7.2 Transformations of Exponential Functions

Recall from chapter 1: $y = f(x) \to y = af\big(b(x-h)\big) + k$

Where

a affects the **vertical** expansion/compression/reflection

b affects the **horizontal** expansion/compression/reflection

h affects the **horizontal** translation

k affects the **vertical** translation

We can apply the transformations to exponential functions:

$$f(x) = c^x \to f(x) = a(c)^{b(x-h)} + k$$

Example 1:

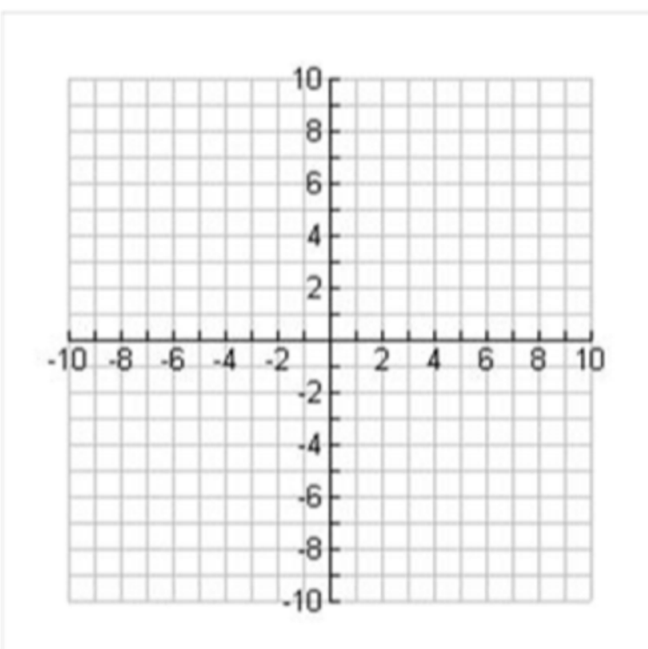
Sketch the graph of $y = 2^x$ and $y = 3 \cdot 2^{x-1}$

i.) Describe the transformations on the graph of $y = 2^x$

ii.) State the domain/range

iii.) State the asymptote

iv.) Find the intercepts



Try:

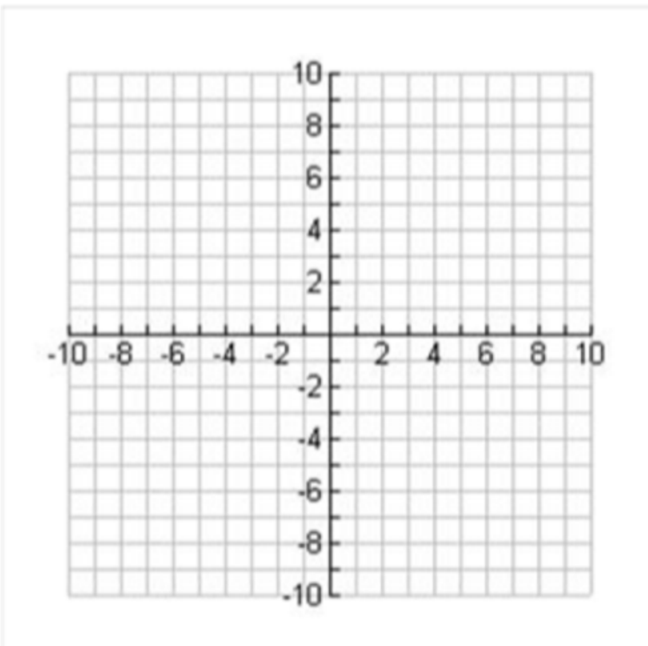
Sketch the graph of $y = \left(\frac{1}{2}\right)^x$ and $y = \left(\frac{1}{2}\right)^{x+1} - 4$

i.) Describe the transformations on the graph of $y = \left(\frac{1}{2}\right)^x$

ii.) State the domain/range

iii.) State the asymptote

iv.) Find the intercepts



Applications:

Exponential equations are found in the form:

$P = P_0 c^x$ where P is the final amount

P_0 is the initial amount

c is the rate of growth or decay

Specific Examples:

1. Compound Interest:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

A = final

P = principle, or initial amount

r = rate of yearly interest

n = number of times yearly interest is compounded

t = time (in years)

Example 2:

How much more would you earn in two years if you compounded daily compared to monthly with an initial investment of $1000 and an annual interest rate of 5%?

2. Half Life:

$$A = A_0(c)^{\frac{t}{T}}$$

A = final

A_0 = initial amount

c= growth or decay value (e.g., half life use $\frac{1}{2}$)

T= time of growth or decay (e.g., half-life time)

t = time

Example 3:

1. An element has a half-life of 30 years. If 5.0 mg of this element decays over a period of 90 years, how many mg of this element would remain?

2. An element has a half-life of 29 hours. how many mg of the element will remain after 46 hours?