \cdot 27$
	$y = \boxed{27000 \text{ bacteria}}$

3. At 2 pm, the population of the sample was 300. The population decreases by 31% each hour. How many bacteria will be in the sample at midnight? ← X = 10 EXPONENTIAL: $y = a \cdot b^x$ 100% − 31% = 69% = 0.69 $y = 300(0.69)^x$ $y = 300(0.69)^{10}$ $y = 7.34$ $\boxed{7 \text{ bacteria}}$	4. At 2 pm, the population of the sample was 900. The population increases by 7.2% each hour. How many bacteria will be in the sample at 8 pm? ← x = 6 EXPONENTIAL: $y = a \cdot b^x$ 100% + 7.2% = 107.2% = 1.072 $y = 900(1.072)^x$ $y = 900(1.072)^6$ $y = 1365.88$ $\boxed{1366 \text{ bacteria}}$

Solve by Creating Common Bases

$2^x \cdot 2^{x-5} = 8^{2x+1}$ common base = 2 $8 = 2^3$ $2^x \cdot 2^{x-5} = (2^3)^{2x+1}$ $2^{x+x-5} = 2^{3(2x+1)}$ $x + x - 5 = 3(2x+1)$ $2x - 5 = 6x + 3$ $-2x \; -3 \quad -2x \; -3$	$\left(\frac{1}{3}\right)^x = 3^{x+1} \cdot 9^x$ common base = 3 $\frac{1}{3} = 3^{-1}$ $\quad 9 = 3^2$ $(3^{-1})^x = 3^{x+1} \cdot (3^2)^x$ $3^{-x} = 3^{x+1} \cdot 3^{2x}$ $3^{-x} = 3^{x+1+2x}$ $-x = x + 1 + 2x$ $-x = 3x + 1$

$-8 = 4x$

$\boxed{-2 = x}$

$-3x \quad -3x$

$-4x = 1$

$\boxed{x = -\frac{1}{4}}$