Graph J curve 2/24

**Exponential Functions**

variable is exponent Power of x.

The **exponential function *f*** is an equation of the form:

$$f(x) = ab^x$$

Where $a \neq 0$, $b > 0$ and $b \neq 1$ $a$ represents the *initial value*, $b$ represents the *growth/decay factor*

r = rate %

**Growth & Decay** ← 2 kinds

- If $0 < b < 1$, then the function **decays** as $x$ increases. Smaller values of $b$ lead to faster rates of decay
  $$b = 100\% - r\% \quad or \quad 1 - r$$
  y = 2(0.5)^x ← decay

b is a fraction/dec. 0.5 ⇒ 50% 1.25

- If $b > 1$, then the function **grows** as $x$ increases. Larger values of $b$ lead to faster rates of growth
  $$b = 100\% + r\% \quad or \quad 1 + r$$
  y = 3(1.5)^x

**Examples: Identify the initial value, the growth/decay, and the rate.**

"a"

1. $f(x) = 2.5(1.25)^x$

   Growth or Decay? Growth

   Growth/Decay Factor? 1.25 "b"

   Initial Value? 2.5

   Rate of Growth/Decay? 25%

   125% − 100% = 25%

2. $f(x) = 3.7(2)^x$

   Growth or Decay? Growth

   Growth/Decay Factor? 2

   Initial Value? 3.7

   Rate of Growth/Decay? 100%

   200% − 100% = 100%

3. $g(x) = 4.3\left(\frac{1}{10}\right)^x$

   Growth or Decay? Decay

   Growth/Decay Factor? .1

   Initial Value? 4.3

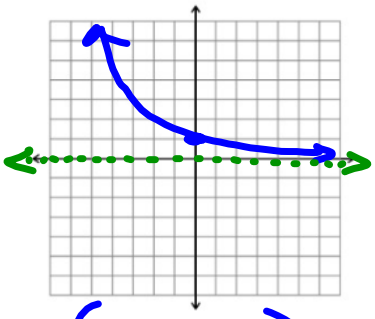
   Rate of Growth/Decay? −90%

   10% − 100% = −90%

**Graphing Exponential Functions**

$$f(x) = ab^x$$

Decay: $0 < b < 1$

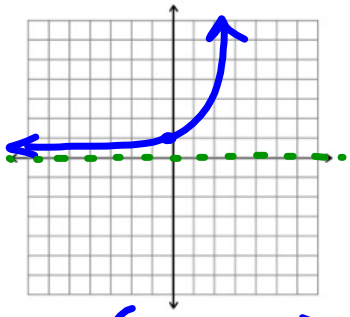


Domain: $(-\infty, \infty)$

Range: $(0, \infty)$ only restricted by H.A.

Asymptote: $y = 0$

Growth: $b > 1$



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

Range: $(0, \infty)$

Asymptote: $y = 0$

all % → decimals!

1. Population of Concord, NC is 80,975 and grows at a rate of 1.2% per year. Write an exponential function to model this situation. ← Exponential

$a = 80,975$
$b = 1.012$
$f(x) = 80975(1.012)^x$

2. Your savings account has an initial deposit of $1,000 and earns 15% interest each year. Write an exponential function to model the situation. What will be your total balance after 15 year?

3. A new truck is sold for $32,000 and depreciates at a rate of 7% yearly. Write a function that models the value of the truck after *t* years. What is the value of the truck after 5 years?

4. The initial population of bacteria is 3 and grows at a rate of 80% per hour. Write a function that models the population after *h* hours. What is the population after 24 hours?

Exponential Growth/Decay HW

**Determine if the function represents a growth/decay. Identify the initial value, growth factor and rate. (Do not graph)**

1. $y = 2(3.5)^x$ 2. $y = 4.2(.09)^x$ 3. $y = 5\left(\frac{1}{3}\right)^x$ 4. $y = 21\left(\frac{5}{2}\right)^x$ 5. $y = 12\left(\frac{1}{4}\right)^x$

6. The mice population is 25,000 and is decreasing by 20% each year. Write a model for this situation.

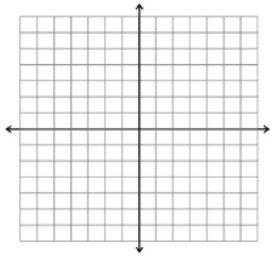
   a. Given the model for #6, what will be the mice population after 3 years?

7. A house that costs $200,000 will appreciate in value by 2% each year. Write a function to model the cost of the over time.

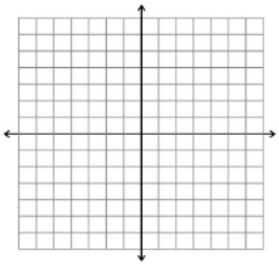
   a. Find the value of the house at the end of 10 years.

**Graph the following functions. State the initial value, domain, range and asymptote.**

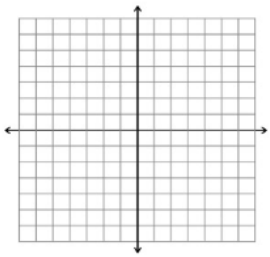
8. $f(x) = -3^x$



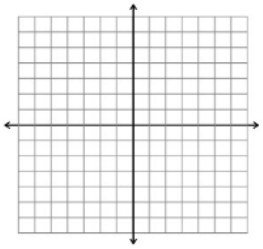
9. $g(x) = 2^x - 3$



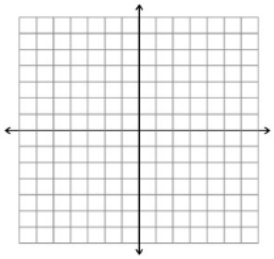
10. $h(x) = 10^{x+3}$



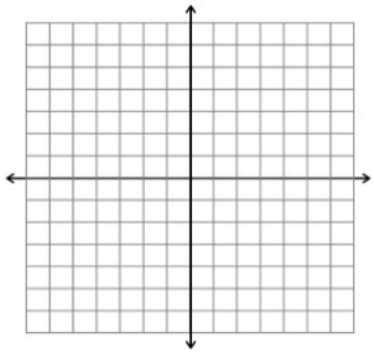
11. $f(x) = -3^{-x}$



12. $y = 1 + 2^{x+1}$



13. The consumption of soda has increased each year since 2000. The function $C(t) = 179(1.029)^t$ models the amount of soda consumed in the world, where *C* is the amount consumed in billions of liters and *t* is the number of years since 2000. **Graph and sketch the function. How much soda was consumed in 2005?**



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