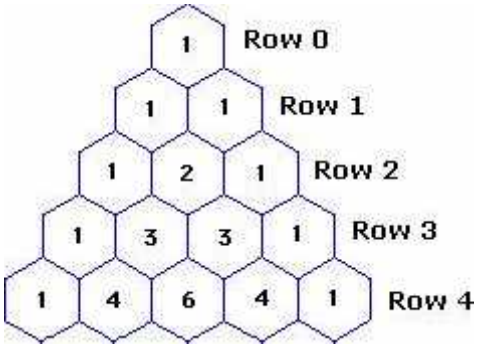
Pascual's Triangle: The arrangement of the binomial coefficients in a pattern of triangle.

Example of Pascal's Triangle



Probability

Definition of Probability

- Probability is a numerical measure of the likelihood of occurrence of an event. The value of probability lies between 0 and 1.
- If all outcomes of an experiment are equally likely, then the probability is given by,

  Probability of an event = $\frac{\text{Number of favorable outcomes}}{\text{total number of possible outcomes}}$.

Examples of Probability

- The probability to pick a blue marble from a basket containing 10 blue marbles is 1.
- Suppose you toss a fair coin. Then the probability of tossing a head or tail is $\frac{1}{2}$.

Ratio

Definition of Ratio

- A ratio is a comparison of two numbers by division.

Examples of Ratio

- 4 : 7, 1 : 6, 10 : 3 etc. are examples of ratio.
- Any ratio a : b can also be written as 'a to b' or $\frac{a}{b}$.

Average

Let $a_1,a_2,a_3,.....,a_n$ be a set of numbers, average = $(a_1 + a_2 + a_3,+.....+ a_n)/n$

Percent

Percent to fraction: x% = x/100

Percentage formula: Rate/100 = Percentage/base

Rate: The percent.
Base: The amount you are taking the percent of.
Percentage: The answer obtained by multiplying the base by the rate

Consumer math formulas:

Discount = list price × discount rate

Sale price = list price − discount

Discount rate = discount ÷ list price

Sales tax = price of item × tax rate

Interest = principal × rate of interest × time

Tips = cost of meals × tip rate

Commission = cost of service × commission rate

$$\frac{\text{is}}{\text{of}} = \frac{\%}{100} \text{ or } \frac{\text{part}}{\text{whole}} = \frac{\%}{100}$$

Percentage formula

Order of Operations

- Order of operations refers to the precedence of performing one arithmetical operation over another while working on a mathematical expression.

  - Here are the rules:

1. Evaluate expressions inside parentheses.
2. Evaluate all powers.
3. Perform all multiplications and/or divisions from left to right.
4. Perform all additions and/or subtractions from left to right.

- Order of operations if not rigidly followed can lead to two different solutions to the same expression.
- PEMDAS or BEDMAS help you remember order of operations.
  PEMDAS - **P**lease **E**xcuse **M**y **D**ear **A**unt **S**ally
  P - Parentheses
  E - Exponents
  M - Multiplication
  D - Division
  A - Addition
  S – Subtraction
-
  BEDMAS
  B - Brackets
  E - Exponents
  D - Division
  M - Multiplication
  A - Addition
  S - Subtraction
-

Convert Decimals to Fractions

(Multiply top and bottom by 10 until you get a whole number, then simplify)

To convert a Decimal to a Fraction follow these steps:

Step 1: Write down the decimal divided by 1, like this: $^{decimal}/_{1}$

Step 2: Multiply both top and bottom by 10 for every number after the decimal point. (For example, if there are two numbers after the decimal point, then use 100, if there are three then use 1000, etc.)

Step 3: Simplify (or reduce) the fraction

Rules of Fractions

Fractions formulas:

Adding Formula: $\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$

Subtracting formula: $\frac{a}{b} - \frac{c}{d} = \frac{ad - bc}{bd}$

Multiplying fractions: $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$

Dividing fractions: $\frac{\frac{a}{b}}{\frac{c}{d}} = \frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$

Converting a mixed number to an improper fraction:

$a\ \frac{c}{d} = \frac{ad + c}{d}$

Converting an improper fraction to a mixed number:

$$\text{Divisor} \overline{)\ \text{Dividend}}\ \begin{matrix}\text{Quotient} & \text{Remainder}\end{matrix}$$

Formula is : $\text{quotient}\ \frac{\text{Remainder}}{\text{Divisor}}$

Formula for a proportion:

$\frac{a}{b} = \frac{c}{d}$

In a proportion, the product of the extremes (ad) equal the product of the means(bc), Thus, ad = bc

Geometry formulas:

Perimeter:

Perimeter of a square: **s + s + s + s**
s:length of one side

Perimeter of a rectangle: **l + w + l + w**
l: length
w: width

Perimeter of a triangle: **a + b + c**
a, b, and c: lengths of the 3 sides

Area:

Area of a square: **s × s**
s: length of one side

Area of a rectangle: **l × w**
l: length
w: width

Area of a triangle: **(b × h)/2**
b: length of base
h: length of height

Area of a trapezoid: **$(b_1 + b_2) \times h/2$**
b_1 and b_2: parallel sides or the bases
h: length of height

Volume:

Volume of a cube: **s × s × s**
s: length of one side

Volume of a box: **l × w × h**
l: length
w: width
h: height

Volume of a sphere: **(4/3) × pi × r^3**
pi: 3.14
r: radius of sphere

Volume of a triangular prism**:**

area of triangle × Height = (1/2 base × height) × Height

base: length of the base of the triangle
height: height of the triangle
Height: height of the triangular prism

Volume of a cylinder:

pi × r^2 × Height

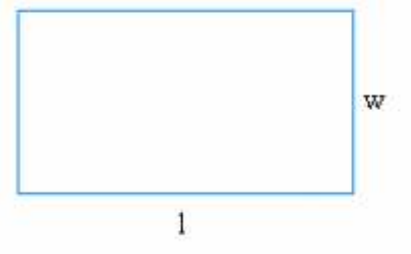
pi: 3.14
r: radius of the circle of the base
Height: height of the cylinder

Math Formulas

Here, we provide you with common geometry formulas for some basic shapes

---

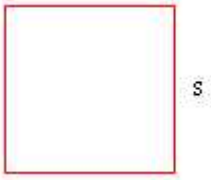
Rectangle:



Perimeter $= l + l + w + w = 2 \times l + 2 \times w$

Area = l × w

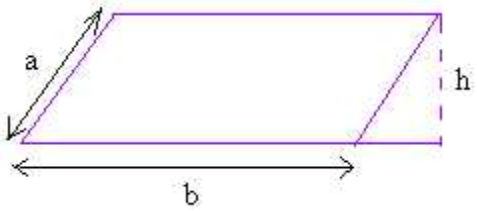
Square:



Perimeter $= s + s + s + s = 4 \times s$

Area = s^2

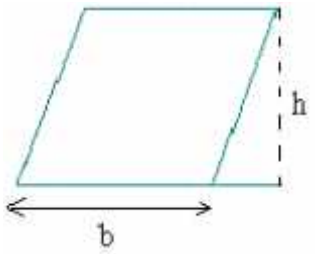
Parallelogram:



Perimeter $= a + a + b + b = 2 \times a + 2 \times b$

Area = b × h

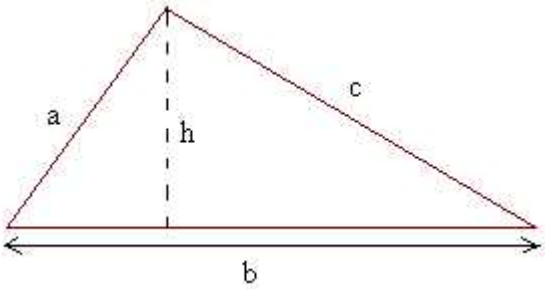
Rhombus:



Perimeter = b + b + b + b = 4 × b

Area = b × h

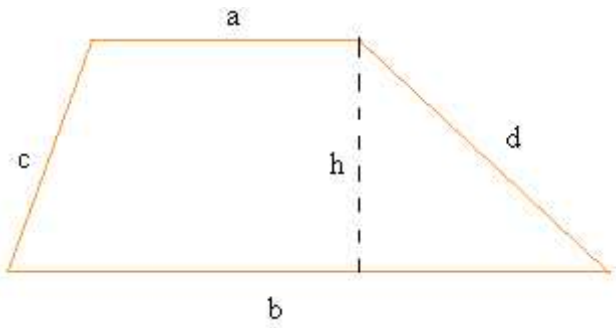
Triangle:



Perimeter = a + b + c

Area = (b × h)/2

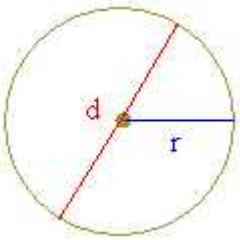
Trapezoid:



Perimeter = a + b + c + d

$$\text{Area} = \frac{(a + b)}{2} \times h$$

Circle:

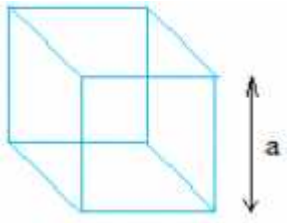


Perimeter = 2 × pi × r or Perimeter = pi × d

Area = pi × r^2 or Area = (pi × d^2)/4

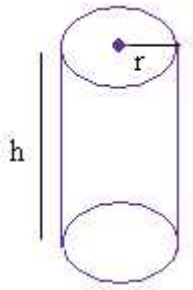
Surface area formulas

Cube:



Surface area = $6 \times a^2$

Right circular cylinder:

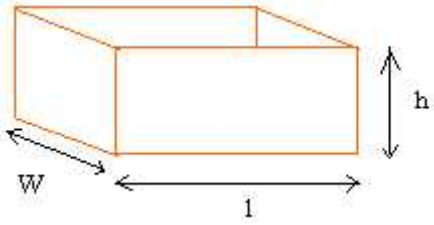


Surface area = $2 \times pi \times r^2 + 2 \times pi \times r \times h$

pi = 3.14
h is the height
r is the radius

Math Formulas

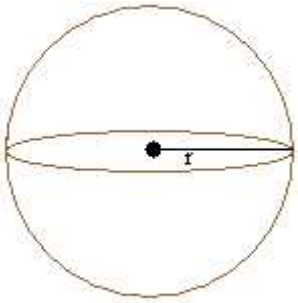
Rectangular prism:



Surface area = $2 \times l \times w + 2 \times l \times h + 2 \times w \times h$

l is the length
w is the width
h is the height

Sphere:

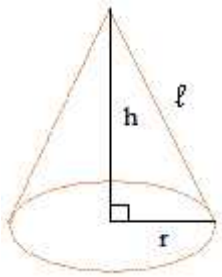


Surface area = $4 \times pi \times r^2$

pi = 3.14
r is the radius

Math Formulas

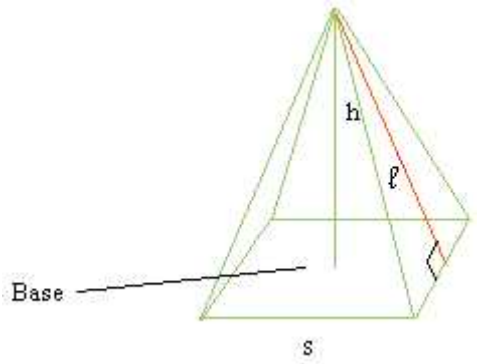
Right circular cone:



Surface area = pi × r^2 + pi × r ×(√(h^2 + r^2))

pi = 3.14
r is the radius
h is the height
ℓ is the slant height

Right square pyramid:



Surface area = s^2 + 2 × s × ℓ

s is the length of the base
h is the height
ℓ is the slant height

The Formula for finding Interior Angles

An interior angle of a **regular** polygon with n sides is

$$(n-2)\cdot 180 \div n$$

Example: To find the measure of an interior angle of a regular octagon, which has 8 sides, apply the formula above as follows:
((8-2) × 180) /8 = 135°

Formula for sum of exterior angles:

The sum of the measures of the exterior angles of a polygon, one at each vertex, is: **360°.**

Measure of a Single Exterior Angle

Formula

To find 1 angle of a regular convex polygon of n sides =

$$\frac{360}{n}$$

Formula for finding diagonals in polygons

Use the formula *(n² - 3n)/2*. "n" represents the sides of a polygon, so if you had a pentagon and you wanted to figure out the diagonals, insert "5" for n. The result will become:

- 1. (5² - 3(5))/2
- 2. (25 - 15)/2
- 3. 10/2
- 4. The number of diagonals for a pentagon is 5.

- Hexagon (6 sides)

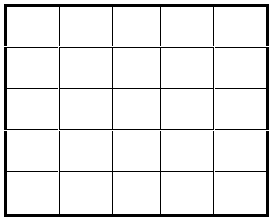
- 1. (6² - 3(6))/2
- 2. (36 - 18)/2
- 3. 18/2
- 4. There are 9 diagonals.

- Decagon (10 sides)
  - 1. $(10^2 - 3(10))/2$
  - 2. $(100 - 30)/2$
  - 3. $70/2$
  - 4. There are 35 diagonals.

- Icosagon (20 sides)
  - 1. $(20^2 - 3(20))/2$
  - 2. $(400 - 60)/2$
  - 3. $340/2$
  - 4. There are 170 diagonals.

- 96-gon (the polygon Archimedes used to find the approximate value of Pi)
  - 1. $(96^2 - 3(96))/2$
  - 2. $(9216 - 288)/2$
  - 3. $8928/2$
  - 4. There are 4464 diagonals.

Formula for finding how many total squares are in the diagram

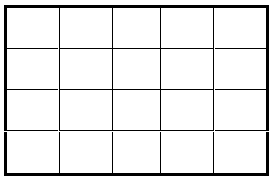


You have a 5 x 5 column your formula for finding how many total squares you can arrange from the diagram is:

$$5^2 + 4^2 + 3^2 + 2^2 + 1^2 =$$

$$25 + 16 + 9 + 4 + 1 = \mathbf{55\ total\ squares}$$

If you have a 4 x 5 column diagram, your formula will be:



5 x 4 = 20

4 x 3 = 12

3 x 2 = 6

2 x 1 = 2

Add totals sums together: 40 total Squares you can arrange.

Conversion of BASE logs

Here are the formulas for converting to Base 10 and from Base 10

Converting to $base_{10}$

Problem#1

12012_3 convert to $base_{10}$

Follow the color sequences.

3 x 0 + **1** = **1**

3 x **1** + **2** = **5**

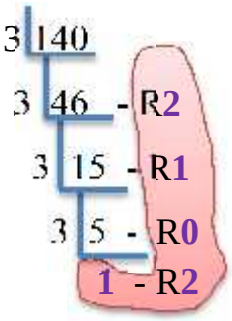
3 x **5** + **0** = **15**

3 x **15** + **1** = **46**

3 x **46** + **2** = **140**

Answer is: 140_{10}

Now, let's convert is back to base$_3$



So the base$_3$ is: **12012_3**, it converts back to the original number. You must write it from the bottom up to the top remainder.

Prime Factorization vs Prime Factors

There is always confusion over the Prime Factorization and the Prime Factors. Let's first start with Prime Factorization, because you have to know what factors are in the number. Prime factorization breaks down the number to the lowest factors that are in it, for example:

100 = 2 x 2 x 5 x 5 - this is called Prime Factorization.

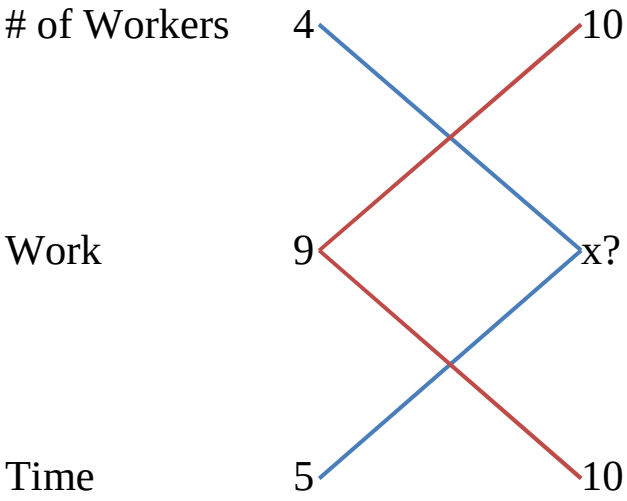
Now, what are the prime numbers in the prime factorization?
Answer: 2 and 5 – these are the Prime Factors.

Here is the break down, out of the number 100,

Prime Factorization is: **$2^2 \times 5^2$** or **2 x 2 x 5 x 5**

Prime Factors are: **2 and 5**

Formula for: Work x Time x # of Workers



Or: $\frac{xy}{x+y}$ **(per hour)**

Roman Numerals

Roman numerals are expressed by letters of the alphabet:

I = 1
V = 5
X = 10
L = 50
C = 100
D = 500
M = 1000

There are three basic principles for reading and writing Roman numerals:

- 1. A letter repeats its value that many times (XXX = 30, CC = 200, etc.). A letter can only be repeated three times.
- 2. If one or more letters are placed after another letter of greater value, add that amount.

VI = 6 (5 + 1 = 6)

LXX = 70 (50 + 10+ 10 = 70)

MCC = 1200 (1000 + 100 + 100 = 1200)

3~If a letter is placed before another letter of greater value, subtract that amount. IV = 4 (5 - 1 = 4)

XC = 90 (100 - 10 = 90)

CM = 900 (1000 - 100 = 900)

Roman Numerals - *Con'd*

Several rules apply for subtracting amounts from Roman numerals:

a. Only subtract powers of 10(I, X, or C, but not V or L)

For 95, do **NOT** write VC(100-5).
DO write XCV (XC + V or 90 + 5)

b. Only subtract one number from another

For 13, do **NOT** write IIXV (15-1-1)
DO write XIII (X + I + I + I or 10 + 3)

c. Do not subtract a number from one that is more than 10 times greater(that is, you can subtract 1 from 10 (IX) but not 1 from 20 - there is no such number as IXX).

For 99, do **NOT** write IC (C - I or 100 - 1)
DO write XCIX (XC + IX or 90 + 9)