

Growth and Decay Applications !

Exponential Growth (Doubling)



It's Magic!

A genie appears from a magic lantern (yes a genie!). Your wish is to have a magic penny that doubles into two magic pennies overnight. The genie grants your wish and gives you the magic penny and allows it to work for one month (30 days).

- (a) How much money will you have at the end of 1 month? ^(30 days)

$$2^{30} = \$10737418.24$$

$$= 10737418.24$$

- (b) If there were two magic pennies, how much money would you have after 1 month?

how many we start with.

$$\rightarrow 2 \times 2^{30}$$

(Double the previous answer)

- (c) What if the magic penny were to triple each night instead of double? How much money would you have?

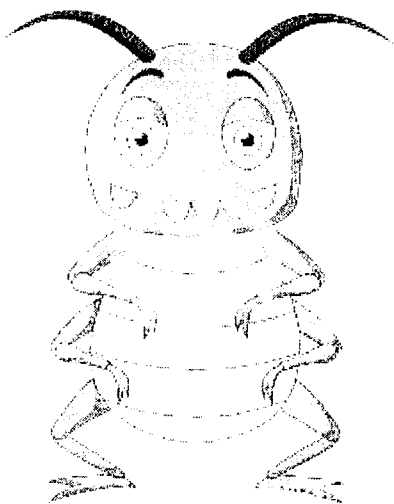
of growth periods

$$3^{30}$$

Rate of Increase

4 magic pennies, triple in value for 12 days.

$$4 \times 3^{12}$$



More Insects!

The number of insects in a colony doubles every 2 months. There are 1000 insects in the colony now.

- (a) How many insects will there be in six months?

$$1000 \times (2)^3 \leftarrow \frac{\text{total time}}{\text{doubling time}} = \frac{6}{2} = 3$$

$$= 8000 \text{ insects in the colony}$$

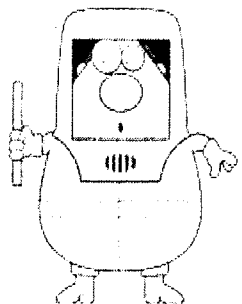
- (b) How many will there be in 15 months?

$$1000(2)^{15/2}$$

$$\approx 181019.34$$

181 019 insects in the colony

Exponential Decay (Half Life)



It's Radioactive!

Polonium-210 is a radioactive element with a half-life of 20 weeks. This means that it decays to half of its mass every 20 weeks. If you start with an initial amount of 24 grams of Polonium-210. How much will be remaining after 1 year?

52 weeks

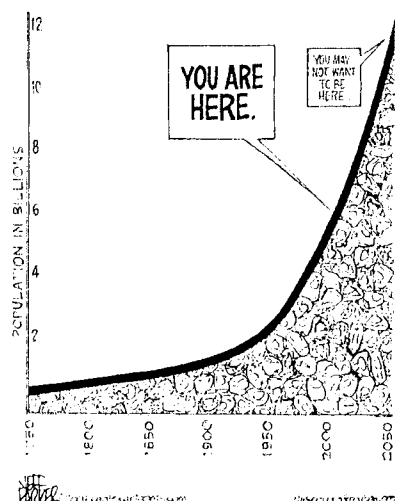
We can use the exponential growth rate formula, using the growth rate as $\frac{1}{2}$!

$$24 \times \left(\frac{1}{2}\right)^{\frac{52}{20}}$$

$$= 3.958$$

3.96 grams would be left

Exponential Growth as a Percentage



It's a Growing Population!

A small town has a population of 12,500. It is growing at a rate of 3% every year. What is the expected population in 12 years?

$$12500(1.03)^{12}$$

$$= 17822.01$$

the population will be 17822 people in 12 years.

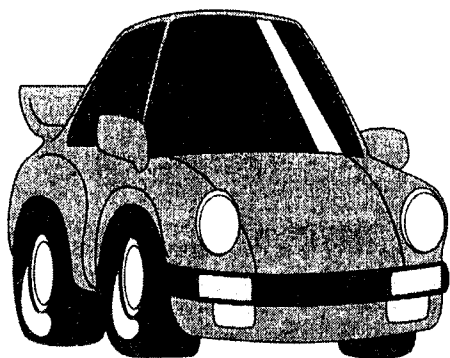
Growth Rate Examples

Growth rate of 5% = (1.05)

Growth rate of 9% = (1.09)

Growth rate of 21% = (1.21)

Exponential Depreciation as a Percentage



It Just Depreciates @

A car is valued at \$23,450 when it is new. It will depreciate in value approximately 4.5% every year. What will be the value of the car in 10 years?

$$23450 (.955)^{10}$$

$$= 14797.1$$

the value of the car in 10 years is 14797.1

Depreciation Rate Examples

Depreciation rate of 3% = $(1 - 0.03) = .97$

Depreciation rate of 9% = $.91$

Depreciation rate of 15% = $.85$