Exponential Problems

Learning Goal:

By the end of today, I will be able to recognize an exponential equation and use it to solve for a desired unknown

Dec 17-2:35 PM

A petri dish contains 8 micro-organism that are able to double their numbers every 5 minutes.

Create a table of values for the number of micro-organisms for the first 40 minutes of an experiment.

Time	Number of MO	
0	Equation Format	8

n

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Different Forms of Exponential Functions

$$A_f = A_o(1+i)^{\frac{n}{k}}$$

k - control

Final Amount

Initial (or starting) amount

Multiplier (growth or decay)

$$A_2 = 400(1-0.15)^n$$

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Interest calculations:

A 5% rate of return on an investment means you receive/pay 5% of the original capital/investment.

A $1,000 investment at 5% for one year will generate $50.00 in interest money.

$1,000 x 0.05 x 1 =

I = P r t

P - principal amount invested

r - annual rate of return

t - time in years (usually)

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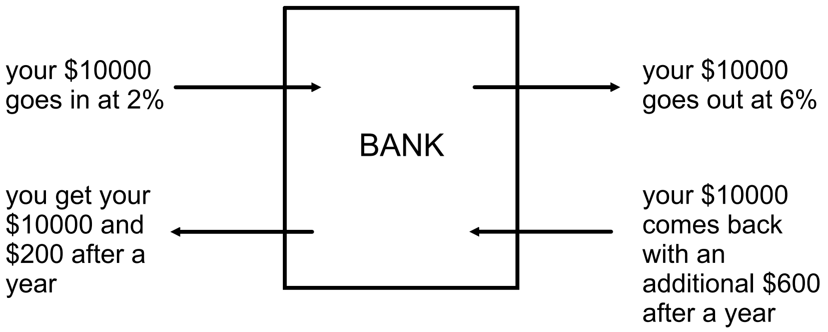
Interest on an investment or a loan is essentially a fee for using that money.

If you are investing YOUR money in a GIC, stock, bank account, etc., you collect interest, or charge the bank a fee to use your money.

If you take out a loan or mortgage, your are using the BANK's MONEY you pay a fee to use it.

Example:

A bank will typically pay you around 1-2% for money that is left in your bank account. The bank then takes that money and loans it out at 4-8% to other people.



+$200 +$400 -$600

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Working with percent calculations - an algebraic simplification

1 - Calculating Tax on an item (increasing)
Original cost = $100.00

HST = 13%

original cost tax calculation

$100.00 + ($100.00 x 0.13)

Factor the $100

2 - Calculating Depreciation on an item (decreasing)

Original cost = $100.00

Sale Discount = 25%

original cost tax calculation

$100.00 - ($100.00 x 0.25)

Factor the $100

Percentage Growth $A = P(1 + i)$

Percentage Decrease $A = P(1 - i)$

where "i" is a percent in decimal form

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A new car **depreciates (decreases)** by 7% for the first 5 years. If the new car originally cost $40,000, what would be the value of the car at the end of each of the first five years.

Create a table of values for the car value over the first five years.

Time		$
0	Equation Format	40,000
n		

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Exponential Equation - General

$$A_f = A_o(1+i)^n$$

Growth

$$A_f = A_o(1-i)^n$$

Decay

Doubling Equation

$$A_f = A_o(2)^n$$

Half Life Equation

$$A_f = A_o(1-0.5)^n$$

$$A_f = A_o(0.5)^n$$

$$A_f = A_o\left(\frac{1}{2}\right)^n$$

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Different Forms of Exponential Functions

$$A_f = A_o(1+i)^{\frac{n}{k}}$$

k - control

Final Amount

Initial (or starting) amount

Multiplier (growth or decay)

Initial Amount

Rate of Return

$$A_2 = 5000(1.34)^n$$

$$A_2 = 5000(1+0.34)^n$$

$$P_f = 250(2)^{\frac{n}{3}}$$

$$P_f = 250(1+1.0)^{\frac{n}{3}}$$

$$A_2 = 400(0.85)^n$$

$$A_2 = 400(1-0.15)^n$$

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Carbon - 14 is a radioactive isotope that loses half of its original mass every 5730 years.

If a sample of carbon-14 started with 100 grams, how many years does it take to get to the following masses:

(i) 50 grams

(ii) 25 grams

(iii) 6.25 grams

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Using percents and ratios with Half Life questions.

$$A_f = A_o\left(\frac{1}{2}\right)^n$$

How long does it take for a sample of plutonium 244 to decay to 25% of its original mass?

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Equation Writing $A_f = A_o(1+i)^n$

1. A piece of artwork appreciates at 12% per year, the original value was $20,000

2. A car depreciates at 25% per year, the original value was $32,000

3. A town of 23,000 people expects to grow by 4.5% per year

Dec 9-10:49 AM

Different Forms of Exponential Functions

$$A_f = A_o(1+i)^{\frac{n}{k}}$$

k - control

Final Amount

Initial (or starting) amount

Multiplier (growth or decay)

$$A_2 = 400(1-0.15)^n$$

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Homework

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