13-1: Exponential Functions

We have learned that the rate of change for an exponential pattern is a common factor, or a number that we multiply by to get from term to term.

2^x x^2

Linear → add Exp → multiply

Does the following table represent exponential behavior? Why or why not?

x	0	5	10	15	20	25
y	64	32	16	8	4	2

÷2 ÷2 ÷2 ÷2

• $\frac{1}{2}$ exponential

Exponential Function: $y = a(b)^x$

- b is called the base and $b \neq 1$ and b > 0
- x is called the exponent and the exponent will always be a variable
- a is called the y-intercept and $a \neq 0$

where x is 0
graph crosses the y-axis

- Examples: $y = 2(3)^x$ $f(x) = (4)^x$ $y = \left(\frac{1}{2}\right)^x$

y-int: 2 base: 3 y-int: 1 base: 4 y-int: 1 base: $\frac{1}{2}$

Task

$y = a(b)^x$

y-int: $x = 0$

RofC

$x^0 = 1$

$x^1 = x$

$y = 3(2)^x$

$3 = 3(2)^0$

$3 = 3(1)$

$3 = 3$ ✓

$6 = 3(2)^1$

$6 = 3(2)$

$6 = 6$ ✓

$12 = 3(2)^2$

$12 = 3(4)$

$12 = 12$ ✓

Linear

$y = mx + b$

m: slope, RofC

b: yint

Exp

$y = a(b)^x$

a: yint

b: RofC

Evaluate the following functions

1. $y = 2(3)^x$ for x=0 and x= 2

$2(1)$
$y=2$
$y=2(3)^2$
$2(9)$
$y=18$
$18=2(3)^2$

2. Find f(3) given $f(x)=4^x$

$F(3)=4^3$
64
$4\cdot4\cdot4$

3. $y=\left(\frac{1}{2}\right)^x$ for x= 3

$\frac{1}{2}\cdot\frac{1}{2}\cdot\frac{1}{2}$

$y=\left(\frac{1}{2}\right)^3=\frac{1^3}{2^3}=\frac{1}{8}$

Remember that domain represents the X -values and range represents the y - values that work for the function.

State the domain and range of the following by writing it as an interval

2 x y

x	y
0	1
1	2
2	4
3	8
4	16
5	32

$\{(-10,1),(-10,2),(-10,3),(-10,4)\}$

(X, y)

X Domain: $\{0,1,2,3,4,5\}$ Domain: $\{-10\}$

y Range: $\{1,2,4,8,16,32\}$ Range: $\{1,2,3,4\}$

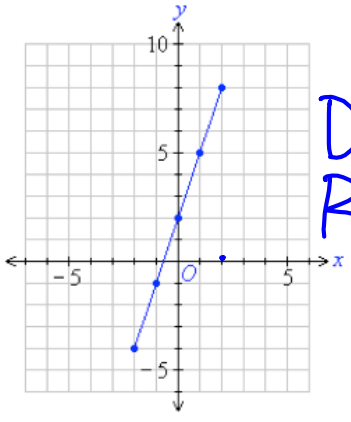
The domain for a graph is where the X -values start to where they end. L → R − → +

[,] included (,) not included

The range for a graph is where the y -values start to where they end

− → + Bottom → Top Low → High

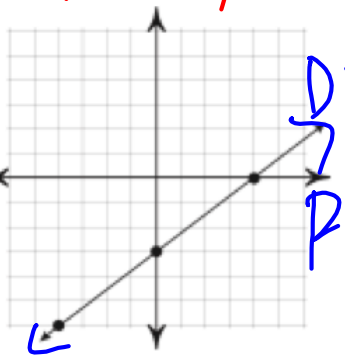
State the domain and range of the following



D: [−2, 2]

R: [−4, 8]

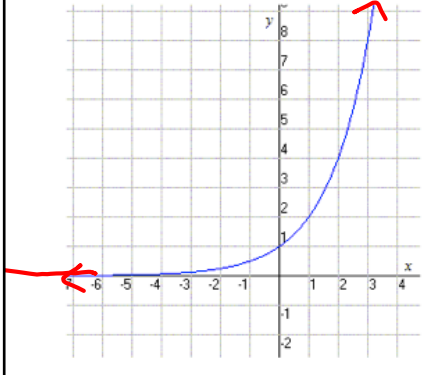
(−∞, ∞)



D: (−∞, ∞)

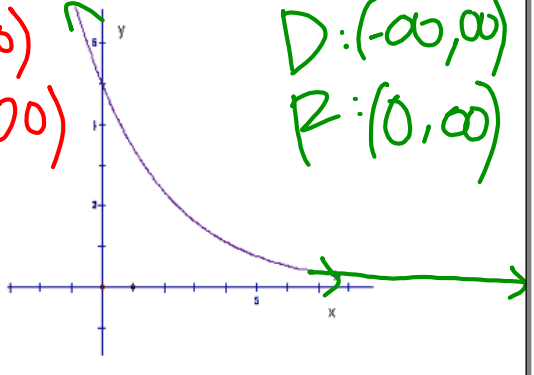
R: (−∞, ∞)

State the domain and range of the following



D: (−∞, ∞)

R: (0, ∞)

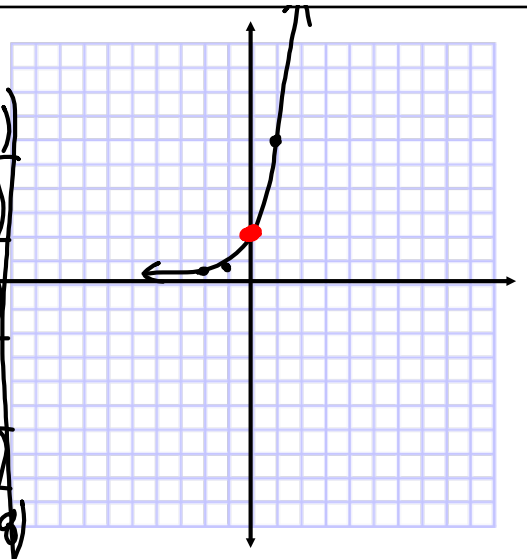


D: (−∞, ∞)

R: (0, ∞)

Graph $y = 2 \cdot 3^x$

X	$y = 2 \cdot 3^x$	y	(x, y)
-2	$= 2 \cdot 3^{-2} =$	0.2 $\frac{2}{9}$	$(-2, \frac{2}{9})$
-1	$y = 2(3)^{-1}$	0.6 $\frac{2}{3}$	$(-1, \frac{2}{3})$
0	$y = 2(3)^0 = 2 \cdot 1$	2	(0, 2)
1	$y = 2(3)^1 = 2 \cdot 3$	6	(1, 6)
2	$y = 2(3)^2 = 2 \cdot 9$	18	(2, 18)



y-intercept _____ Domain:_____ Range:_____

$2 \cdot 3^{-2}$ $\quad \frac{2}{3^2} = \frac{2}{9}$

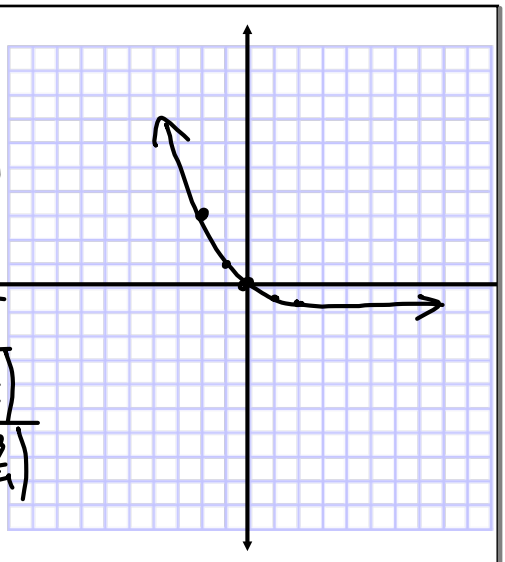
$3^{-1} = .33 \cdot 2$ $\quad$ CALC: $\quad 0.\overline{6}$

$2(3)^{-1}$ $\quad 2(3)\wedge -1$

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

Graph $y=\left(\frac{1}{2}\right)^x-1$

x	y =	y	(x, y)
-2	$\left(\frac{1}{2}\right)^{-2}-1=4-1$	3	(-2, 3)
-1	$\left(\frac{1}{2}\right)^{-1}-1=2-1$	1	(-1, 1)
0	$\left(\frac{1}{2}\right)^{0}-1=1-1$	0	(0, 0)
1	$\left(\frac{1}{2}\right)^{1}-1=\frac{1}{2}-1$	$-\frac{1}{2}$	$\left(1,-\frac{1}{2}\right)$
2	$\left(\frac{1}{2}\right)^{2}-1=\frac{1}{4}-1$	$-\frac{3}{4}$	$\left(2,-\frac{3}{4}\right)$



y-intercept _____ Domain:_____ Range:_____

$$\left(\frac{1}{2}\right)^{-2}=\frac{1^{-2}}{2^{-2}}\qquad \frac{2^2}{1^2}=\frac{4}{1}$$

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