

**Exponential Functions**

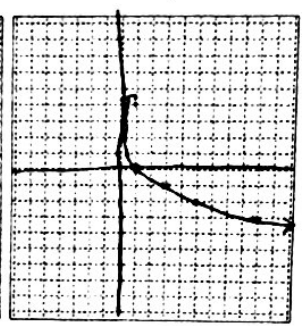
- > function in the form  $y = a \cdot b^x$  where  $x$  is a real number  $a \neq 0$ ,  $b > 0$ , &  $b \neq 1$ 
  - when  $b > 1$  the equation models growth;
  - when  $0 < b < 1$  the equation models decay
- > graph an exponential function by making a table of values

**Graphing Exponential Functions**

Complete the tables, then graph.

Ex 1.  $y = 2^x$

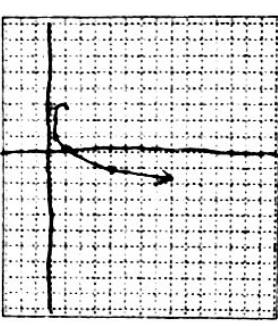
x	y = 2 <sup>x</sup>	y
-4	$2^{-4} = \frac{1}{16}$	$\frac{1}{16}$
-3	$2^{-3} = \frac{1}{8}$	$\frac{1}{8}$
-2	$2^{-2} = \frac{1}{4}$	$\frac{1}{4}$
-1	$2^{-1} = \frac{1}{2}$	$\frac{1}{2}$
0	$2^0 = 1$	1
1	$2^1 = 2$	2
2	$2^2 = 4$	4
3	$2^3 = 8$	8
4	$2^4 = 16$	16
5	$2^5 = 32$	32



Domain:  $(-\infty, \infty)$   
 Range:  $(0, \infty)$   
 Y-intercept:  $(0, 1)$   
 X-intercept: None  
 Asymptote:  $y = 0$

Ex 2.  $y = 4^x$

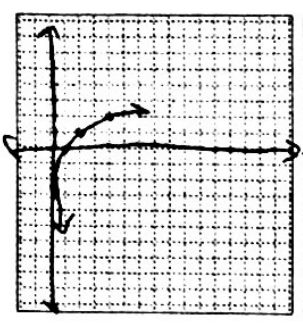
x	y = 4 <sup>x</sup>	y
-3	$4^{-3} = \frac{1}{64}$	$\frac{1}{64}$
-2	$4^{-2} = \frac{1}{16}$	$\frac{1}{16}$
-1	$4^{-1} = \frac{1}{4}$	$\frac{1}{4}$
0	$4^0 = 1$	1
1	$4^1 = 4$	4
2	$4^2 = 16$	16
3	$4^3 = 64$	64



Domain:  $(-\infty, \infty)$   
 Range:  $(0, \infty)$   
 Y-intercept:  $(0, 1)$   
 X-intercept: None  
 Asymptote:  $y = 0$

Ex 3.  $y = (1/2)^x$

x	y = (1/2) <sup>x</sup>	y
-2	$(\frac{1}{2})^{-2} = 4$	4
-1	$(\frac{1}{2})^{-1} = 2$	2
0	$(\frac{1}{2})^0 = 1$	1
1	$(\frac{1}{2})^1 = \frac{1}{2}$	$\frac{1}{2}$
2	$(\frac{1}{2})^2 = \frac{1}{4}$	$\frac{1}{4}$



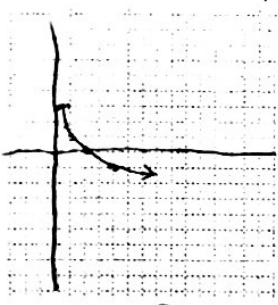
Domain:  $(-\infty, \infty)$   
 Range:  $(0, \infty)$   
 Y-intercept:  $(0, 1)$   
 X-intercept: None  
 Asymptote:  $y = 0$

**Transformations of  $y = b^x$**

- >  $y = -b^x$  reflect over x
- >  $y = b^{-x}$  reflect over y (same as  $y = \frac{1}{b^x} = (\frac{1}{b})^x$ )
- >  $y = b^{x+c}$  shift right/left
- >  $y = b^x \pm c$  shift up/down
- >  $y = a \cdot b^x$  vertical stretch ( $a > 1$ ) / shrink ( $a < 1$ )

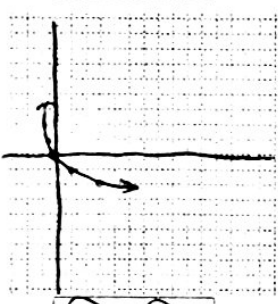
Examples: Graph, state the domain & range

1.  $y = 2^{x+1}$



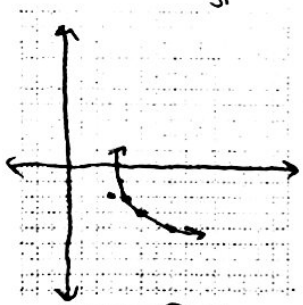
Domain:  $(-\infty, \infty)$   
 Range:  $(0, \infty)$

2.  $y = 2^x - 1$



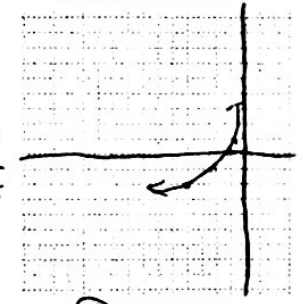
Domain:  $(-\infty, \infty)$   
 Range:  $(-1, \infty)$

3.  $y = 2^{x-2} + 3$



Domain:  $(-\infty, \infty)$   
 Range:  $(3, \infty)$

4.  $y = -2^x$



Domain:  $(-\infty, \infty)$   
 Range:  $(-\infty, 0)$

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

x	y
0	3.25
1	3.5
2	4
3	5
4	7

x	y
-2	$\frac{1}{4}$
-1	$\frac{1}{2}$
0	1
1	2
2	4

x	y
-2	$-\frac{1}{4}$
-1	$-\frac{1}{2}$
0	-1
1	-2
2	-4