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Exponential Growth & Decay

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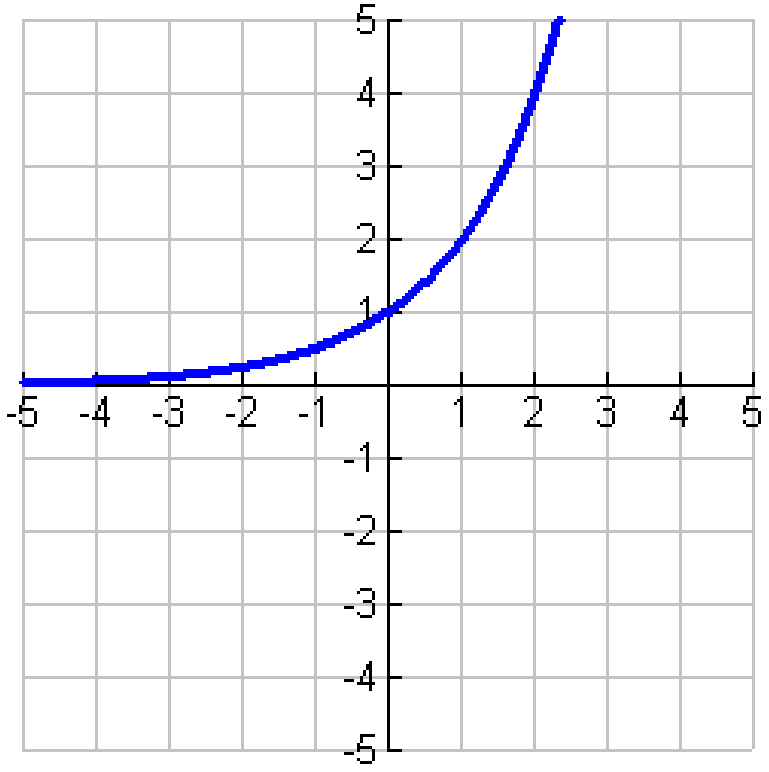
Exponential Function

- $f(x) = b^x$ where the base b is a positive number other than one.
- Graph $f(x) = 2^x$
- Note the end behavior
- $x \to \infty$ $f(x) \to \infty$
- $x \to -\infty$ $f(x) \to 0$
- y=0 is an asymptote



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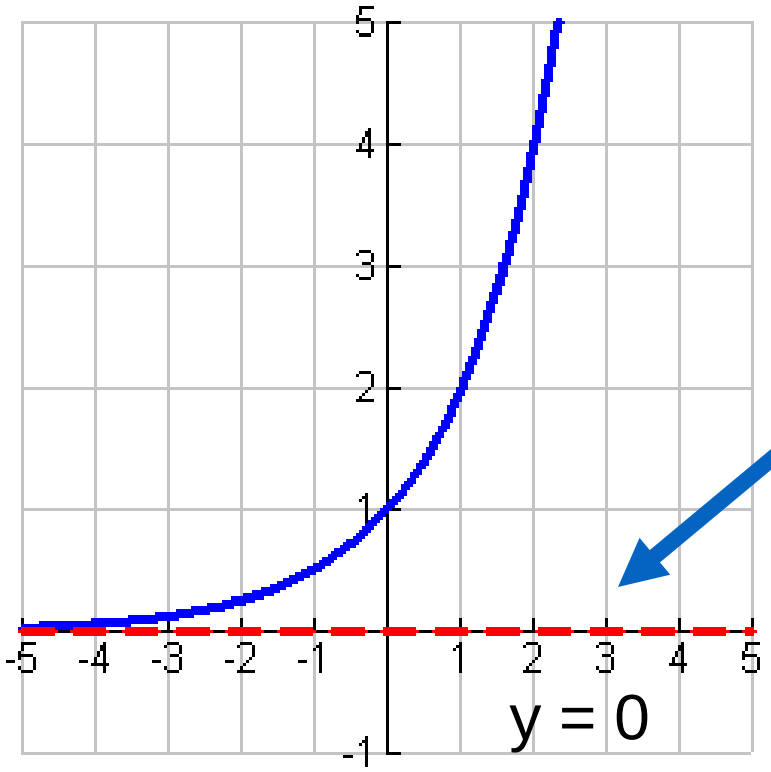
Asymptote

- A *line* that a graph *approaches* as you move away from the origin



The graph gets closer and closer to the line y = 0 …….
But NEVER reaches it

2 raised to any power
Will NEVER be zero!!

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- These are true of $y = ab^x$
  - If $a>0$ & $b>1$ ……
- The function is an *Exponential Growth Function*

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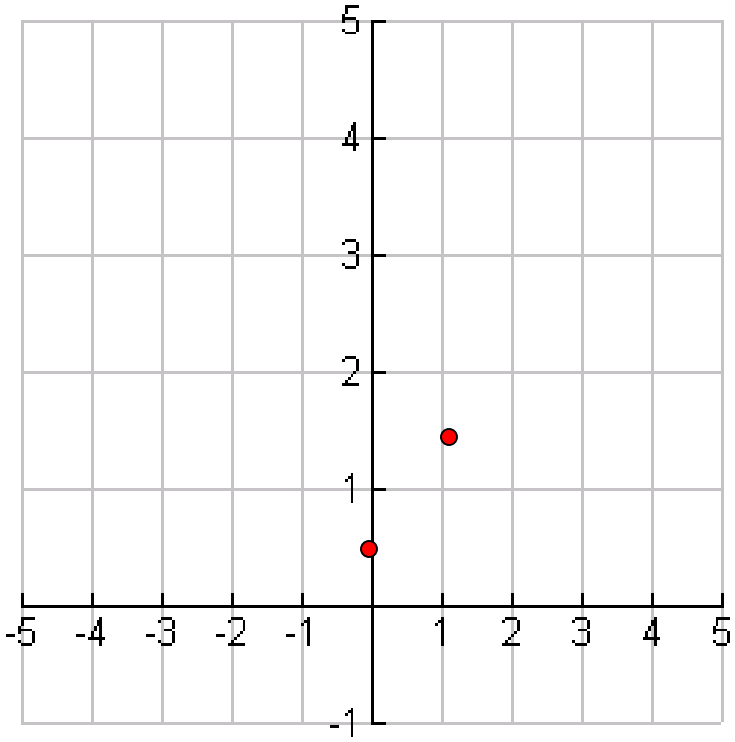
Example 1

- Graph $y = \frac{1}{2}\ 3^x$
- Plot ordered pairs (0, ½) and (1, 3/2)
- Then, from left to right, draw a curve that begins just above the x-axis, passes thru the 2 points, and moves up to the right



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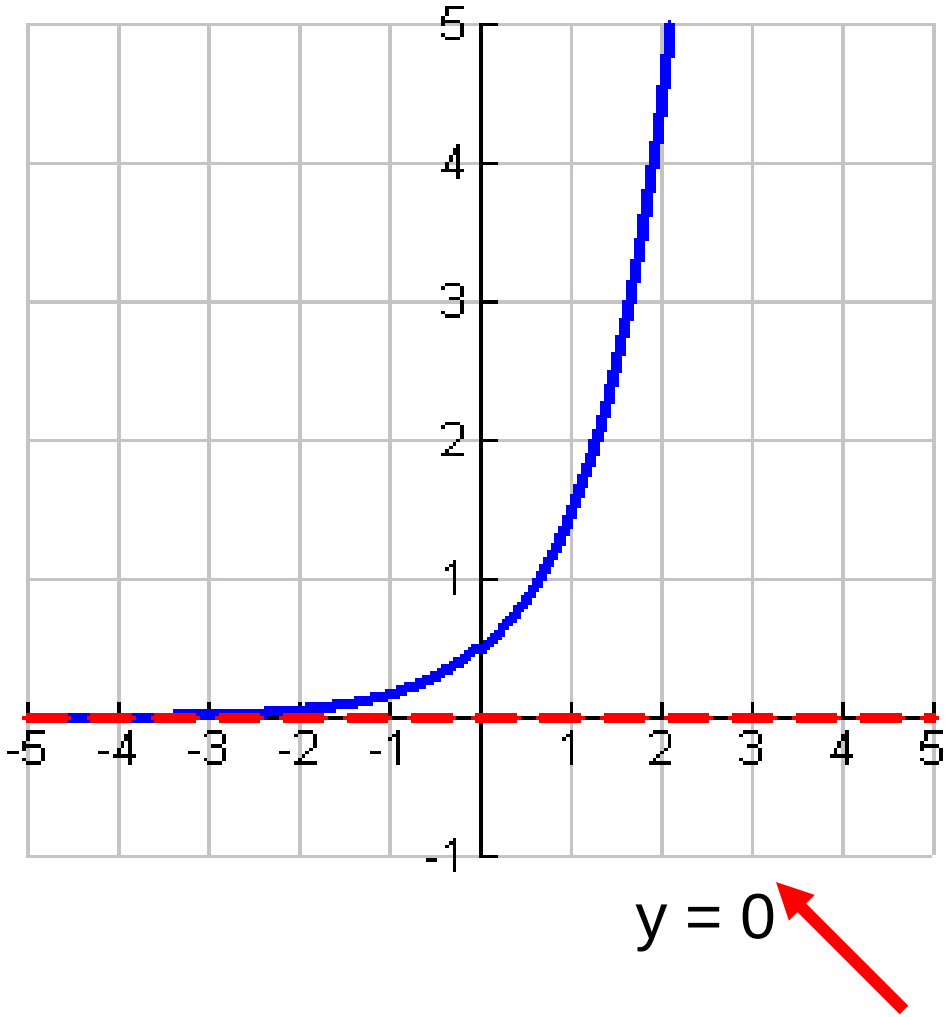
D= (-∞, +∞)
R= (0, +∞)



Always mark asymptote!!

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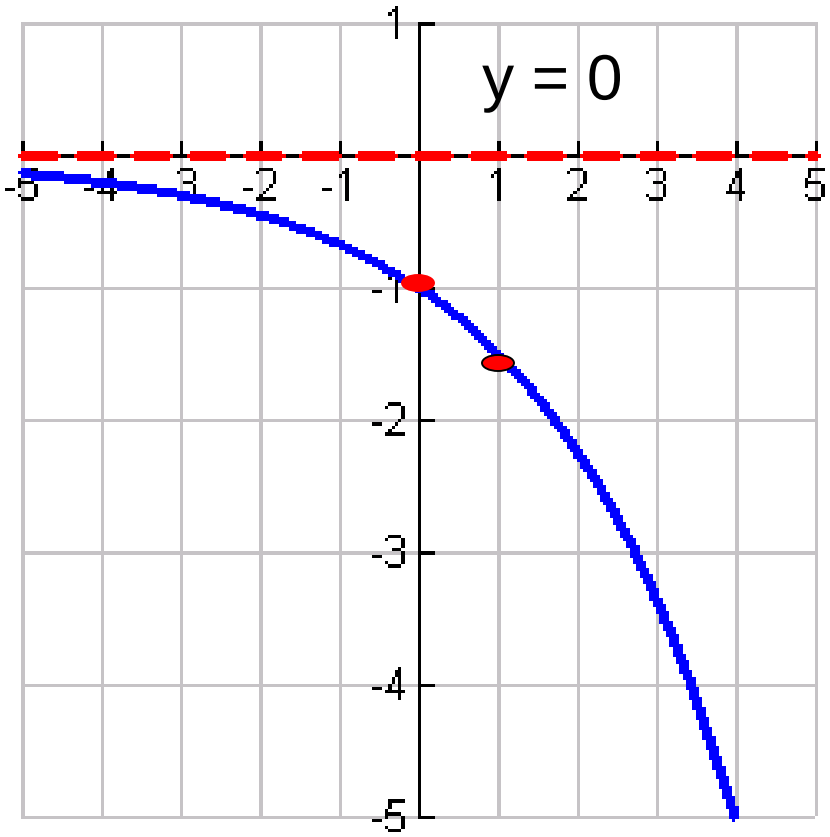
Example 2

- Graph $y = -(3/2)^x$
- Plot (0, -1) and (1, 3/2)
- Connect with a curve
- Mark asymptote
- D=?
- R=?



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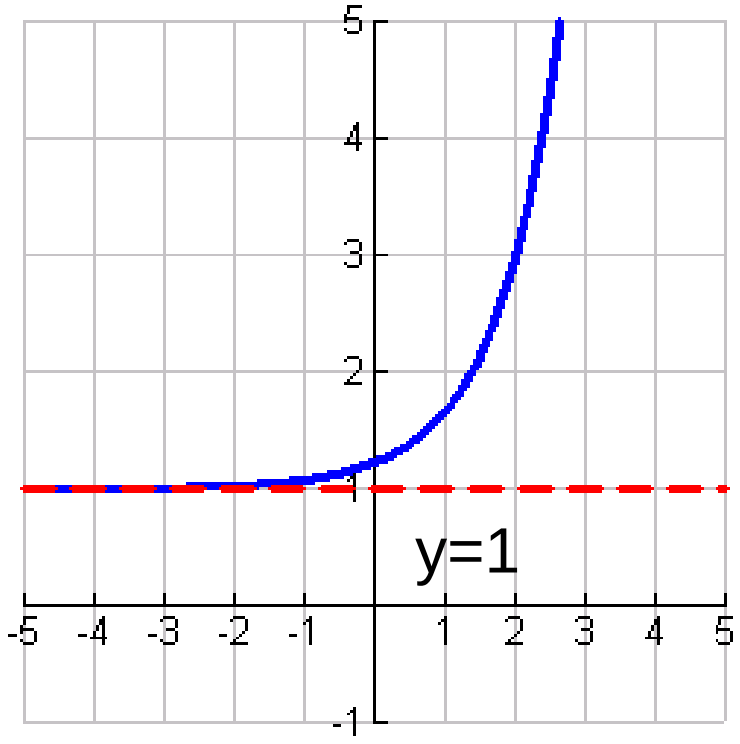
Now…you try one!

- Graph $y= 2 \cdot 3^{x-2} +1$
- State the Domain and Range!
- D= ?
- R= ?



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Exponential Decay

- Has the same form as growth functions $f(x) = ab^x$
- Where $a > 0$
- BUT:
- $0 < b < 1$ (a fraction between 0 & 1)

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Recognizing growth and decay functions

- State whether f(x) is an exponential growth or decay function
- $f(x) = 5(2/3)^x$
- $b=2/3$, $0<b<1$ it is a decay function.
- $f(x) = 8(3/2)^x$
- $b= 3/2$, $b>1$ it is a growth function.
- $f(x) = 10(3)^{-x}$
- rewrite as $f(x)=10(1/3)^x$ so it is decay

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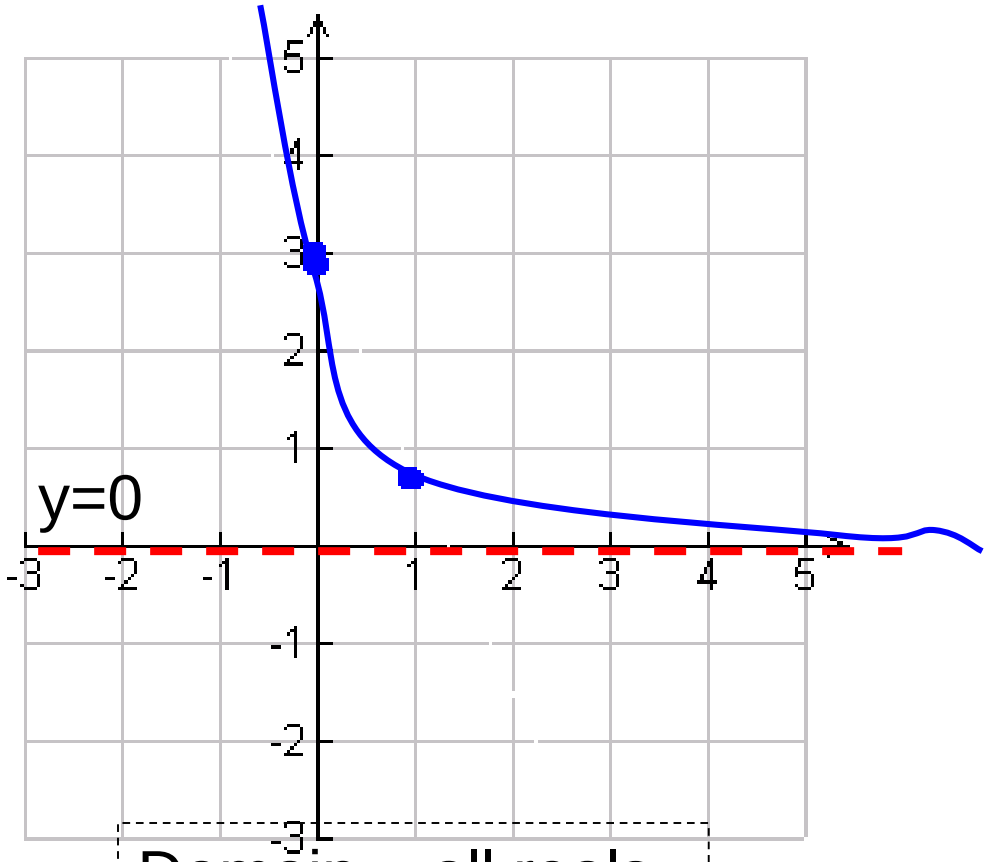
Graph:

- $y = 3(1/4)^x$
- Plot (0,3) and (1,3/4)
- Draw & label asymptote
- Connect the dots using the asymptote



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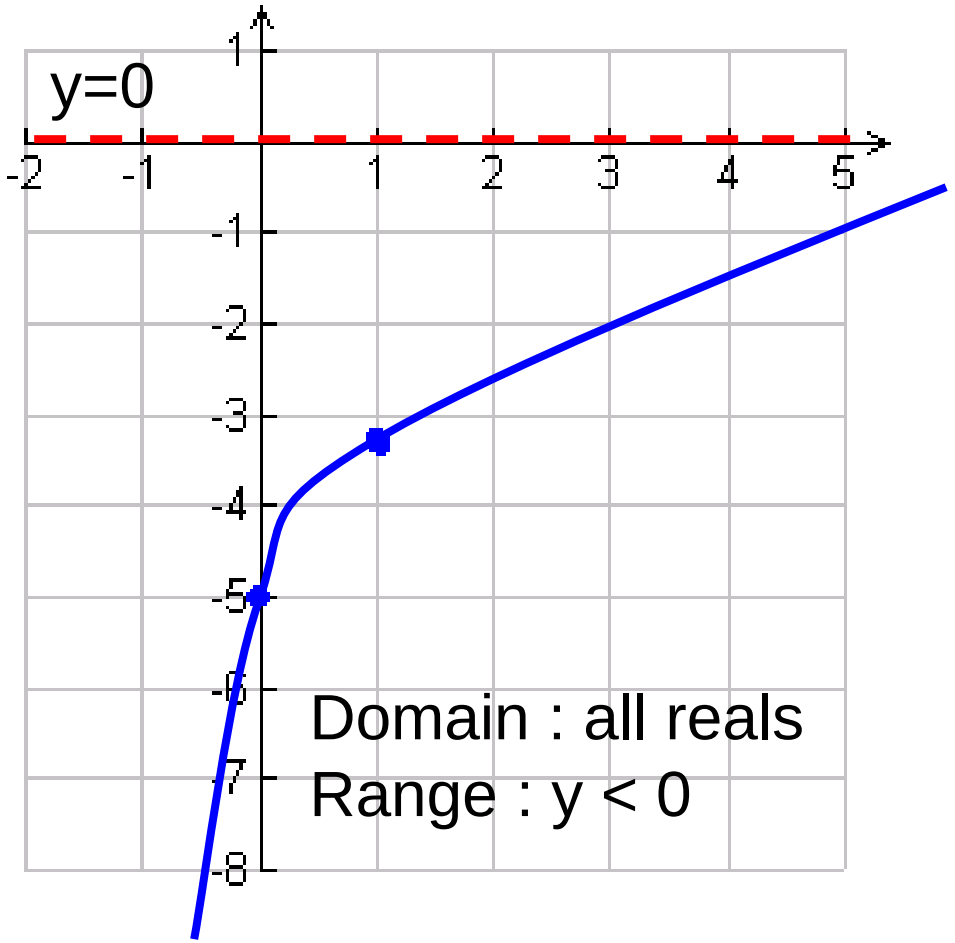
Graph

- $y = -5(2/3)^x$
- Plot (0,-5) and (1,-10/3)
- Draw & label asymptote
- Connect the dots using the asymptote



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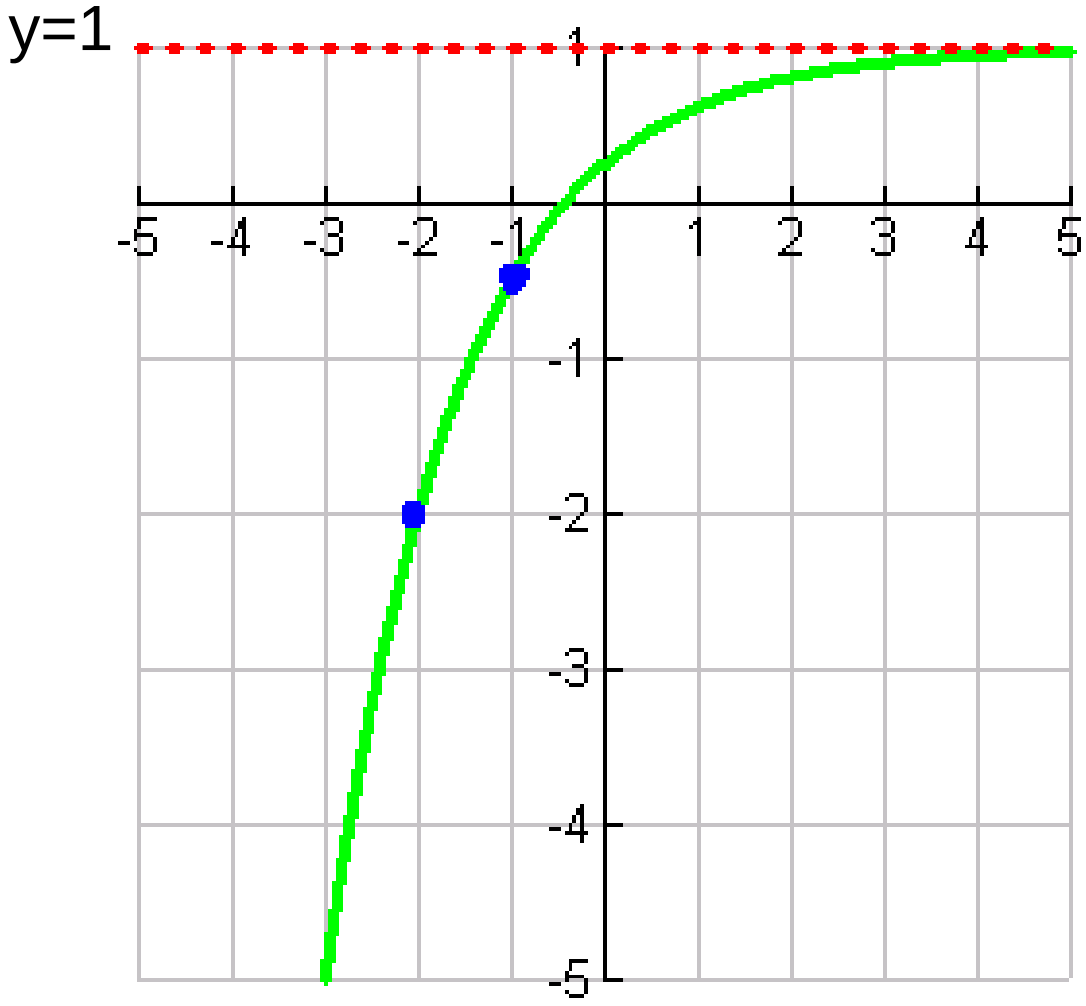
Example graph $y= -3(1/2)^{x+2} + 1$



Domain :

Range :