MCR3U
Ms. Kueh

April 22

Appreciation and Depreciation

* Unit test will be Monday, April 27

Recall: Calculate the total cost, with tax, of a book that is priced at $29.99.

$\$29.99(0.13) + \$29.99 = 3.90 + \$29.99 = 33.89$

$\$29.99 \times 1.13 = 33.89$ → we use this method in this unit.

Was your calculation one step? If not, figure out how to calculate the total cost in one step.

Example 1 Compound Interest

In 2000, $1000 was invested at a rate of 6% per year for 4 years.

a) How much money was there after 4 years?

0.06

$\$1000 = A$

$1.06 = B$

Number of years	Money	
0	$\$1000$	
1	$\$1000(1.06) =$	$\$1060$
2	$\$1060(1.06) =$	$\$1123.60$
3	$\$1123.60(1.06) =$	$\$1191.02$
4	$\$1191.02(1.06) =$	$\$1262.48$

b) Write an equation to model this growth.

$y = 1000(1.06)^x$

Let x be # of years

Let y be amount of money

b) How much money is there after 25 years?

When $x = 25$ years, $y = ?$

$y = 1000(1.06)^{25}$

$y = \$4291.87$

Example 2 Population Growth

The world population has just reached 7 billion people and the average growth rate is about 1.1%/a.

$1.1\% = \frac{1.1}{100} = 0.011 \Rightarrow b = 1 + 0.011 = 1.011$

a) Assuming the growth rate stays the same, what will the population be in 5 years?

Number of years	Number of people
0	7,000,000,000 $= a$
1	7,000,000,000 (1.011) = 7,077,000,000
2	7,077,000,000 (1.011) = 7,154,847,000
3	7233550317
4	7313119370
5	7393563684

b) Write an equation to model this growth.

$Y = 7000,000,000\ (1.011)^x$

Let Y be population

Let x be # of years.

Example 3 Depreciation

A new car costs \$24 000. It loses 18% of its value each year after it is purchased.

$= 1 - 0.18 = 0.82 = b$

$100\% - 18\% = 82\%$

a) Determine the equation that models the value of the car.

Age of Car	Value of Car
0	\$24000
1	\$24000 × 0.82 = \$19680
2	\$19680 × 0.82 = \$16137.60

* After first year, you have to calculate:

\$24000 − 0.18(\$2400

= \$19680

Let y be the car's value

Let x be the # of years

$Y = 24000\ (0.82)^x$

b) **Use your equation to determine the value of the car after 30 months.**

$\frac{30 \text{ months}}{12 \text{ months}} = 2.5 \text{ years}$

$y = 24000(0.82)^{2.5}$

$= \$14613.22$

c) **Determine the number of years it will take for the car to depreciate to one-half of its original value.**

$24000 \div 2 = 12000 \rightarrow$ when $y = 12000$, $x = ?$

$\frac{12000}{24000} = \frac{24000(0.82)^x}{24000}$

$\frac{1}{2} = 0.82^x$

You have to guess and check until you find the answer

$0.5 = 0.82^{3.49}$

$\therefore x = 3.49$

$\therefore$ It takes 3.49 years to depreciate to one-half of its original value.

* Grade 12 Method: $\log 0.5 = \log 0.82^x \rightarrow \frac{\log 0.5}{\log 0.82} = \frac{x \cdot \log 0.82}{\log 0.82}$

$x = \frac{\log 0.5}{\log 0.82} = 3.49$

Example 4 Determine equations for the following:

a) **A town with a population of 12 000 has been growing at an average rate of 2.5% for the last 10 years. Suppose this growth rate will be maintained in the future.**

$y = 12000(1.025)^x$

$= a$

$b = 1 + 0.02$
$= 1.025$

Let y be population
Let x be # of years

b) **Find an equation for the situation above but for population in the thousands.**

$y = 12(1.025)^x$

same "Let statements" as above.