**Math 3** | Name: Key
**Unit 2 Day 7 Notes – Graphing Exp. and Log. Functions** | Date:

**Part I:** Determine which functions are exponential functions. For those that are not, explain why they are not exponential functions.

(a) $f(x) = 2^x + 7$ Yes No

(b) $g(x) = x^2$ Yes No it is a quadratic function

(c) $h(x) = 1^x$ Yes No can't have a one as the base

(d) $f(x) = x^x$ Yes No base has to have a #

(e) $h(x) = 3 \cdot 10^{-x}$ Yes No

(f) $f(x) = -3^{x+1} + 5$ Yes No

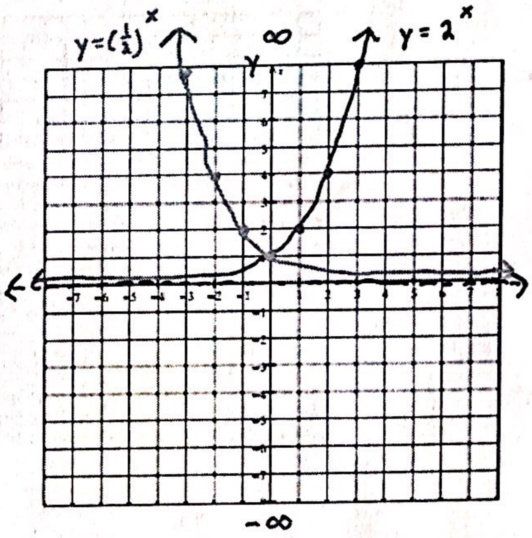
(g) $g(x) = (-3)^{x+1} + 5$ Yes No

(h) $h(x) = 2x - 1$ Yes No it is a linear function

**Part 2:** Graph each of the following and find the domain and range for each function.

(a) $f(x) = 2^x$ growth domain: $(-\infty, \infty)$ range: $(0, \infty)$

(b) $g(x) = \left(\frac{1}{2}\right)^x$ decay domain: $(-\infty, \infty)$ range: $(0, \infty)$




**Horizontal Asymptote:** an "invisible" line that the graph of a function never crosses.

Identify the horizontal asymptote of (a):

$y = 0$

Identify the horizontal asymptote of (b):

$y = 0$

Identify the y-intercept of (a):

$(0, 1)$

Identify the y-intercept of (b):

$(0, 1)$

End behavior:

$\rightarrow -\infty$ $f(x) \rightarrow 0$

$\rightarrow +\infty$ $f(x) \rightarrow \infty$

End Behavior:

$x \rightarrow -\infty$ $g(x) \rightarrow \infty$

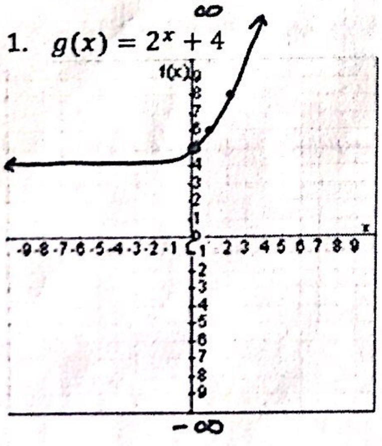
$x \rightarrow +\infty$ $g(x) \rightarrow 0$

## Transforming Exponential Functions:

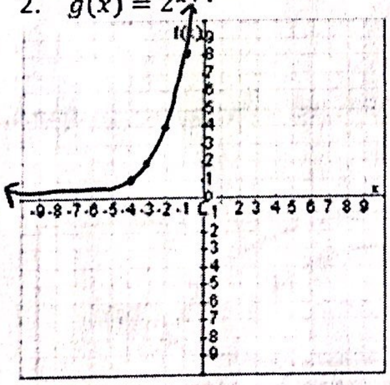
| | |
|---|---|
| Translate left or right: | $g(x) = b^{x+c}$ (graph moves $c$ units left)<br>$g(x) = b^{x-c}$ (graph moves $c$ units right) |
| Vertical stretch or compression: | $g(x) = cb^{x}$ (graph stretches if $c > 1$)<br>(graph shrinks if $0 < c < 1$) |
| Horizontal stretch or compression: | $g(x) = b^{cx}$ (graph shrinks if $c > 1$)<br>(graph stretches if $0 < c < 1$) |
| Reflections: | $g(x) = -b^{x}$ (graph reflects over the $x$-axis)<br>$g(x) = b^{-x}$ (graph reflects over the $y$-axis) |
| Translate up or down: | $g(x) = b^{x} + c$ (graph moves up $c$ units)<br>$g(x) = b^{x} - c$ (graph moves down $c$ units) |

**Part 3: Describe the transformation using the function f(x) = 2ˣ as the parent function. Then graph the function. For each, identify the domain, range, y-intercept, the asymptote, and the end behavior as x→ ∞ and -∞. horizontal asymptote.**

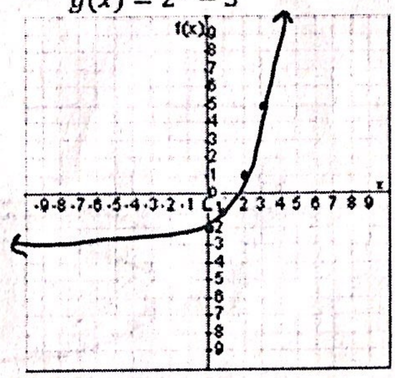
1. $g(x) = 2^x + 4$



2. $g(x) = 2^{x+4}$ ∞



3. $g(x) = 2^x - 3$

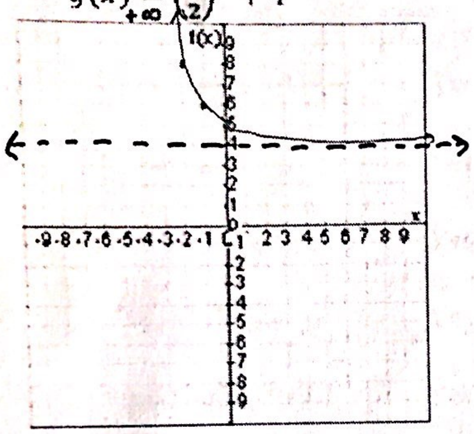


**1.**
Domain: (-∞, ∞)
Range: (4, ∞)
Y-Intercept: (0, 5)
Asymptote: y = 4
End Behavior: x → -  y → 4
x → +∞  → ∞

**2.**
Domain: (-∞, ∞)
Range: (0, ∞)
Y-Intercept: (0, 16)
Asymptote: y = 0
End Behavior: x → -∞  y → 0
x → +∞  y → ∞

**3.**
Domain: (-∞, ∞)
Range: (-3, ∞)
Y-Intercept: y = -3
Asymptote: (0, -2)
End Behavior: x → -∞  y → -3
x → +∞  y → ∞

4. $g(x) = \left(\frac{1}{2}\right)^x + 4$




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

Range: $(4, \infty)$

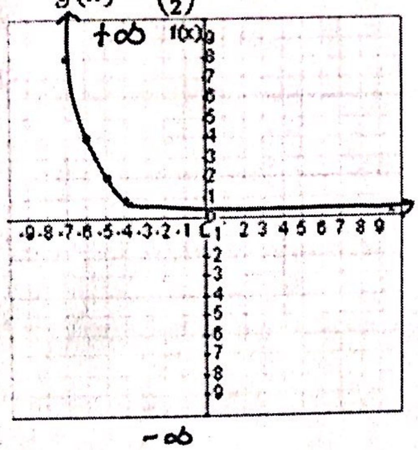
Y-Intercept: $(0, 5)$

Asymptote: $y = 4$

End Behavior: $x \to -\infty \quad y \to \infty$

$x \to \infty \quad y \to 4$

5. $g(x) = \left(\frac{1}{2}\right)^{(x+4)}$




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

Range: $(0, \infty)$

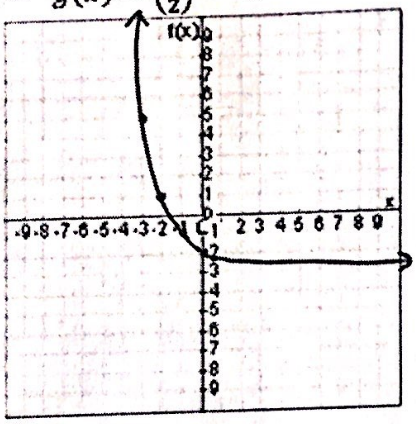
Y-Intercept: $(0, 0.0625)$

Asymptote: $y = 0$

End Behavior: $x \to -\infty \quad y \to \infty$

$x \to \infty \quad y \to 0$

6. $g(x) = \left(\frac{1}{2}\right)^x - 3$




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

Range: $(-3, \infty)$

Y-Intercept: $(0, -2)$

Asymptote: $y = -3$

End Behavior: $x \to -\infty \quad y \to \infty$

$x \to \infty \quad y \to -3$

## Graphing and Transforming Logarithmic Functions:

The logarithmic function is the inverse of the exponential function.

- $\log_a x = y$ is read "log base a of x equals y."
- It is equivalent to $a^y = x$

$$\boxed{\log_a x = y \qquad a^y = x}$$

Practice: Change to the other form:

| | | | | |
|---|---|---|---|---|
| Exponential Form | $2^3 = 8$ | $2^{-3} = \frac{1}{8}$ | $7^m = x$ | $10^3 = 1000$ |
| Logarithmic Form | $\log_2 8 = 3$ | $\log_2\left(\frac{1}{8}\right) = -3$ | $\log_7 x = m$ | $\log_{10} 1000 = 3$ |