# Survival Guide: Exponential

## Exponentials

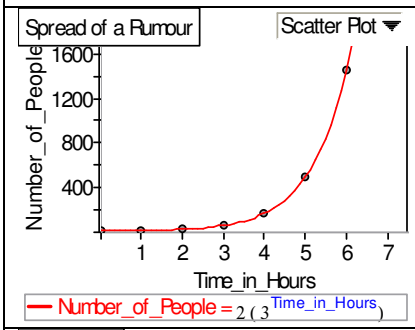
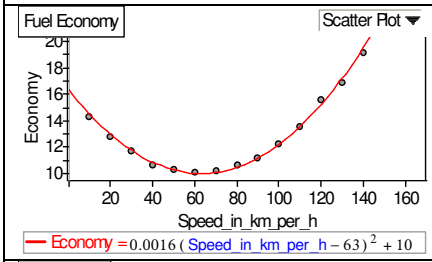
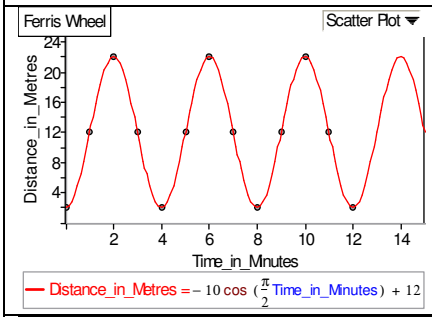
### Exponent Laws

| Law | Description | Examples |
|---|---|---|
| Multiplication | When the bases are the same, keep the base and _____ the exponent. | $3^4 \cdot 3^5$ |
| Division | When the bases are the same, keep the base and _____ the exponent. | $\frac{7^5}{7}$ |
| Power of a Power | Keep the base the same and _____ the exponents. | $\left(3^2\right)^5$ |
| Power of a Product | _____ the exponent to all numbers/variables in the product. | $\left(5x^6y^2\right)^3$ |
| Power of a Quotient | _____ the exponent to all numbers/variables in the quotient. | $\left(\frac{2x^4}{3^2y^3}\right)^5$ |
| Negative Exponents | Change the base to it's _____ and make the exponent _____. | $\frac{3x^{-2}}{(2y)^{-1}}$ |
| Zero Exponents | Anything to the power of 0 is equal to _____. | $8^0$ |
| Rational Exponents | Change to an equivalent _____ where $\frac{m}{n}$ indicates the _____ root of the base raised to the exponent _____. | $\sqrt[4]{16x^8}$ |
| | | $121^{\frac{1}{2}}$ |

### Solve Exponential Equations

| Steps | Example |
|---|---|
| | $64^{2x-4} \cdot 8^x = 512^{-x}$ |

**DISTINGUISH BETWEEN TYPES OF FUNCTIONS:**

| EXAMPLE | TYPE | REASON | DOMAIN & RANGE | EXAMPLE | TYPE | REASON |
|---|---|---|---|---|---|---|
|  | | | | **Time (days)** / **Number of E-mails with Virus**<br>1 / 15<br>2 / 225<br>3 / 3 375<br>4 / 50 625<br>5 / 759 375<br>6 / 11 390 625 | | |
|  | | | | **Time (s)** / **Height of Ball (m)**<br>0 / 18<br>1 / 15<br>2 / 12<br>3 / 9<br>4 / 6<br>5 / 3 | | |
|  | | | | $h(t) = -5t^2 + 4t + 100$ | | |
| | | | | $N(t) = 5000 + 0.4t$ | | |
| **Time (min)** / **Temperature**<br>0 / 55<br>4 / 47<br>8 / 40<br>12 / 34<br>16 / 29<br>20 / 25 | | | | $A(n) = 5000(1.12)^n$ | | |

Characteristics of the **BASIC - PARENT EXPONENTIAL FUNCTION**, $f(x) = b^x$, $b \neq 1$:

- when $b > 1$, the function is _____
- when $0 < b < 1$, the function is _____
- $b^x \neq 0$ because there is a _____at the $x$-axis
- the domain is _____
- the range is _____

**CHARACTERISTICS OF EXPONENTIAL MODELS**

$y = a(b)^{\frac{x}{c}}$

____ is the growth/decay factor

it is found by:

____ is the initial value

____ is how long it takes to grow/decay

Solve these examples:

1. The half-life of a radioactive substance is 70 years. What fraction will remain in 140 years?

2. The fox population in a national wildlife refuge has been decreasing by 4% every year. The fox population was 580 in 2007. Estimate the fox population in 2015.

## FINANCE

For single deposits you'd use either _____ or _____ formula

For many deposits you'd use either _____ or _____ formula

To determine if it is simple interest calculation and not compounded look for

_____

To determine if it is present value not future value look for

_____

*Simple Interest* – <u>the interest earned on the principal for the whole term</u>

_____

where ___ = the total interest to be paid or earned
___ = the principal, or what is borrowed or invested
___ = the interest rate, in decimal form
___ = the length of time in years

*Compound Interest* – interest is added on to the principal after a set period of time and then calculated again

where ___ = the final amount (future value)

_____ ___ = the periodic interest rate (rate per compounding period)

$i = \frac{r}{C}$, where ___ = the annual interest rate and

___ = the number of compounding periods per year

___ = the principal, or initial amount (present value)

___ = the total number of compounding periods

$n = Ct$, where ___ = the number of years and

___ = the number of compounding periods per year

*Annuities* – annuity is a series of equal payments made at equal intervals of time

_____ and _____

where ___ = the future value of the annuity

___ = the present value of the annuity

___ = the regular payment

___ = the periodic interest rate

___ = the total number of payments

Solve the examples

3. Joe invested $500 at option A: 5% compounded quarterly for 2 years, or option B: 5% simple interest. Determine what the investment be worth at the end of the 2-year term for both options.

4. Andrea is planning to save $2000 in 2 years.
   a. Determine what her regular quarterly deposits must be if her savings account earns 6% interest per year, compounded quarterly.

   b. How much interest will Andrea earn during the 2 years?