4.7 Applications

Think & Play: A) You buy an Android tablet for your math teacher. It costs $175 + HST. What is the final cost?

HST = 13% Rate

175 x 0.13 = 22.75

Total: 175 + 22.75 = $197.75

OR.

175 x 1.13 = 197.75

The price has increased 13%. The growth rate = 13% OR 0.13

The growth factor = 1+ 13

OR 1 + 0.13 = 113% OR 1.13

= 1.13

B) For a ball dropped from a height of 1 meter, the equation that models it's rebound height after each bounce is $y = 0.75^x$.

So each rebound height is 75% of it's previous height. This means that the ball loses 25% of its previous height each bounce

The height has decreased 25%. The decay rate = −25% OR 0.25

The decay factor =

$1 - .25 = 0.75$

OR $100\% - 25\% = 75\%$

The function $f(x) = ab^x$ can be used as a model to solve problems involving exponential growth and decay.

$f(x) = a\,(b^x)$ Where a is the initial value, b is the growth factor and x is the number of compounding periods.

Eg. 1) A hockey card is purchased in 1990 for \$5.00. The value increases by 6% each year. Write an equation and determine it's value in 2011.

$\frac{6}{100} = 0.06$

$f(x) = a\,b^x$

$y = 5(1.06)^x$

$b = 1 + 0.06$
$= 1.06$

$= 5(1.06)^{21}$

$\doteq 16.99$

Eg. 2) In 1980 the population of the town of St. Albert, Alberta was 20 000. If the town grows at a rate of 2% a year, what was the population in 2014?

$$y = 20000(1.02)^x$$
$$= 20000(1.02)^{34}$$
$$= 39213.5$$

$\therefore$ In 2014 the population is about 39213.

There are growth and decay applications that involve doubling times or half-lives. The formula can be altered to:

$$N(t) = N_o(2)^{\frac{t}{d}}$$

← total time

← doubling time

$$N(t) = N_o\left(\frac{1}{2}\right)^{\frac{t}{d}}$$

← total time

← amount of time to have 50% left. (half-life)

Eg. 3) For a biology experiment, the number of cells present after 4 hours is 10 000. If the number of cells doubles every 2 hours, how many were there originally?

$y = ab^{\frac{x}{2}}$

$10000 = a(2)^{\frac{4}{2}}$

$10000 = a(2)^2$

$10000 = 4a$

$\frac{10000}{4} = a$

$2500 = a$

$\therefore$ There were 2500 cells to begin with

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Eg. 4) Another experiment starts with 1000 cells. After 4 hours the count is estimated to be 256 000. What is the doubling period for the cells?

$y = ab^{\frac{x}{d}}$

$256000 = 1000(2)^{\frac{4}{d}}$

$\frac{256000}{1000} = 2^{\frac{4}{d}}$

$256 = 2^{\frac{4}{d}}$

$2 \boxed{\wedge} (4 \div 8) = 1.4$

$2 \boxed{\wedge} (4 \div 1) = 16$

$2 \boxed{\wedge} (4 \div 0.25) =$ Too big

$\boxed{2 \boxed{\wedge} (4 \div 0.5) = 256}$

$\therefore$ my doubling time is $\frac{1}{2}$ an hour.

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$\boxed{\text{p. 261 \#1-8}}$ ok

2. c) 300%

how long until it doubles? $y = 15000(1.03)^n$

$30000 = 15000(1.03)^n$

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