Notes – Transformations of Exponential Functions

- The parent function of an exponential function is \( f(x) = b^x \)
  - The \( b \) is the base
  - The \( x \) is the exponent
- A transformed exponential function takes the form \( f(x) = a \cdot b^{x-h} + k \)
  - The \( a \) is the vertical stretch factor (also, the function rises if \( a \) is positive, and falls if \( a \) is negative)
  - The \( b \) is the base
  - The \( h \) is the horizontal shift left or right (always “opposite”)
  - The \( k \) is the vertical shift up or down (always “same”)

Write down the parent function for each of the following. Then, describe in words what the transformation would be for the new graph.

1. \( f(x) = 3^{x-2} \)
2. \( g(x) = \left( \frac{1}{2} \right)^x - 4 \)
3. \( h(x) = 3 \cdot 2^x + 1 \)
4. \( f(x) = -5^{x+2} \)
5. \( k(x) = \frac{1}{3} \cdot 4^x + 7 \)
6. \( l(x) = \left( \frac{2}{3} \right)^{x-9} - 10 \)

7. The graph for \( f(x) = 2^x \) is shown below. The function \( g(x) \) is also shown. What is the equation for \( g(x) \)?
Steps to Graphing an Exponential Transformation
1. Make a table for the parent function.
2. Make a second table for the transformation.
   a. Do the opposite operations to the x.
   b. Do the same operations to the y.

Recall Domain and Range
- Domain – the set of all x values for which the function is defined (inputs)
- Range – the set of all y values for which the function is defined (outputs)
- When the domain or range is the set of all real numbers, we write it in interval notation like this: \((-\infty, \infty)\)

Graph each of the following exponential functions. Also state the domain and range.

8) \(y = 3^{x-2}\)  

9) \(y = 3^x - 2\)  

10) \(y = \left(\frac{1}{4}\right)^{x+2} - 1\)  

11) \(y = 2 \cdot \left(\frac{1}{2}\right)^x\)
12) \( y = 4 \cdot \left( \frac{1}{2} \right)^x + 1 \)

13) \( y = 5 \cdot 2^{x-1} \)

14) \( y = 4^{x+2} + 2 \)

15) \( y = \frac{1}{2} \cdot 6^{x+1} - 1 \)