Assignment 4A: Graphing Exponential Functions

Answer the following problems with as much details, explanations, and work that is appropriate.

1. Match each function with one of the graphs below. Explain.

   a. $g(x) = 2\left(\frac{3}{4}\right)^x$

   Graph A, Exponential decay with lower initial value.

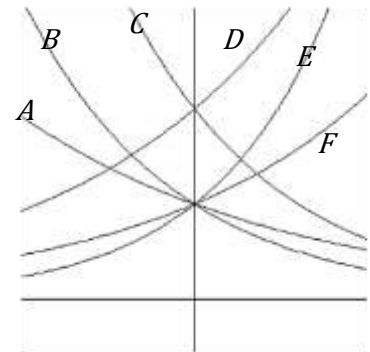   b. $h(x) = 2\left(\frac{1}{2}\right)^x$

      *Graph B, Exponential decay with
      lower initial value, steeper than (a).*

   c. $f(x) = 4(1.28)^x$

   Graph D, Exponential growth with higher intial value than (a) and (b)

2. Which function has the greatest growth rate?

   Graph E, it has the greatest rate of change and it is increasing.

If all the graphs to the right have equations with form $f(x) = ab^x$,

3. Which graph has the smallest value for b? Explain.

The value of b affects the steepness of the slope, since graph B has the

highest negative slope it has the smallest value for b.

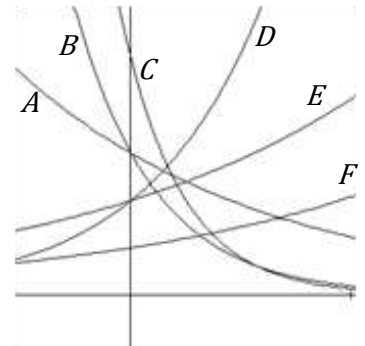   Which graph has the largest value for b? Explain

   Graph D has the greatest positive rate of change.

4. Which graph has the smallest value for a? Explain.

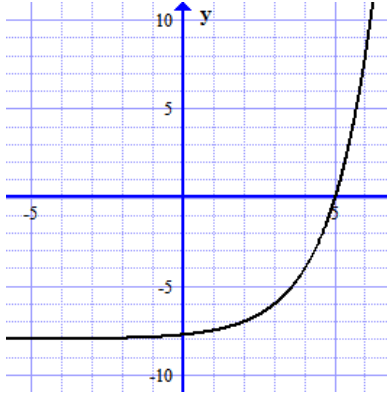*Graph F has the lowest initial value, which is the $y-intercept$*

   Which graph has the largest value for a? Explain.

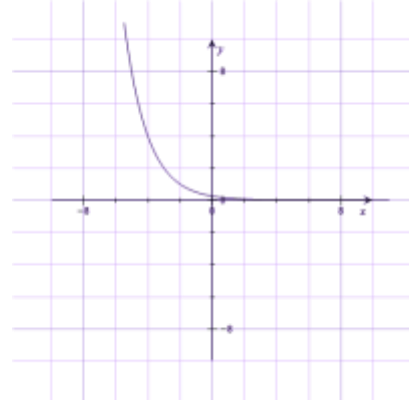*Graph C has the largest initial value, which is the $y-intercept$*

5. Sketch a graph of each of the following transformations of $f(x)=2^x$

$$f(x)=2^{x-2}-8 \qquad\qquad\qquad\qquad y=\frac{1}{4}\cdot 2^{-x}$$

6. Describe the long run behavior, as $x\to\infty$ and $x\to-\infty$ of each function $f(x)=-2(3)^{-x}-1$

$$\textbf{\textit{as }} x \to -\infty, \quad f(x) \to -\infty \textbf{ \textit{because}} (3)^{-x} = \left(\frac{1}{3}\right)^{x} \textbf{ \textit{so}} f(x) \to \infty.$$

7. Use the graph of $f(x)=3^x$ to describe the transformation that results in each function:
   a) $f(x)=-(3)^{x+1}-3$

   Reflected across the $x-$ axis; then it is translated left 1 unit, and down 3 units.

   b) $f(x)=\frac{1}{2}(3)^{-x}+5$

   Reflected across the $y-$ axis; Vertical shrink by a factor of $\frac{1}{2}$; translated up 5.

7. Find an equation for the exponential function graphed.

$$f(x)=-2(3)^x+7 \text{ \textit{The form of an exponential function is}}$$
$y=ab^x+c. \text{\textit{This equation has a horizontal asymptote at}} x=7 \text{ \textit{so we know}}$
$c=7, \text{\textit{you can also now solve for}} a \text{ \textit{and}} b \text{ \textit{by choosing two other points on}}$
$\text{\textit{the graph, in this case (0,5) an (1,1), you can then plug (0,5) into your}}$
$\text{\textit{general equation and solve for}} a \text{ \textit{algebraically, and then use your second}}$
$\text{\textit{point to solve for}} b.$