1.4 B Applications of Exponential Functions (Day 2)

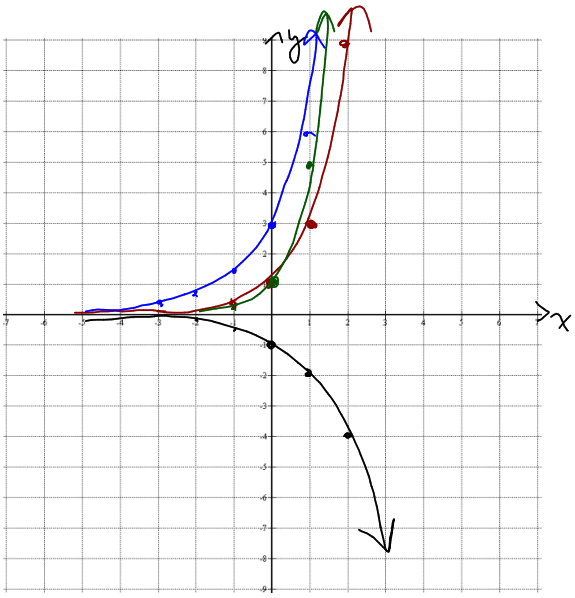
Ex. 1 Sketch the following:

$y = 3^x$

$y = 5^x$

$y = 3(2)^x$

$y = -2^x$

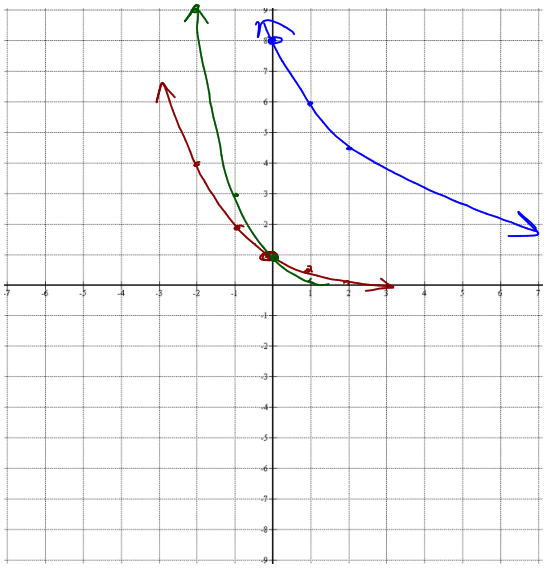


- growth

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

$y = \left(\frac{1}{3}\right)^x$

$y = 8(0.75)^x$



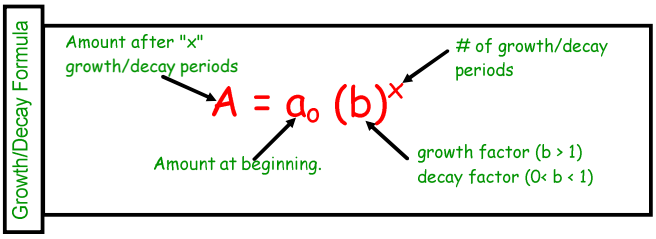
- decay

$y = 8(0.75)^x$

x	y
0	8
1	6
2	4.5

Sep 12-10:18 PM

Recall:



Ex. 2 A radioactive substance has a half life of 2.4 days. What fraction of the original amount would remain after 12 days?

"Half-life" = decay factor of $\frac{1}{2}$

Let x rep. # of days

$A = \left(\frac{1}{2}\right)^{\frac{x}{2.4}}$

in 12 days? $x = 12$

$A = \left(\frac{1}{2}\right)^{\frac{12}{2.4}}$

$= \left(\frac{1}{2}\right)^5$

$= \frac{1}{32}$

∴ There will only be $\frac{1}{32}$ of the material left.

Ex. 3 256g of a substance decays to 64g in 15.6 hours. Determine the half-life of the substance.

$64 = 256\left(\frac{1}{2}\right)^{\frac{15.6}{h}}$

$\frac{64}{256} = \left(\frac{1}{2}\right)^{\frac{15.6}{h}}$

$\frac{1}{4} = \left(\frac{1}{2}\right)^{\frac{15.6}{h}}$

$\left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^{\frac{15.6}{h}}$

∴ $2 = \frac{15.6}{h}$

$h = \frac{15.6}{2}$

$= 7.8$

∴ Half-life is 7.8 hours

Ex. 4 In 2001, the population of Canada was 31 051 000. The annual growth rate is assumed to be 1% per year.

a) Create an exponential equation to represent the population growth of Canada.

Let x be # of years after 2001
Let P be pop.

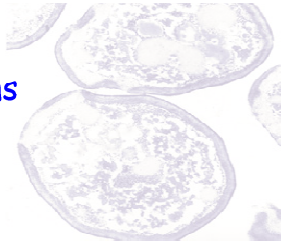
$$P = 31051000(1.01)^x$$

b) What was the population of Canada in 2010, when Vancouver hosted the Olympic Games.

$x = 2010 - 2001$
$= 9$

$P = 31\,051\,000(1.01)^9$
$= 33\,960\,021$

$\therefore$ The pop. was approx. 33 960 021



Ex. 5 A certain strain of yeast cell doubles under certain conditions every 20 minutes. If there were 350 initially, how many cells will there be in 3 hours?

Let A be amt of cells

Let t be # minutes

$$A = 350(2)^{\frac{t}{20}}$$

In 3 hours?

Need same UNITS!

$t = 180$ minutes

$$A = 350(2)^{\frac{180}{20}}$$

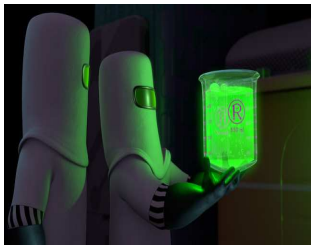
$$= 350(2)^{9}$$

$$= 179200$$

∴ There are 179200 cells after 3 hours

Sep 12-9:56 PM

Eg. 6 The half-life of a radioactive element is 15 days. This means that every 15 days, the amount decreases by 50%. How much of a 200-gram sample will be left after 150 days?



Let A be amount left
Let x be # of days

$$A = 200(0.5)^{\frac{x}{15}}$$

$x = 150$?

$$A = 200(0.5)^{\frac{150}{15}}$$

$$A = 200(0.5)^{10}$$

$$\doteq 0.195$$

$\therefore$ After 150 days, 0.195 g remain.

Sep 12-10:08 PM

Homework:

page 24 #13,15-18

Sep 12-10:26 PM