

# Exponential Functions

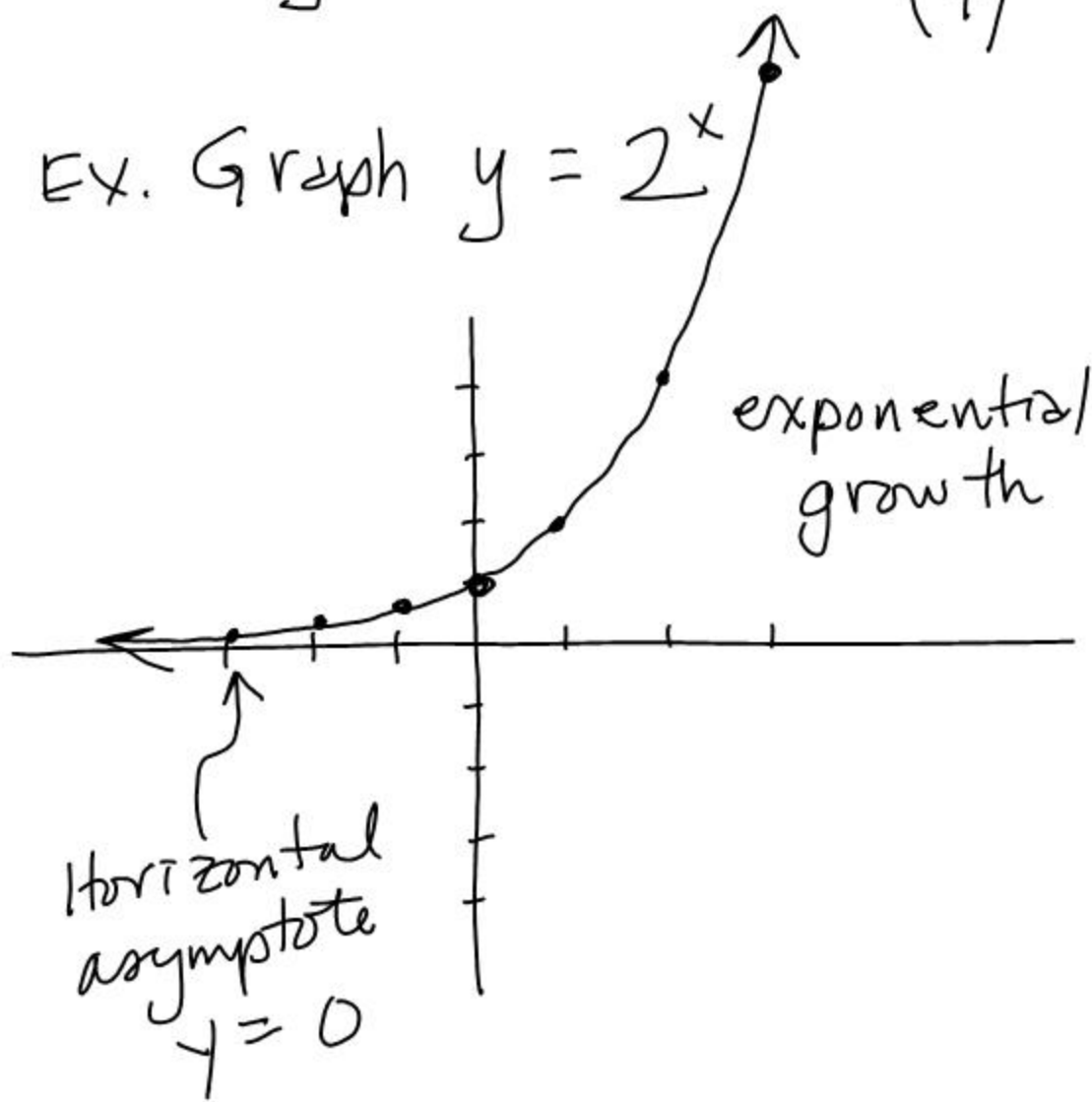
$$f(x) = a \cdot b^x, \quad b > 0, \quad b \neq 1$$

$b = \text{base}$

Ex.  $y = 2^x$  ← variable in the exponent

Ex.  $y = 3 \cdot 4^{-x} = 3 \cdot \left(\frac{1}{4}\right)^x$

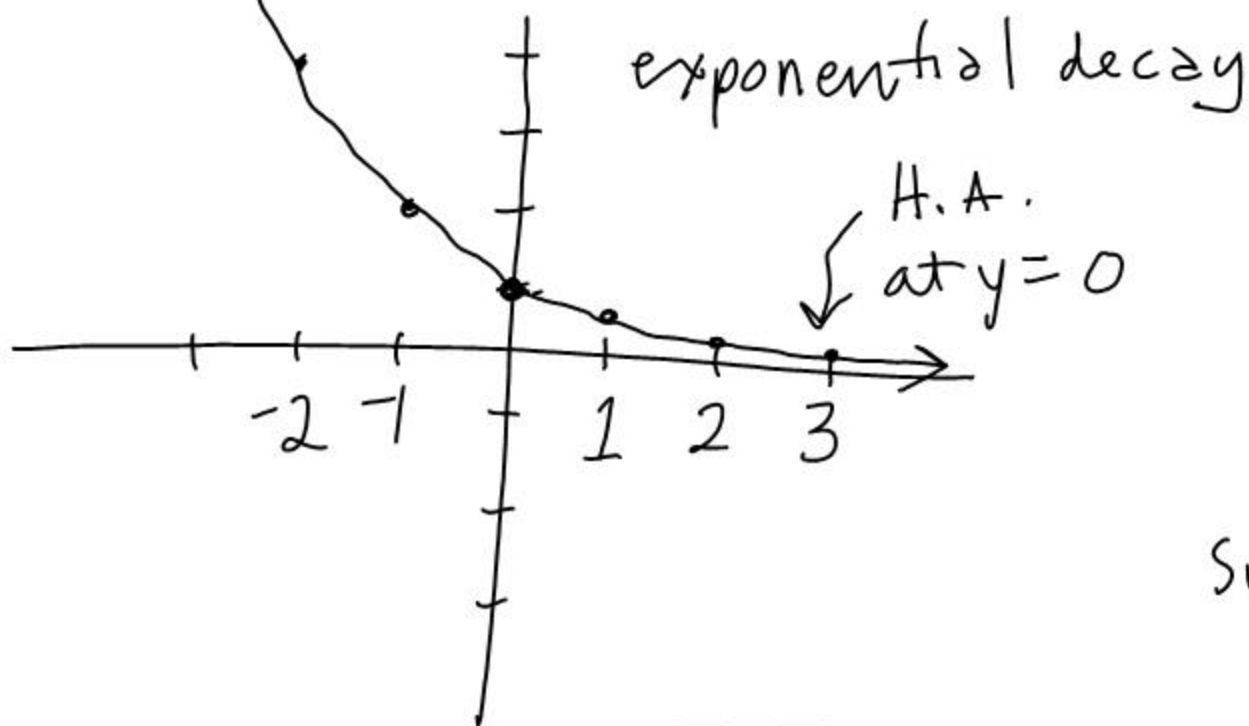
Ex. Graph  $y = 2^x$



$y = (-2)^x$   
x couldn't be  $\frac{1}{2}, \frac{3}{2}, \dots$   
 $\frac{1}{4}, \frac{3}{4}, \dots$

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

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



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The Euler Number (Leonhard Euler)

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$$e = \frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \dots$$

Factorials:  $5! = 5 \times 4 \times 3 \times 2 \times 1$

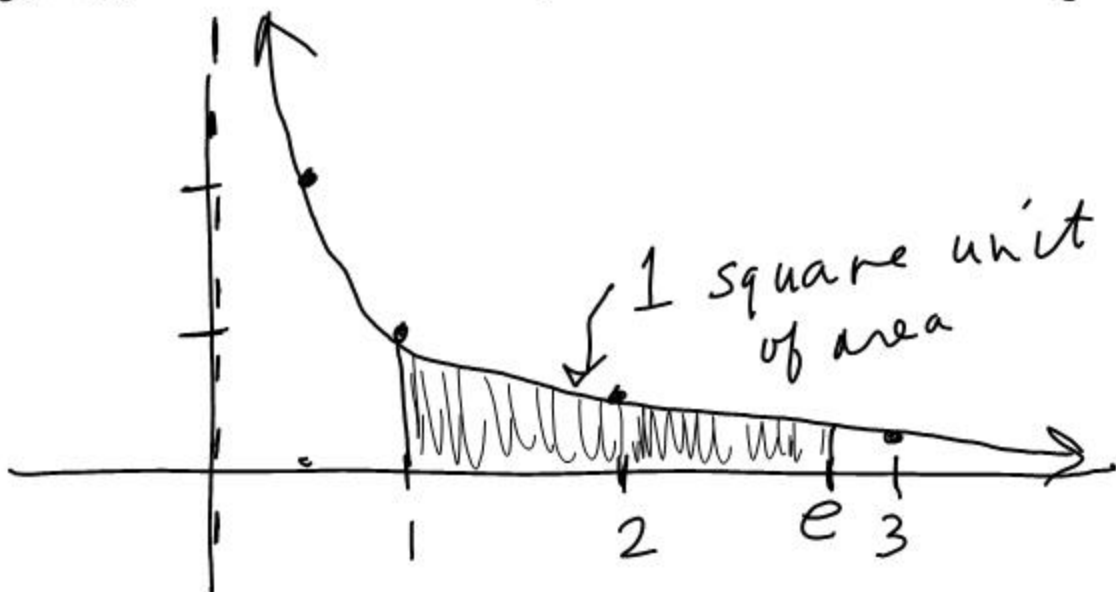
$$0! = 1$$

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$$e = \lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n$$

"The limit as  $n$  goes to infinity"

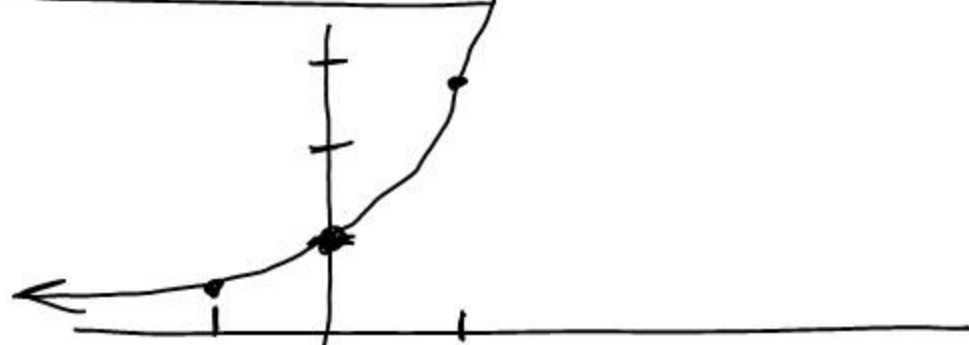
$$y = \frac{1}{x}$$



$$\ln 2 = \log_e 2$$

The Natural Exponential Function

$$f(x) = e^x \approx 2.718^x$$

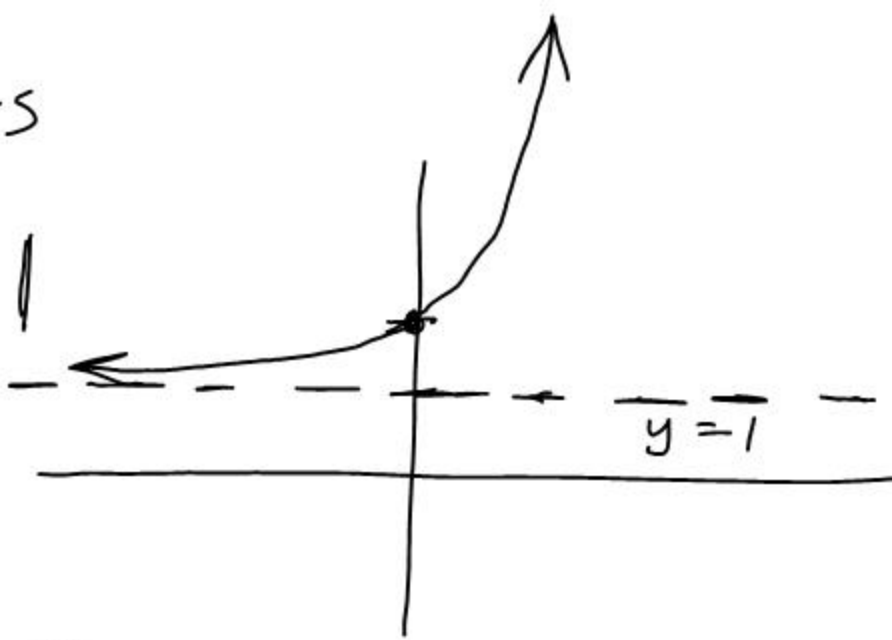


H.A.  $y = 0$

# Making Sketches

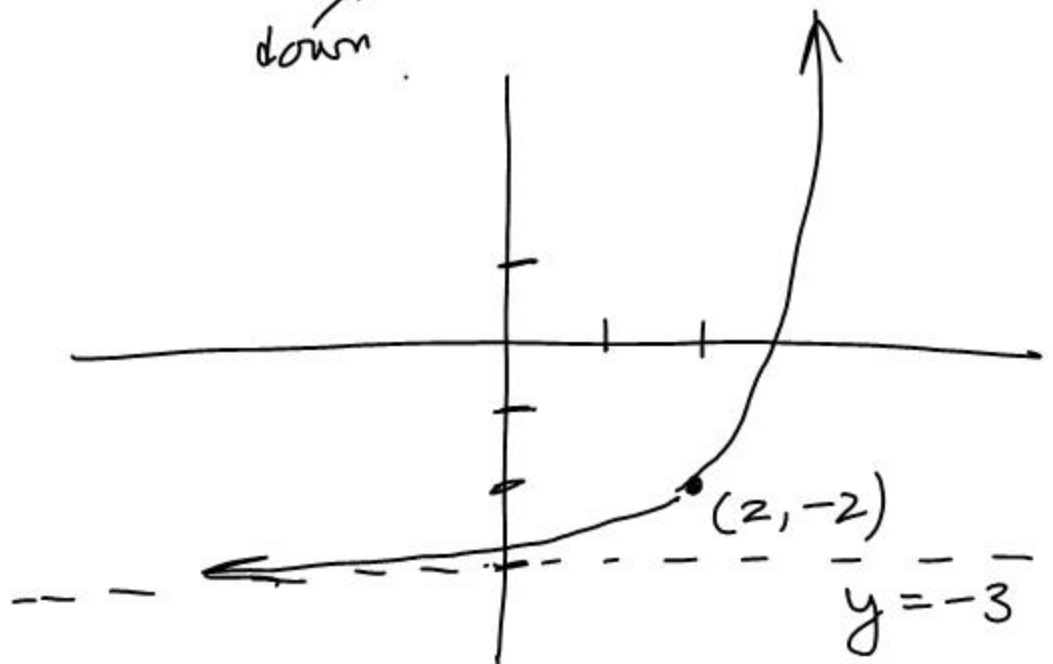
Ex.  $y = e^x + 1$

shift  
up



Ex.  $y = e^{x-2} - 3$

right  
down



Ex.  $y = e^x$   
up 1 over the x-axis

