January 19, 2022

Exponential Functions

$y = b^x$ ← exponent is a variable
← base is a constant #

$b > 0, b \neq 1$

$y = 7^x$

$y = (0.25)^{x-3}$

Exponential Growth

$y = b^x \quad b > 1$

$y = 7^x$

$y = 1.3^x$

Exponential Decay

$y = b^{-x}$

$y = 6^{-x}$

$y = b^x \quad 0 < b < 1$

$y = \left(\frac{2}{3}\right)^x$

$y = \left(\frac{7}{5}\right)^x$ growth

$y = 4^{3-x}$ decay

$y = \left(\frac{1}{3}\right)^{7+x}$ decay

$y = (0.83)^{9-x}$ growth

(0.83): decay; $9-x$: decay

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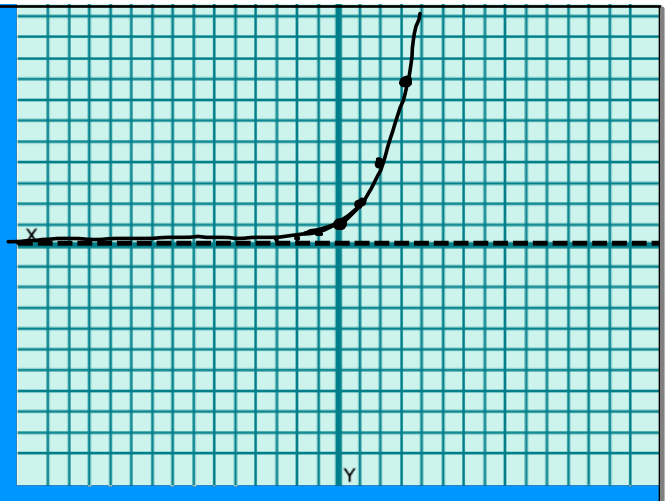
$y = 2^x$

x	y
0	$2^0 = 1$
1	$2^1 = 2$
2	$2^2 = 4$
3	$2^3 = 8$
-1	$2^{-1} = \frac{1}{2}$
-2	$2^{-2} = \frac{1}{2^2} = \frac{1}{4}$
-3	$2^{-3} = \frac{1}{2^3} = \frac{1}{8}$

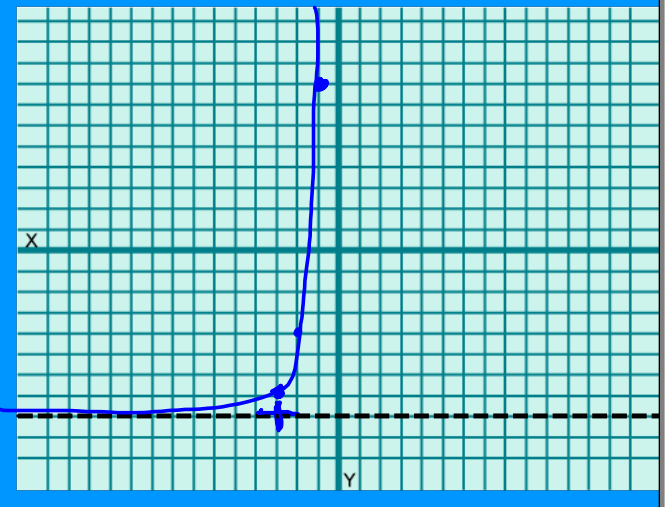


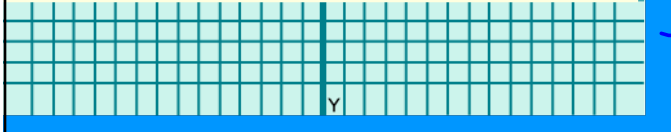
$y = 4^{x+3} - 8$

Left 3 Down 8

$y = 4^x$

0	1
1	4
2	16

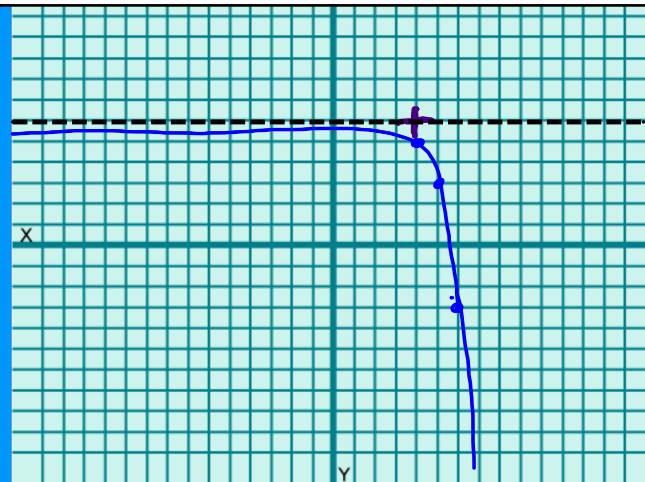




$y = -3^{x-4} + 6$

Right 4   up 6

0	−1
1	−3
2	−9



$y = 2^{6-x} - 7 \quad (6-x = -(x-6))$

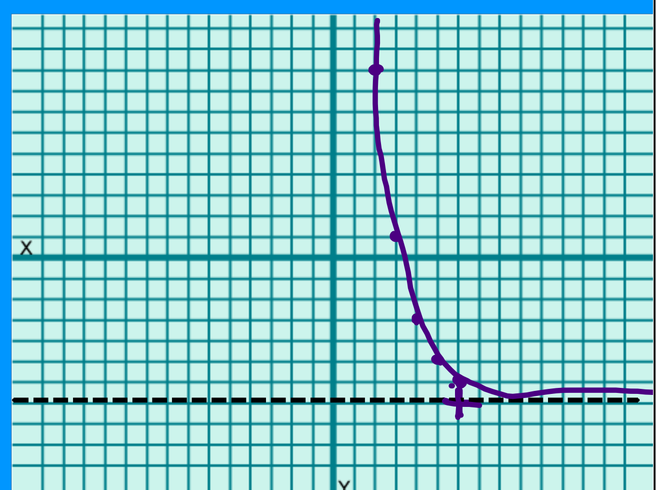
Right 6   Down 7

0	1
−1	2
−2	4
−3	8

$y = \sqrt{4-x} = \sqrt{-(x-4)}$

$y = -2^{x}$ ← change y-coord to −

$y = 2^{-x}$ ← change x-coord to −



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Compound Interest

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

- A: Final Amt
- P: Principal
- r: interest rate
- n: # of times compounded in a year
- t: time

Compounded
- monthly $n = 12$
- quarterly $n = 4$
- Semi-annually $n = 2$
- bimonthly $n = 6$
- Semi-monthly $n = 24$

Exponential Growth (Main in control)

$$N = N_0(1 \pm r)^t$$

$$N = 7200(1 + 0.076)^{10}$$
$$= 7200(1.076)^{10}$$
$$\approx 14{,}978$$

KSU Tuition

2012 $7200

7.6% per year

What is tuition in 2022?

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$e = \left(1 + \frac{1}{n}\right)^n$ Leonard Euler (pronounced Oiler)

$n=1$ $\left(1+\frac{1}{1}\right)^1 = 2$ } 0.25

$n=2$ $\left(1+\frac{1}{2}\right)^2 = 2.25$ } 0.12

$n=3$ $= 2.37$ } 0.07

$n=4$ $= 2.44$

$= 2.718$

Nature Number

things grow/decay in nature with base e.

Nature Formula

$$q = q_0 \cdot e^{kt}$$

$$1000 = 300 \cdot e^{0.125t}$$

$$t = 9.6 \text{ hrs.}$$

Bacteria

300 bacteria

$K = 0.125$

In how many hours will there be 1000 bacteria?