October 2, 2024

Exponential Functions

$$\frac{(a^3b^3)(a^{-5}b^2)^3}{a^{-4}b^2}$$

$$\frac{(a^3b^3)(a^{-15}b^6)}{a^{-4}b^2}$$

$$\frac{a^{-12}b^{9-2}}{a^{-4+12}b^2}$$

$$\frac{b^7}{a^8}$$

$$\sqrt[5]{a^2} = a^{2/5}$$

$$\left(4^{-3/2} + 2^{-1}\right)^{-1}$$

$$\left(\frac{1}{\sqrt[2]{4^3}} + \frac{1}{2}\right)^{-1}$$

$\frac{1}{2^3}$

$$\left(\frac{1}{8} + \frac{1}{2}\right)^{-1}$$

$$\left(\frac{1}{8} + \frac{4}{8}\right)^{-1}$$

$$\left(\frac{5}{8}\right)^{-1}$$

$$= \boxed{\frac{8}{5}}$$

Exponential Functions – base is a constant # variable exponent

$y = 2^x$ $\quad b > 0,\ b \neq 1$

$y = 5^{x+2}$

$y = 2.4^{3x}$

Domain: $(-\infty, \infty)$

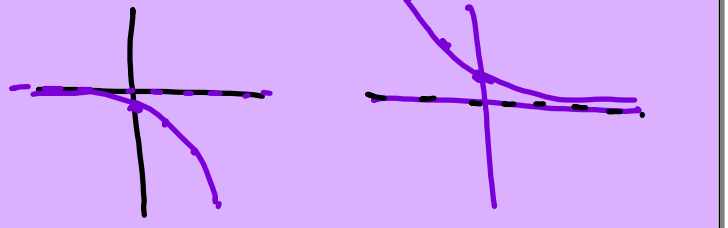
Range: $(0, \infty)$

$y = -2^x$ ← flip over x-axis

0	-1
1	-2
2	-4
3	-8

$y = 2^{-x}$ ← flip over y-axis

0	1
-1	2
-2	4
-3	8

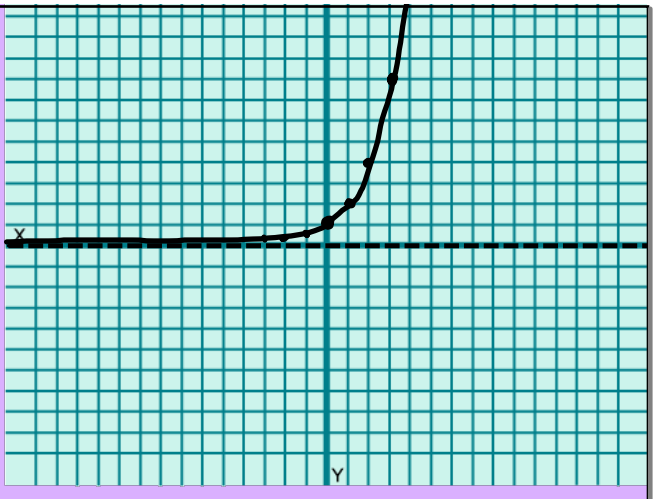


$y = 2^x$

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

$y = 3^x$

0	$3^0 = 1$
	3
	9
	27

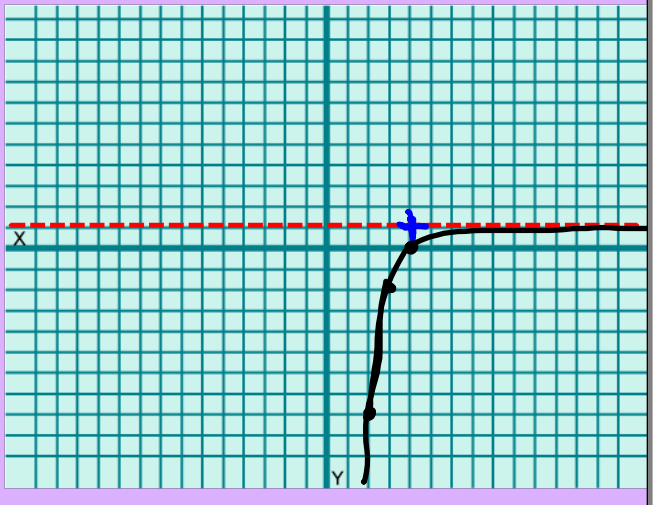


$y = -3^{4-x} + 1$

$-(3)^{-(x-4)} + 1$

Right 4 UP 1

0	−1
1	−3
2	−9



Solve for x.

$$\left(\frac{1}{9}\right)^{3x} = \left(\sqrt[4]{27}\right)^{x+3}$$

Make common bases!

$$\left(\frac{1}{3^2}\right)^{3x} = \left(\sqrt[4]{3^3}\right)^{x+3}$$

$$\left(3^{-2}\right)^{3x} = \left(3^{3/4}\right)^{x+3}$$

$$3^{-6x} = 3^{\frac{3}{4}x + \frac{9}{4}}$$

$$4\left[-6x = \frac{3}{4}x + \frac{9}{4}\right]$$

$$-24x = 3x + 9$$

$$\frac{-9}{27} = \frac{27x}{27}$$

$$\boxed{-\frac{1}{3} = x}$$

$e = \left(1 + \frac{1}{n}\right)^n \approx 2.718$ Leonard Euler (Oiler)

$n=1$	2
$n=2$	2.25
$n=3$	2.37
$n=4$	2.44

Nature Number

Compound Interest

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

Continuously

$$A = Pe^{rt}$$

Culture of Bacteria

final → $N = N_0 e^{kt}$ ← initial

20 bacteria

$K = 0.42$

How many bacteria in 12 hrs.?

$N = 20e^{(0.42)(12)}$

$= 3089$ bacteria

When will there be 5000 bacteria

$5000 = 20e^{0.42t}$