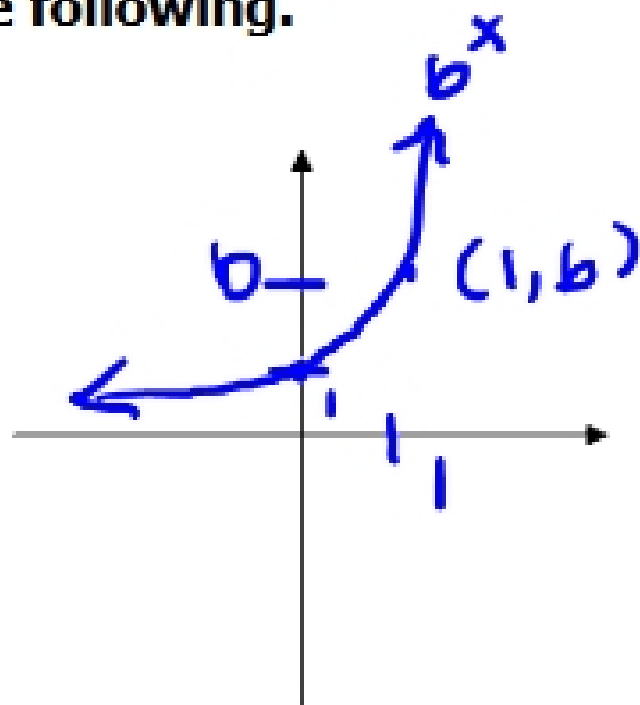
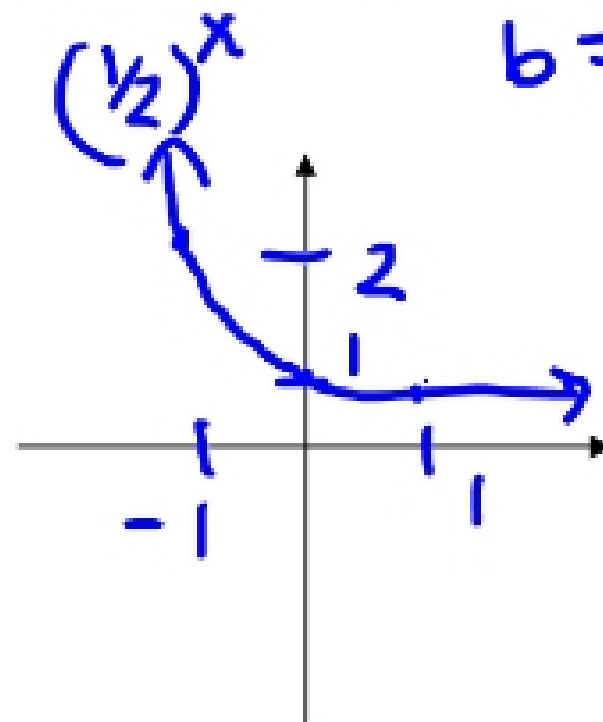


$$1 \quad \left(\frac{1}{2}\right)^{-1} = \frac{1^{-1}}{2^{-1}} = \frac{2}{1}$$

For any exponential function $f(x) = b^x$, the graph looks like one of the following.



$b > 1$



$b = 1/2$

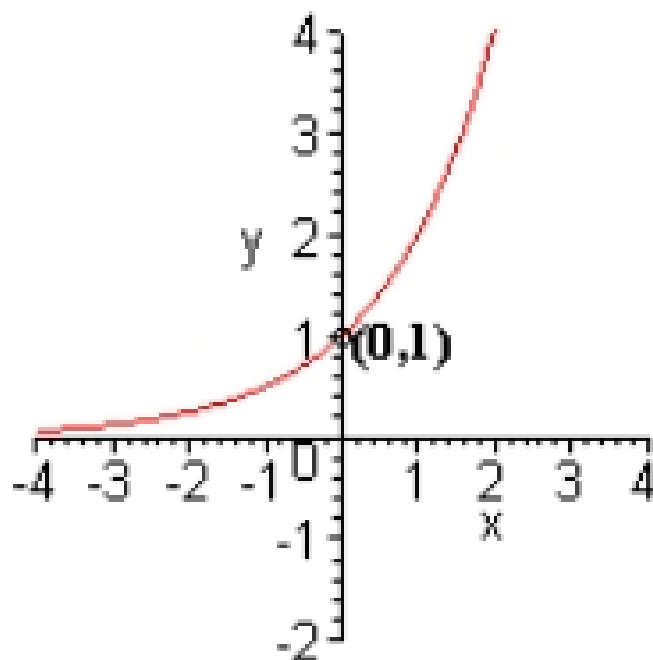
$0 < b < 1$

$$f(x) = \frac{1}{2}^x$$

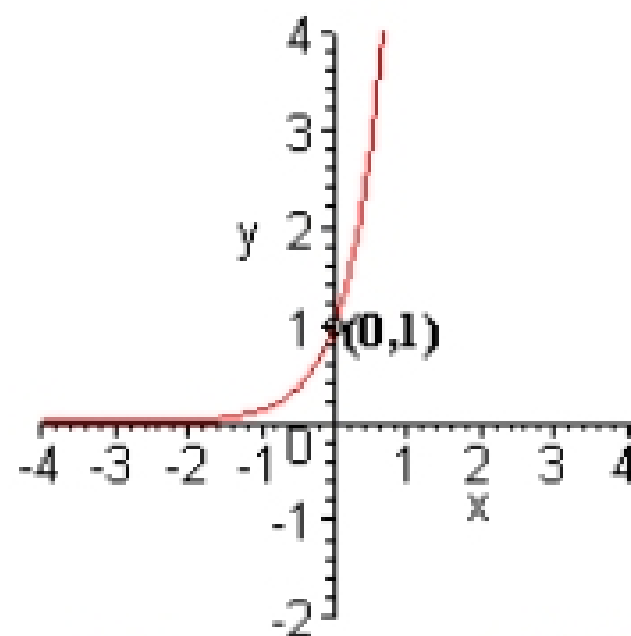
Notice: for $f(x) = b^x$

- Domain is $(-\infty, \infty)$.
- Range is $(0, \infty)$.
- Horizontal asymptote is $y = 0$.
- Always passes through the points $(0, 1)$ $(1, b)$

For $b > 1$, a larger b results in a steeper graph

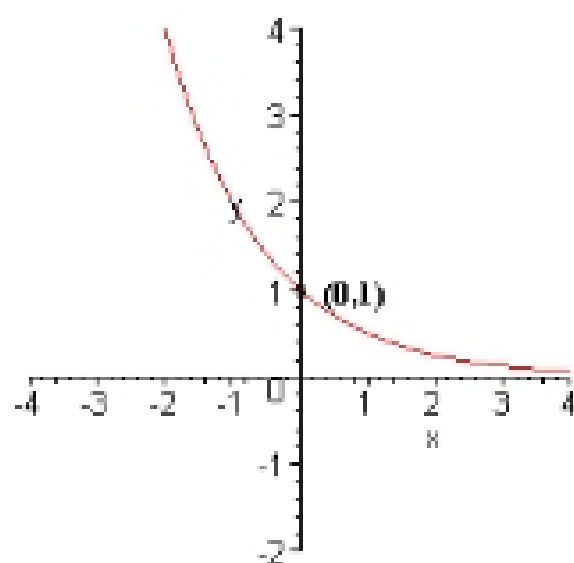


$b=2$ $f(x) = 2^x$

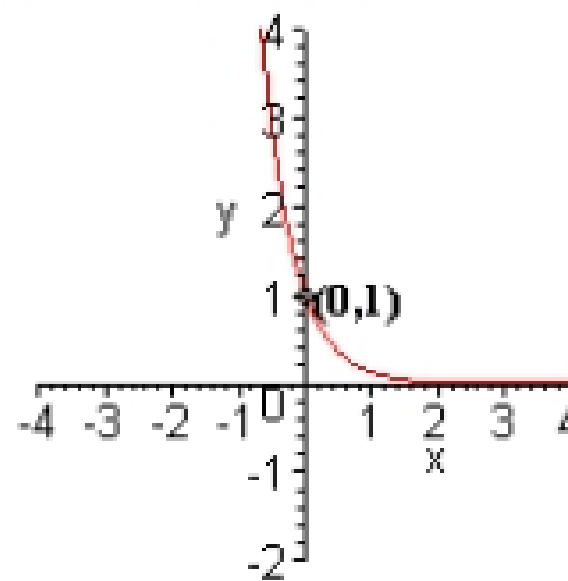


$b=8$ $f(x) = 8^x$

For $0 < b < 1$, a smaller b results in a steeper graph.



$$b = \frac{1}{2}$$



$$b = \frac{1}{8}$$

Example 1:

Sketch the graph of $f(x) = 2^x + 1$

Basic $f(x) = 2^x$
 Domain: $(-\infty, \infty)$
 $f(x) = 2^x + 1$

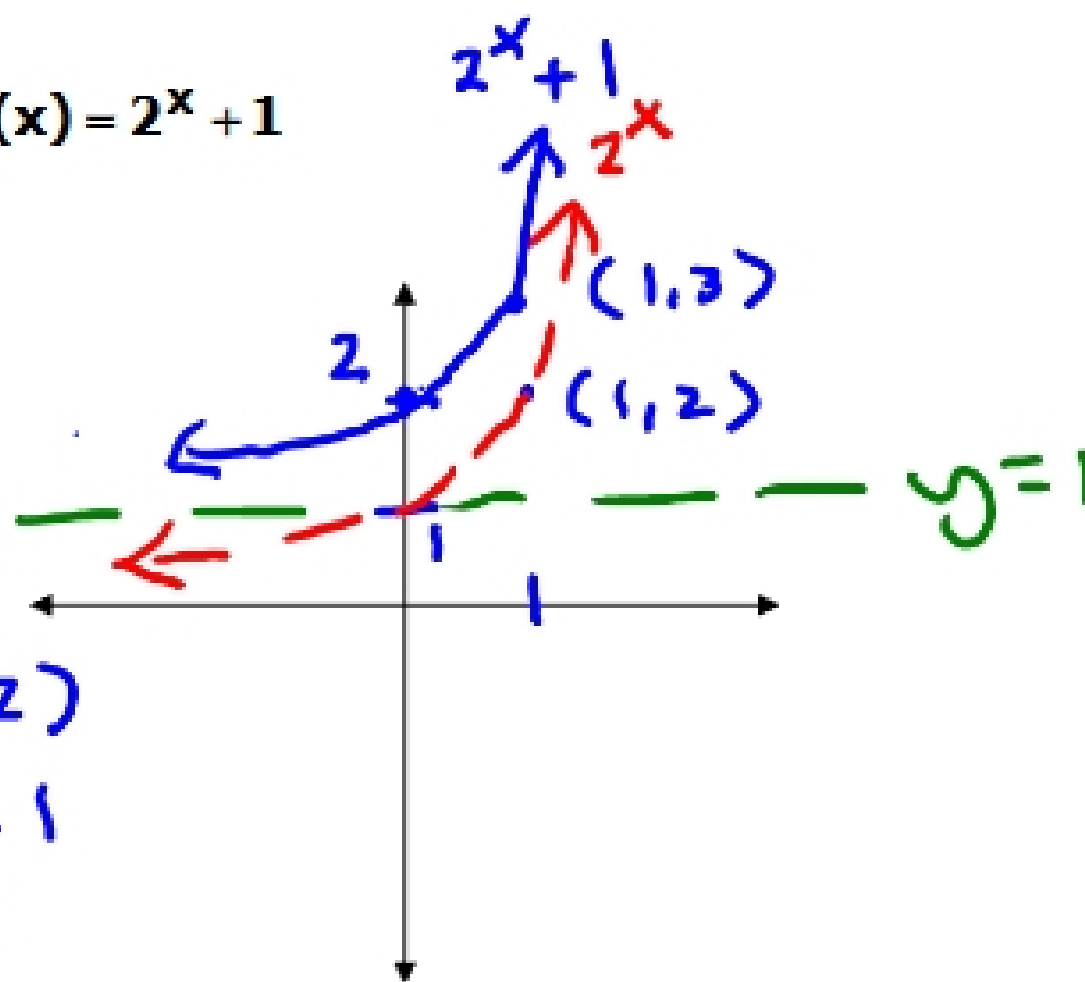
$(0, 1) \rightarrow$ up 1 $\rightarrow (0, 2)$

HA: $y = 0 \rightarrow y = 1$

Range: $(1, \infty)$

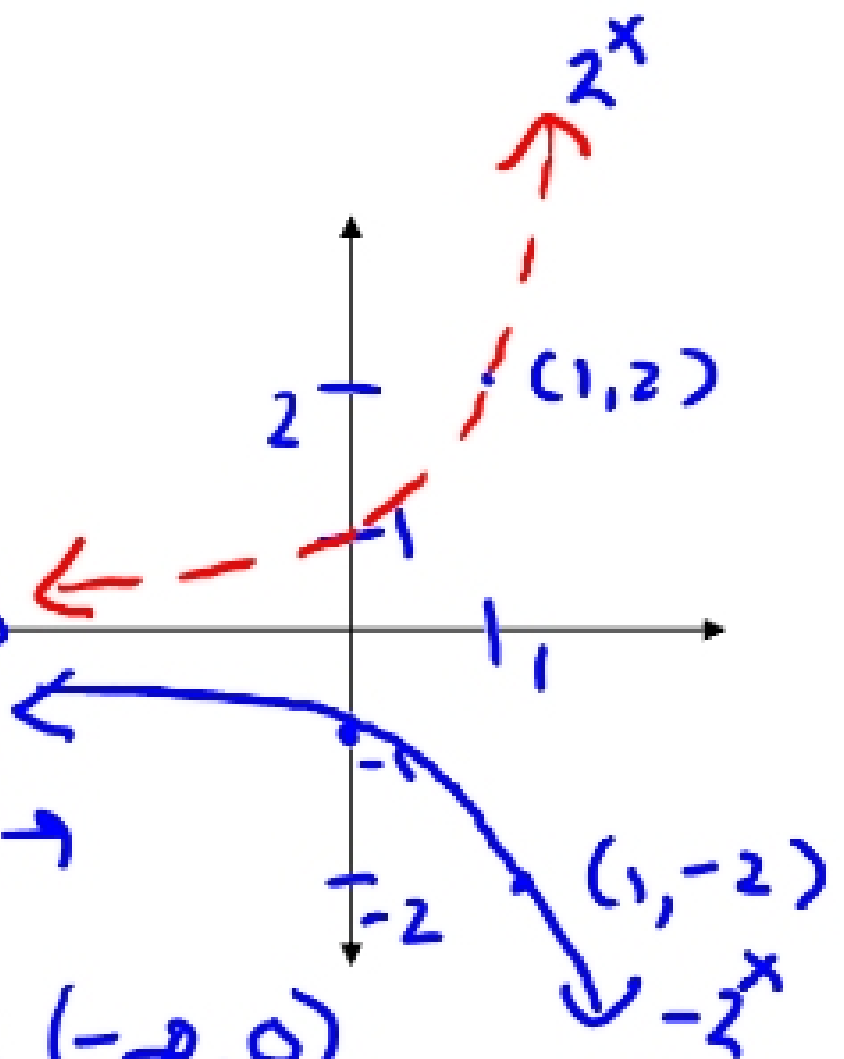
y-int: $x = 0$

$$2^0 + 1 = 1 + 1 = 2 \quad (0, 2)$$



Example 2:Sketch the graph of $f(x) = -2^x$ Basic $f(x) = 2^x$

$$f(x) = -2^x$$

Domain: $(-\infty, \infty)$ $(0, 1) \rightarrow$ x-axis reflection $\rightarrow (0, -1)$ $(1, 2) \rightarrow$ x-axis reflection $\rightarrow (1, -2)$ HA: $y = 0$ Range: $(-\infty, 0)$ yint: $x = 0$ $-2^0 = -1$ $(0, -1)$ **Example 3:**Sketch the graph of $f(x) = 4^{x-1}$ Basic graph $f(x) = 4^x$

$$f(x) = 4^{x-1}$$

Domain: $(-\infty, \infty)$ $(0, 1) \rightarrow$ right 1 $\rightarrow (1, 1)$ $(1, 4) \rightarrow$ right 1 $\rightarrow (2, 4)$ HA: $y = 0$ Range: $(0, \infty)$ yint: $x = 0$ $4^{0-1} = 4^{-1} = \frac{1}{4}$ $(0, \frac{1}{4})$ 