① Consider the function f shown here.

3 3 3 3

x	0	3	6	9	12
f(x)	3	4.5	6.75	10.125	15.1875

1.5 2.25 3.375 5.0625

$\frac{1.5}{3} \times 100\% = 50\%$

$\frac{2.25}{4.5} \times 100\% = 50\%$

$\frac{3.375}{6.75} \times 100\% = 50\%$

$\frac{5.0625}{10.125} \times 100\% = 50\%$!

Is f a linear function?

Exponential Functions (outputs change at a steady percentage rate)

① Formula can be written as

$$y = f(x) = c \cdot b^x, \quad b > 0, \; b \neq 1$$

b is called the base or growth factor

c is called the initial value

② Domain = $(-\infty, \infty)$ ③ no x-int.

④ y-int. = $f(0) = c \cdot b^0 = c$ ⑤ no turning pts.

⑥ If $b > 1$, the function is increasing
If $0 < b < 1$, the function is decreasing

② Suppose a graduate takes a job with an initial salary of \$50,000 per year and a union contract that requires a 5% cost-of-living raise each year. Let S be the salary after x elapsed years.

a. Is $S = f(x)$?

b. Find the formula for S.

③

③ Let $y = f(x) = 2(9)^x$

Evaluate : $c = 2$
$b = 9$

a. $f(-2) = 2(9)^{-2} = 2 \cdot \frac{1}{9^2} = \frac{2}{81}$

b. $f(-1/2) = 2(9)^{-1/2} = 2 \cdot \frac{1}{9^{1/2}} = 2 \cdot \frac{1}{\sqrt{9}}$
$= 2/3$

c. $f(0) = 2(9)^0 = 2 \cdot 1 = 2$

d. $f(2) = 2(9)^2 = 2 \cdot 81 = 162$

④ For each of the following exponential functions, identify the base and intial value and then graph the function.

a. $y = 2(1.5)^x$ $c = 2$
$b = 1.5$

b. $y = 3e^x$ $c = 3$
$b = e \sim 2.71828$

c. $y = 4(1/2)^x$ $c = 4$
$b = 1/2$

⑤ A sample of the radioactive element radium decays acording to the exponential function ④

$$A = 1(0.958)^t \qquad \begin{matrix} C=1 \\ b=0.958 \end{matrix}$$

where A is the mass of the sample in grams and t is elapsed time in centuries.

a. How much radium is in the sample initially?

Initial amount $= A(0) = 1$ gram

b. How much radium is left after 100 years?

$A(1) = 1(0.958)^1 = 0.958$ grams

⑥

c. What is the half-life of radium? 1600 years

$$1\,(0.958)^{t} = \frac{1}{2}$$

$$t \sim 16$$

⑥ The number N of E. coli bacteria in a culture after t elapsed minutes can be modeled by

$$N(t) = 500000e^{0.014t}$$

$$e \sim 2.71828$$

a. How many bacteria are present after 99 minutes?

$$N(99) = 500000e^{0.014(99)}$$

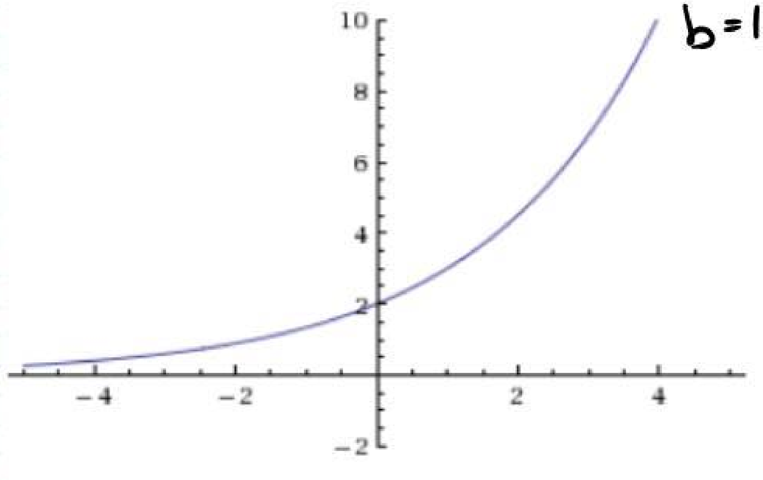
$$\sim 2{,}000{,}000$$

b. How long will it take for the bacteria population to reach 25,000,000 ?

$$25000000 = 500000\, e^{0.014t}$$

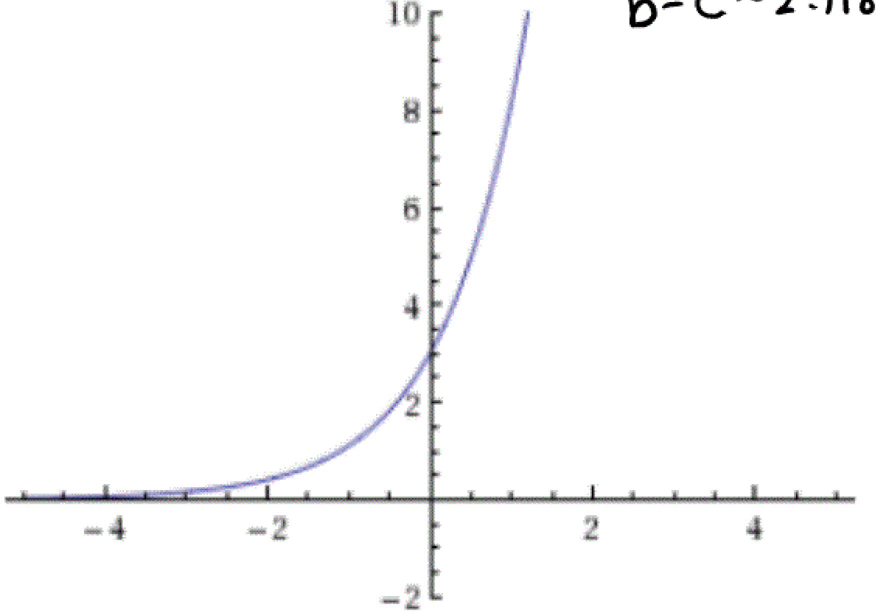
$$t = ?$$

a. $Y = 2(1.5)^x$



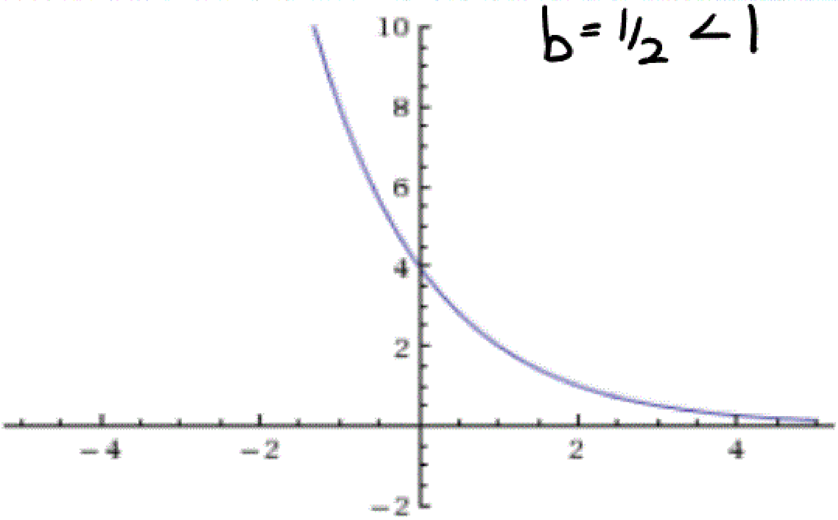
$b = 1.5 > 1$

b. $y = 3e^x$



$b = e \sim 2.71828 > 1$

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



$b = 1/2 < 1$