EXPONENTIAL FUNCTION

Remember BEDMAS

Do the EXPONENT 1st

Goal:

- calculate values that are depreciating (decr) and appreciating (incr) in an exponential function
- find the rule of an exponential function from a graph.

Formula: $y = \text{start} \times \text{keep}^{\text{time}}$

Exponent Length of time

Number you start with

Amount you are keeping

1 + % (if its increasing) appreciating

1 - % (if its decreasing) depreciating

Dec 14-12:03 PM

When the value of y is INCREASING

Words that mean it is increasing: increasing, growing, appreciating, appreciation, interest

Example: St Hubert has a population of 50000 people. If the population is increasing a rate of 2% per year, how many people will there be in 5 years.

$100\% + 2\% = 102\% = \frac{102}{100} = 1.02$

Start: 50000 Keep: $1 + 2\% = 1.02$ Time: 5

$2\% = \frac{2}{100} = 0.02$

$y = \text{start} \times \text{keep}^{\text{time}}$

$y = 50000 \times (1.02)^{5}$

$= 55,204.$

$50000 \times 2\% = 1000$

$50000 + 5(1000) = 55,000$

Pop

1st $50000 + 1000 = 51,000$

2nd $51000 + 1020 = 52,020$

3rd $52020 + 1040.4 = 53060$

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Example: A bacteria triples every hour. If there were 25 bacteria to begin with, how many bacteria will there be in 2 days.

Start: 25 Keep: 3 Time: 2(24) = 48

y = start x keep ^{time}

48

y = 25 (3)

1.99×10^{24}

1st 25(3) = 75

2nd 75(3) = 225

1,990,000,000,000,000,000,000,000

Dec 15-10:04 AM

When the value of y is DECREASING

Words that mean it is decreasing: depreciation, decreasing

Example: My Porsche cost $112000 brand new. How much will it be worth in 8 years if its value depreciates by 15% every year?

100% - 15% = 85% = 0.85

Start: 112000 Keep: 1 − 0.15 = 0.85 Time: 8

y = start x keep ^{time}

8

y = 112000 (0.85)

= 30,518.94

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Example: My PK Subban rookie card cost $50 brand new. How much will it be worth in 8 years if its value depreciates by 15% every year?

Start: 50 Keep: $1 - 0.15 = 0.85$ Time: 8

$$y = \text{start} \times \text{keep}^{\text{time}}$$

$$y = 50 (0.85)^{8}$$

$$= \$13.62$$

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Ex. Each year the frog population of a small wooded area declines by 5% in contrast to the previous year. If this wooded area has 2000 frogs, how many frogs will be present in 10 years from now?

S: 2000

K: $1 - 0.05 = 0.95$

T: 10

$$y = 2000(0.95)^{10}$$

$$= 1197.$$

Dec 15-10:22 AM

Ex. Among the options available to finance a purchase, credit cards are the ones that have the highest interest rates. If Diane makes a purchase worth $1200 with a credit card that has an interest rate of 1.5% each month, how much will she pay in interest if she can only clear her card a year later?

S: 1200

K: $1 + 1.5\% = 1 + 0.015 = 1.015$

$100\% + 1.5\% = \frac{101.5}{100} = 1.015$

T: $1\text{yr} \times 12 = 12$ months

$y = 1200(1.015)^{12}$

$= 1434.74$

Interest $= 1434.34 - 1200 = \$234.74$

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Ex. Samuel is looking at making some investments to save for the future. His investment advisor has suggested a Mutual Fund that grows at an annual interest rate of 8% per year. If Samuel invested $5000 in the fund,

a) How much would his investment be worth after 5 years?

b) How long would it take Samuel's investment to double in value? $10,000

a) S: 5000

K: $1 + 8\% = 1 + 0.08 = 1.08$ $\left(100\% + 8\% = \frac{108\%}{100} = 1.08\right)$

T: 5

$y = \text{start}(\text{keep})^{\text{time}}$

$= 5000(1.08)^5$

$= \$7346.64$

b) S: 5000

K: 1.08

T: x

y: 10000

$y = 5000(1.08)^x$

time x	$ y
5	7346.64
10	10794.62
8	9254.65
→ 9	9995.02

after 9 years

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Ex. Farah purchased a new car five years ago for $25 000 and the car has depreciated in value by 15% per year. She would like to sell the car today in order to purchase a used vehicle for $10 000. The used car she is intending to purchase is anticipated to retain 90% of its previous year's value each year.

a) If Farah sells the original car, will she have the $10,000 she needs to purchase the used car? Yes

S: 25000

K: $1-15\% = 1-0.15 = 0.85$

T: 5

$y = 25000(0.85)^5$

$= \$11,092.63$

b) If Farah intends to sell the used car when it is worth $6561, how long will she own it for?

time

x

10

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Ex. If the population of rabbits doubles every 4 months, when will there be 5000 rabbits if there were only 2 rabbits.

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1. A community of 90 penguins increase in population by 4% per year. Which of the following equations could be used to determine the population in the future?

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2. Jim bougt a cottage a few years ago. He has been analyzing the water in the well every year.

$$f(x) = 16\ (1.5)^{x}$$

In 2012, there were 54 bacteria. In what year will there be more than 200 bacteria for the first time?

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3. A lab technician notes that the number of type A bacteria doubles every hour whereas the number of type B bacteria triples every hour. At the outset there are 1000 of type A bacteria and 500 of type B bacteria. Which of the two bacteria will be more numerous after five hours?

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4.

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