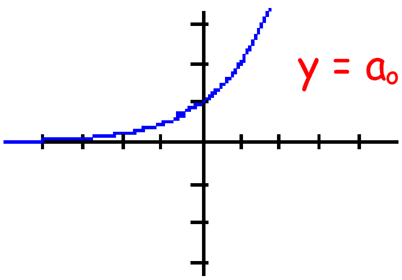
4.7 Solving Problems Involving Exponential Growth and Decay

a) Applications of Exponential Functions: **EXPONENTIAL GROWTH**



$y = a_o (b)^x$

a_o represents initial amount

b represents growth factor

x represents # of growth periods

y represents amount after growth

Seen in:

- APPRECIATION in the value of money
- APPRECIATION in the value of a home
- Population GROWTH
- **DOUBLING PERIOD** of bacteria

(time it takes for population to double)

- INCREASE in value

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Ex 1: 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

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

Let t be # years

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

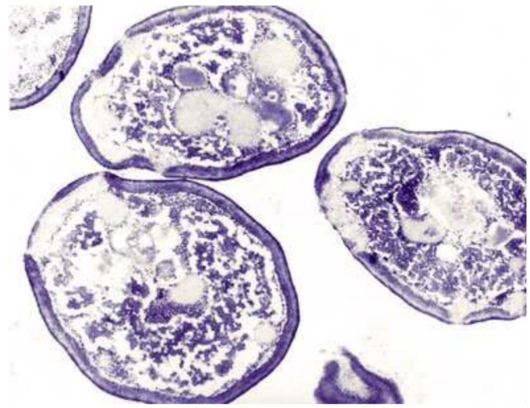
$t = ?$ Equation started in 2001

$\therefore$ for 2010

then $t = 2010 - 2001$
$= 9$

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

Ex 2: 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?



Method 1

Let t be # 20 minute periods

$P = 350(2)^t$

$t = ?$

3 hours => 180 minutes

$180 \div 20$ minutes

$= 9$ periods

$\therefore P = 350(2)^9$

$= 179\,200$

Method 2

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

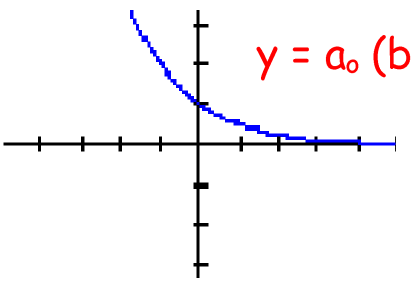
Let t be # of minutes

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

$= 350(2)^9$

$= 179200$

b) Applications of Exponential Functions: <u>**EXPONENTIAL DECAY**</u>



$y = a_o (b)^x$

a_o represents initial amount

b represents decay factor

x represents # of decay periods

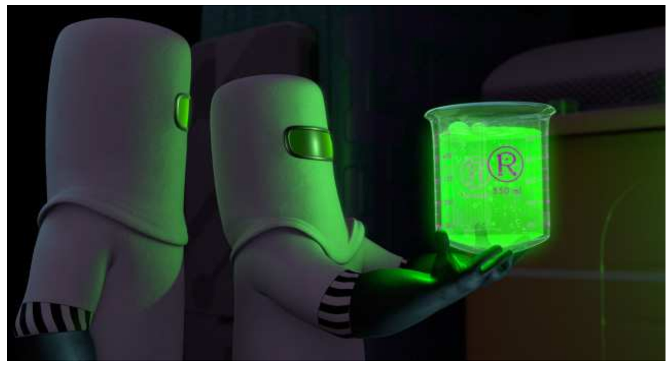
y represents amount after decay

Seen in:

- DEPRECIATION on an automobile
- DEPRECIATION in the value of a home
- Population DECAY
- **HALF-LIFE** of a radioactive element

(time it takes for 1/2 the population to decay)

Ex 1: 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 t be # of days

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

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

$A \doteq 0.195 g$

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

$\frac{150}{15} = 10$

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

$A \doteq 0.195 g$

<u>Ex 2</u>: Donald Trump invested $55,000 in a new computer company that was supposed to grow very quickly. Instead of increasing in value, it depreciated by 6.2% in the first year. What was the value of the investment at the end of the year?

$$A = 55000(0.938)^t$$

Let t be # of years.

$t = 1$

$$A = 55000(0.938)^1$$
$$= 51590$$

Practice: pg 410-413

 # 1, 2, 4, 5, 6

May 4-10:20 AM