*Review 6.1*

Exponential Functions: $f(x$) = $b^{x}$ $x$: any real number; $ b$ > 0, $b$ ≠ 1

 ***Notes:***

 (i) If $b$ < 0, function would not be defined for some values.

 Suppose $b=$ $-2$ $f(x$) = $(-2)^{x}$

 Let $x= 1/2$ $f(1/2$) = $(-2)^{(1/2)}$ $= \sqrt{-2}$ Not a real number!

 (ii) If $b$ = 0, function would not be defined for some values.

 Let $x= -1$ $f(-1$) = $(0)^{-1}$ $= 1/0$ Undefined!

 (iii) If $b$ = 1, $f(x$) = $(1)^{x }$= 1 for all *x* values. Constant function!

1. Identify the exponential function(s):

 a.$ f(x$) = $3^{x}$ b. $f(x$) = $x^{3}$ c. $f(x$) = $(-7)^{x}$ d. $f(x$) = $-7^{x}$

2. Graphs of exponential functions: if *b* > 1, graph increasing; if 0 < $b$ < 1, graph decreasing

 For each function, complete the table and graph the function:

 a. $f(x$) = $3^{x}$

|  |  |
| --- | --- |
| *x* | *y* |
| 0 |  |
| 1 |  |
| 2 |  |
| -1 |  |
| -2 |  |

 

 b. $f(x$) = $(1/3 )^{x}$

|  |  |
| --- | --- |
| *x* | *y* |
| 0 |  |
| 1 |  |
| 2 |  |
| -1 |  |
| -2 |  |

 

3. Does $f(x$) = $b^{x}$ have an inverse function? Explain your decision.

4. $f(x$) = $cb^{x}$ $c$ will vertically stretch or compress the graph of $f(x$) = $b^{x}$.

If $\left|c\right|$ > 1, graph is stretched; if 0 < $\left|c\right|$ < 1, graph is compressed.

The vertical or $y$-intercept of $f(x$) = $cb^{x}$ is given by $(0, c)$.

Examples:

$f(x$) = $7(2)^{x}$ graph is stretched by a factor of 7; vertical intercept is (0, 7) ***Caution:*** $f(x$) = $7(2)^{x}$ **≠** $(14)^{x}$ $f(x$) = $\frac{1}{7}(2)^{x}$ graph is compressed by a factor of 1/7; vertical intercept is (0, 1/7)

$f(x$) = $3^{x}$ $f(x$) = $3^{x}$ is equivalent to $f(x$) = $1(3)^{x}$; vertical intercept is (0, 1)

 Use the calculator to graph $f(x$) = $5(3)^{x}$ and $f(x$) = $\frac{1}{5}(3)^{x}$; compare each graph with that of

 $f(x$) = $3^{x}$. Find the vertical intercept for each graph.

5. Compare graphs of $f(x$) = $2^{x}$ and $f(x$) = $-2^{x}$.

6. For each function, do the following without graphing: Find the vertical intercept and state whether it is an increasing or decreasing function.

 a. $f(x)$ = $5(3.2)^{x}$ b. $f(t)$ = $\frac{1}{4}\left(\frac{8}{3}\right)^{t}$ c. $y$ = $0.8(0.7)^{x}$ d. $f(x)$ = $8^{x}$

 e. $f(x)$ = $\left(\frac{4}{3}\right)^{-x}$

 Hint: Beginning algebra review: A fraction $\left(\frac{r}{s}\right)^{negative exponent}$ is equivalent to $\left(\frac{s}{r}\right)^{positive exponent}$

7. State any transformations on each exponential function.

 a. $f(x$) = $3^{x}+ 5$ b. $f(x$) = $3^{x + 5}$ c. $f(x$) = $3^{x - 6}-2$

8. Exponential growth and decay: $P(t)$ = $P\_{0}(b)^{t}$

 $P\_{0}$ = initial value (that is, population at time = 0) Note: This is equivalent to the vertical intercept.

 $b$ = growth or decay factor: If *b* > 1, growth; if 0 < $b$ < 1, decay

 $t $ = time

 For each function, find the initial value and the growth or decay factor.

 a. $P(t)$ = $2.4(5.6)^{t}$ b. $N\left(x\right)$ = $21.3(0.8)^{x}$

9. The number of Facebook active users in millions can be modeled by the function

*P*(*t*) *=* $1.53(2.82)^{t}$, where *t* is the number of years after 2004.

 a. Identify and interpret $P\_{0}$.

 b. Identify the growth or decay factor.

 c. Without graphing, determine whether the function is increasing or decreasing. Explain your

 decision.

 d. Approximate the number of Facebook active users in 2008.

 e. Find the average rate of change in the number of Facebook active users between 2004-2008.

 Round your answer to the nearest whole number.

10. For each of the following, identify the growth or decay factor; state the percent increase or decrease.

 a. *P*(*t*) *=* $5(1.25)^{t}$

 b. *N*(*t*) *=* $210,000(1.015)^{t}$

 c. *P*(*t*) *=* $8,700(0.98)^{t}$

 d. *V*(*t*) *=* $35,000(0.655)^{t}$