Classification of numbers

List of type of Numbers

Class	***Symbol***	***Description***
Natural Numbers	**N**	1, 2, 3,...
Whole Numbers	**W**	0, 1, 2, 3,...
Integers	**Z**	{...-3, -2, -1, 0, 1, 2, 3,...}
Odd Integers		{..., -5, -3, -1, 1, 3, 5, ...}
Even Integers		{...-6, -4, -2, 0, 2, 4, 6, ...}
Rational Numbers	**Q**	p/q Where p,q are integers and q ≠ zero.
Irrational Numbers		Irrational numbers are numbers which cannot be represented as fractions. Eg.: √2, √3, π, e.
Real Numbers	**R**	All the rational numbers and all the irrational numbers together form the real numbers. 0.45, 5/2, -0.726495 ..., 18, and -65 1/4 are all real numbers.
Prime Number		It can be divided only by 1 or itself . Eg: 2, 3, 5, 7, ...
Non Prime Number		The positive integers which are not prime (except 1) are known as non prime numbers. Eg: 4, 6, 8, ...
Co Prime Number		A pair of numbers not having any common factors other than 1 or -1. Eg: 15 and 28

Absolute Values:

The absolute value of A is denoted by $|A|$.
If $a < 0$, then $|a| = -(a)$ and $a > 0$,then $|a| = a$.
For example: $|-3| = 3$, $|4| = 4$

Division:

Dividend = (Divisor X quotient) + Remainder
(Note: Remainder < Divisor)

Factors:

If b divides A perfectly and the remainder is 0, then b is a factor of A

GCD:

GCD (greatest common divisor) or HCF (highest common factor) of two non-zero integers, is the largest positive integer that perfectly divides both numbers.

LCM:

LCM(least common multiple) of two integers a and b is the smallest positive integer that is a multiple
of both a and b.

Adding Rules:

Positive + Positive = Positive: $5 + 4 = 9$
Negative + Negative = Negative: $(-7) + (-2) = -9$

Sum of a negative and a positive number: Use the sign of the larger number and subtract

$(-7) + 4 = -3$
$6 + (-9) = -3$

Subtracting Rules:

Negative - Positive = Negative: $(-5) - 3 = -5 + (-3) = -8$
Positive - Negative = Positive + Positive = Positive: $5 - (-3) = 5 + 3 = 8$
Negative - Negative = Negative + Positive = Use the sign of the larger number and subtract
(Change double negatives to a positive)
$(-5) - (-3) = (-5) + 3 = -2$
$(-3) - (-5) = (-3) + 5 = 2$

Multiplying Rules:

Positive x Positive = Positive: 3 x 2 = 6
Negative x Negative = Positive: (-2) x (-8) = 16
Negative x Positive = Negative: (-3) x 4 = -12
Positive x Negative = Negative: 3 x (-4) = -12

Dividing Rules:

Positive ÷ Positive = Positive: 12 ÷ 3 = 4
Negative ÷ Negative = Positive: (-12) ÷ (-3) = 4
Negative ÷ Positive = Negative: (-12) ÷ 3 = -4
Positive ÷ Negative = Negative: 12 ÷ (-3) = -4

Operations on Odd and Even integers:

Odd + Odd = Even

Even + Even = Even

Odd – Odd = Even

Even – Even = Even

Odd + Even = Odd

Odd – Even = Odd

Odd * Odd = Odd

Even * Even = Even

Even * Odd = Even

Fractions Decimals and percentage

Converting Fractions, Decimals, and Percents

How to change

A fraction to a decimal:

Divide the denominator (the bottom part) into the numerator (the top part):

$^{1}/4$ = 1 ÷ 4.00 = 0.25

<u>A fraction to a percent:</u>

Multiply the fraction by 100 and reduce it. Then, attach a percent sign.

$^{1}/4 \text{ x } ^{100}/1 = ^{100}/4 = ^{25}/1 = 25\%$

<u>A decimal to a fraction:</u>

Starting from the decimal point, count the decimal places. If there is one decimal place, put the number over 10 and reduce. If there are two places, put the number over 100 and reduce. If there are three places, put it over 1000 and reduce, and so on.

0.25 $= ^{25}/100 = ^{1}/4$

<u>A decimal to a percent:</u>

Move the decimal point two places to the right. Then, attach a percent sign.

0.25 = 25%

<u>A percent to a decimal:</u>

Move the decimal point two places to the left. Then, drop the percent sign.

25% = 0.25

<u>A percent to a fraction:</u>

Put the number over 100 and reduce. Then, drop the percent sign.

$25\% = ^{25}/100 = ^{1}/4$

Adding Formula = (a/b) + (c/d) = (ad + bc)/bd
Subtracting Formula = (a/b) - (c/d) = (ad - cd) / bd
Multiplying Fractions = (a/b) * (c/d) = (ac/bd)
Dividing Fractions = (a/b)/(c/d) = (a/b) * (d/c) = ad/bc

Converting a mixed number to an improper fractions

a(c/d) = (ad + c)/d

Ratio and Proportions

Ratios :

If a : b = c : d, then a : b = c : d = (a + c) : (b + d)

If a < b, then for a positive quantity x,

[(a+x)/(b+x)] > (a/b) and [(a-x)/(b-x)] < (a/b)

If a > b, then for a positive quantity x,

[(a+x)/(b+x)] < (a/b) and [(a-x)/(b-x)] > (a/b)

Proportions :

If a : b : : c : d (or) a/b = c/d then,
(a/c) = (b/d)
(b/a) = (d/c)
(a+b)/b = (c+d)/d
(a-b)/b = (c-d)/d
(a+b)/(a-b) = (c+d)/(c-d)
If (a/b) = (c/d) = (e/f) = ... = k, then (a+c+e+..)/(b+d+f+...) = k

Sequence

Arithmetic Progression :

(a, a+d, a+2d, a+3d, ...)

Tn = a+ (n-1) d

Where a is the first term and d is the common difference.

Sn = (n/2) [2a + (n-1)d]

Geometric Progression :

(a, ar, ar^2, ar^3, ...)

$T_n = ar^{(n-1)}$

$S_n = a(r^{(n-1)})/(r-1)$ When $r > 1$

$S_n = a(1-r^{(n-1)})/(1-r)$ When $r < 1$

Sum Important series:

Sum of first n natural numbers
$1+2+3+...+n = (n(n+1))/2$

Sum of the squares of the first n natural numbers
$1^2 + 2^2 + 3^2 + ... + n^2 = (n(n+1)(2n+1))/6$

Sum of the cubes of the first n natural numbers
$1^3 + 2^3 + 3^3 + ... + n^3 = [(n(n+1))/2]^2$

Algebraic Expressions

Average (or) Mean:

Sum of elements/Number of elements

Arithmetic Mean :

$(x1+ x2 + x3 + ...+xn)/n$

MATHEMATICAL FORMULAE

1. $(x+y)^2 = x^2 + 2xy + y^2$
2. $(x-y)^2 = x^2-2xy+y^2$
3. $(x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$
4. $(x-y)^3 = x^3 - 3x^2y + 3xy^2 - y^3$
5. $x^2 - y^2 = (x+y)(x-y)$
6. $x^3 - y^3 = (x-y)(x^2 + xy + y^2)$
7. $x^3 + y^3 = (x+y)(x^2 - xy + y^2)$

Linear and Quadratic Equations

Linear equation:

General form

Ax + By +C = 0

Quadratic equation:

A general quadratic equation can be written in the form

ax^2 + bx + c = 0

And the roots are given by,

x = [-b +- sqrt(b^2 -4ac)/2a

Linear Inequalities

- Adding (or Subtracting) the same number to both sides of an Algebra Inequality does not change the order of the inequality sign (i.e., '>', or '<'). i.e., if a < b then a + c < b + c and a - c < b - c. Similarly, if a > b then a + c > b + c and a - c > b - c for any three numbers a, b, c.

- Multiplying (or Dividing) both sides of an Algebra Inequality by the same positive number does not change the order of the inequality sign (i.e., '>', or '<').
  For any three numbers a, b, c where c > 0,
  (i) if a < b then ac < bc and a/c < b/c
  (ii) if a > b then ac > bc and a/c > b/c

- Multiplying (or Dividing) both sides of an Algebra Inequality by the same negative number reverses the order of the inequality sign (i.e., '>' to '<' and '<' to '>').
  For any three numbers a, b, c where c < 0,
  (i) if a < b then ac > bc and a/c > b/c
  (ii) if a > b then ac < bc and a/c < b/c

- If three numbers are related in such a way that the first is less (greater) than the second and the second is less (greater) than the third, then the first is less (greater) than the third. This is called transitive property.

- If **a** and **b** are of the same sign and **a** < **b** (**a** > **b**), then 1/**a** > 1/**b** (1/**a** < 1/**b**).
  If reciprocals are taken to quantities of the same sign on both sides of an inequality, then the order of the inequality is changed.

Rules of Exponent

Law	Example
a^m a^n= a^(m+n)	x^5 x^(-2) = x^3
a^m/a^n = a^(m-n), a not equal to Zero	x^5 / x^3 = x^2
(a^m)^n = a^(mn)	[(x^(-2))]^3 = x^(-6)
(ab)^m = (a^m)(b^m)	(xy)^2 = x^2 y^2
(a/b)^m = (a^m/b^m), b is not equal to Zero	(x/y)^2 = (x^2/y^2)
a^(-m) = 1/(a^m), a is not equal to Zero	x^(-3) = 1/(x^3)
a^0 =1, a is not Equal to Zero	2(3x)^0 = 2(1) = 2
a^1 = a	(3x^2)^1 = 3x^2
a^(m/n) = nsqrt(a^m)	

Laws for fractional exponents

Law	Example
$a^{m/n} = \sqrt[n]{a^m}$	$x^{2/3} = \sqrt[3]{x^2}$
$\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}, b \neq 0$	$\frac{\sqrt[3]{16}}{\sqrt[3]{2}} = \sqrt[3]{8} = 2$
$a^{1/2} = \sqrt[2]{a^1} = \sqrt{a}, a \geq 0$	$\sqrt{25} = 5, (not \pm 5)$

Applied Formula

S.P – Selling price

C.P – Cost price

M.P – Marked Price

Percentage Change :

Percentage Change = [(Final value - Initial Value)/Initial Value] */100

Interest :

Amount = Principal + Interest

Profit and Loss :

Profit = SP – CP

Loss = CP – SP

Percentage Profit = (Profit/CP)*100 = [(SP -CP)/CP] *100

Percentage Loss = (Loss/CP) * 100 = [(CP - SP)/CP] *100

Discount :

Discount is usually expressed as a certain per cent of the M.P.

Discount = M.P - S.P

Rate of Discount = Discount% = (Discount/M.P) *100

S.P = M.P*[(100- Discount%)/100]

M.P = (100 * S.P)/(100- Discount%)

Simple and Compound Interest:

Simple Interest = (Principal * Rate * Time)/100 = (PNR)/100

Compound Interest = P(1+(R/100)^n - P

Total Amount = Principal + CI (Compound Interest)

a. Formula for Interest Compounded Annually
Total Amount = $P(1+(R/100))^{n}$

b. Formula for Interest Compounded Half Yearly
Total Amount = $P(1+(R/200))^{2n}$

c. Formulae for Interest Compounded Quarterly

Total Amount = $P(1+(R/400))^{4n}$

d. Formulae for Interest Compounded Annually with fractional years (e.g 2.5 years)

Total Amount = $P(1+(R/100))^{a}\times(1+(bR/100))$

here if year is 2.5 then a =2 and b=0.5

e. With different interest rates for different years

Say x% for year 1, y% for year2, z% for year3

Total Amount = P(1+(x/100))*(1+(y/100))*(1+(z/100))

where CI = Compound Interest, P = Principal or Sum of amount, R = % Rate per annum, n = Time Span in years

Online Compound Interest Calculation. Calculating Compound Interest, Principal, different Rate of Interest for annual, half yearly, quarterly and for fractional years are made much easier.

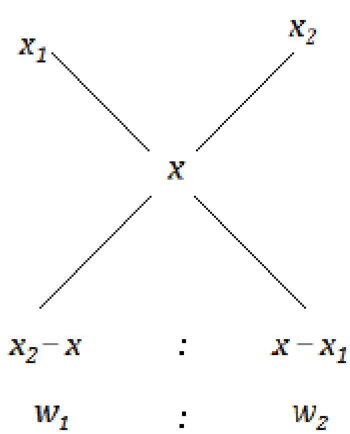
Mixture:

Alligation Rule :

The ratio of the weights of the two items mixed will be inversely proportional to the deviation of attributes of these two items from the average attribute of the resultant mixture.

W1/W2 = (x2 -x1)/(x-x1)

Alligation Cross:



Speed:

Speed = (Distance/Time)

Average Speed :

= (Total Distance traveled)/(Total time taken)
= (d1+d2+d3+....)/(t1+t2+t3+...)

Relative Speed :

For Train :

Time = (Sum of the lengths)/(Relative Speed) = (L1+L2)/(s1 + - S2)

For Boats and streams :

S(Downstream) = S(boat) + S (Stream)
S(upstream) = S(boat) - S(Stream)

Some important formulas for Train Problem

1. a km/hr= (a * 5/18) m/s.

2. a m / s = (a * 18/5) km/hr.

3. Time taken by a train of length 1 metres to pass a pole or a standing man or a signal post is equal to the time taken by the train to cover 1 metres.

4. Time taken by a train of length 1 metres to pass a stationary object of length b metres is the time taken by the train to cover (1 + b) metres.

5. Suppose two trains or two bodies are moving in the same direction at u m / s and v m/s, where u > v, then their relatives speed = (u - v) m / s.

6. Suppose two trains or two bodies are moving in opposite directions at u m / s and v m/ s, then their relative speed is = (u + v) m/s.

7. If two trains of length a metres and b metres are moving in opposite directions at u m / s and v m/s, then time taken by the trains to cross each other = (a + b)/(u+v)sec.

8. If two trains of length a metres and b metres are moving in the same direction at u m / s and v m / s, then the time taken by the faster train to cross the slower train = (a+b)/(u-v) sec.

9. If two trains (or bodies) start at the same time from points A and B towards each other and after crossing they take a and b sec in reaching B and A respectively, then
(A's speed) : (B's speed) = (b1/2: a1/2).

Some important formula for Boat and stream

1. In water ,the direction along the stream is called downstream and ,the direction against the stream is called upstream.

2. If the speed of a boat in still water is u km/hr and the speed of the stream is v km/hr,then:

speed downstream=(u+v)km/hr.
speed upstream=(u-v)km/hr.

3. If the speed downstream is a km/hr and the speed upstream is b km/hr,then :

speed in still water=1/2(a+b)km/hr

rate of stream=1/2(a-b)km/hr

Age Problems:

Odd Days:

We are supposed to find the day of the week on a given date. In a given period, the number of days more than the complete weeks are called odd days.

Leap Year:

Every year divisible by 4 is a leap year, if it is not a century.

Every 4^{th} century is a leap year and no other century is a leap year.

Note: A leap year has 366 days.

Ordinary Year:

The year which is not a leap year is called an ordinary years. An ordinary year has 365 days.

Counting of Odd Days:

1 ordinary year = 365 days = (52 weeks + 1 day). 1 ordinary year has 1 odd day.

1 leap year = 366 days = (52 weeks + 2 days). 1 leap year has 2 odd days.

100 years = 76 ordinary years + 24 leap years

= (76 x 1 + 24 x 2) odd days = 124 odd days.

= (17 weeks + days) = 5 odd days.

Number of odd days in 100 years = 5.

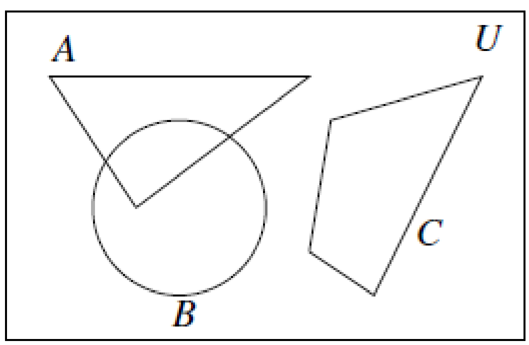
Number of odd days in 200 years = (5 x 2) = 3 odd days.

Number of odd days in 300 years = (5 x 3) = 1 odd day.

Number of odd days in 400 years = (5 x 4 + 1) = 0 odd day.

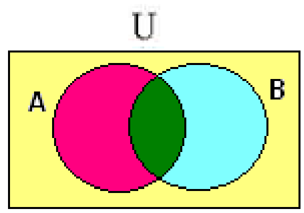
Similarly, each one of 800 years, 1200 years, 1600 years, 2000 years etc. has 0 odd days.

Venn Diagram:

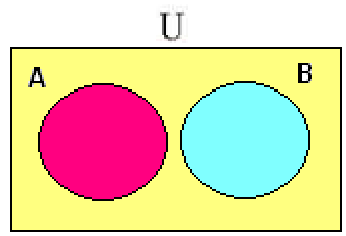


The universal set U is usually represented by a rectangle.

Inside this rectangle, subsets of the universal set are represented by geometrical figures.



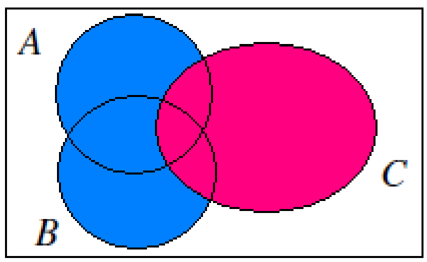
Intersecting Sets



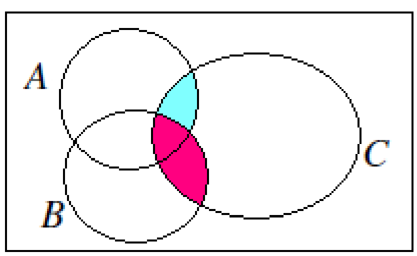
Disjoint Sets

Venn diagrams help us identify some useful formulas in set operations.

To represent (AUB)∩ C:



To represent (A∩C) U (B∩C):



(AUB)∩ C = (A ∩ C) U(B ∩ C)

Work and Efficiency:

Work = force x distance

Time and Work :

Number of days to complete the Work = [1/(Work done in one day)]

Data Analysis

Factorial :

n! = 1*2*3*...*(n-1)*n
n! = n*(n-1)!

Probability :

Probability of an Event

= [Number of Favorable Outcomes]/(Number of Total Outcomes)

Odds in favour

= [Number of Favourable Outcomes]/(Number of Unfavourable Outcomes)

Odds in against

= [Number of unfavourable outcomes]/(Number of favourable outcomes)

Permutations :

nPr = n!/(n-r)!

Combinations :

nCr = n!/[(n-r)!r!]

where,

n, r are non negative integers and r < = n.
r is the size of each permutation.
n is the size of the set from which elements are permuted.
! is the factorial operator.

If the order doesn't matter, it is a Combination.
If the order does matter it is a Permutation.

Permutation with and without repetition

Repetition Allowed:

where n is the number of things to choose from, and you choose r of them
(Repetition allowed, order matters) = n^r

Repetition not allowed:

= n!/(n-r)!

where n is the number of things to choose from, and you choose r of them
(No repetition, order matters)

Combination with and without repetition:

Repetition not allowed:

= n!/[(n-r)!r!]

where n is the number of things to choose from, and you choose r of them
(No repetition, order doesn't matter)

Repetition allowed:

= (n+r-1)/(r!(n-1)!)

where n is the number of things to choose from, and you choose r of them
(Repetition allowed, order doesn't matter)

Statistics :

Mean – Average value
Mode – Most frequently occurring value
Median – Midpoint between lowest and highest value of a set
Range – Difference between largest and smallest value within a set

n = Sample Size and N = Population Size

Sample mean:

xbar = sum(x)/n

Population Mean:

mu = Sum(x)/N

Sample standard deviation:

s = sqrt[sum(x-xbar)^2/n-1]

Population standard deviation

sigma = sqrt[sum(x-mu)^2/N]

Sample mean for a frequency distribution

xbar = Sum(xf)/n

Sample standard deviation for a frequency distribution

s = sqrt[(sum(x - xbar))^2f/(n-1)]

Sample coefficient of variation

CV = s/xbar

Range = Largest data value - smallest data value

Probability of an event A

P(A) = f/n

where *f* = frequency of occurrence of event
n = sample size

Probability of the complement of event A

P(not *A*) = 1 - *P*(*A*)

Multiplication rule for independent events

P(A and B) = P(A).P(B)

General multiplication rules

P(A and B) = P(A).P(B given A)

P(A and B) = P(B).P(A given B)

Addition rule for mutually exclusive events

P(*A* or *B*) = *P*(*A*) + *P*(*B*)

General addition rule

P(*A* or *B*) = *P*(*A*) + *P*(*B*) - *P*(*A* and *B*)

A **random variable** is a variable (typically represented by *x*) that has a single numerical value that is determined by chance.

A **probability distribution** is a graph, table, or formula that gives the probability for each value of the random variable.

If *x* is a random variable then denote by *P(x)* to be the probability that *x* occurs. It must be the case that $0 \le P(x) \le 1$ for each value of *x* and $\sum P(x) = 1$(the sum of all the probabilities is 1.)

Normal Distribution :

The Normal Distribution is also called the Gaussian distribution. It is defined by two parameters mean ('average' m) and standard deviation (σ). A theoretical frequency distribution for a set of variable data, usually represented by a bell-shaped curve symmetrical about the mean.

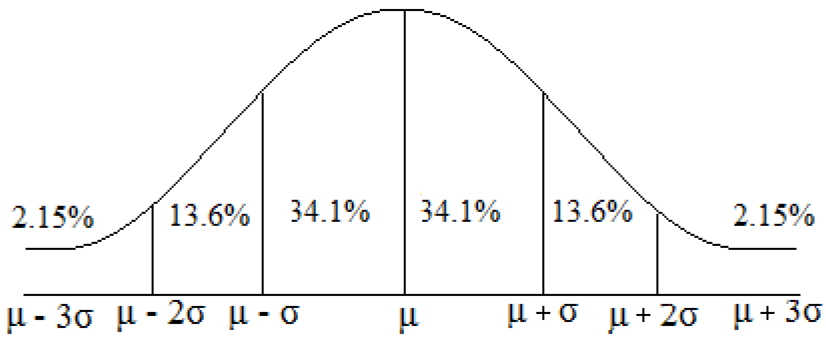
Formula:

X < mean = 0.5-Z
X > mean = 0.5+Z
X = mean = 0.5

Z = (X-m) / σ

where,

m = Mean.
σ = Standard Deviation.
X = Normal Random Variable



Mean of a discrete probability distribution

mu = Sum (xP(x))

Standard deviation of a discrete probability distribution

sigma = sqrt[sum (x-mu)^2 P(x)]

BINOMIAL DISTRIBUTION FORMULAS

Formula for a binomial probability distribution

P(r) = n!/(r!(n-r)! * p^r *q^(n-r)

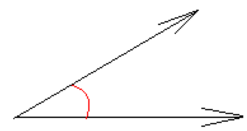
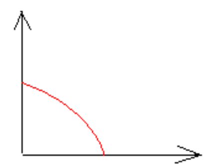
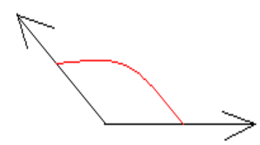
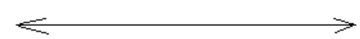
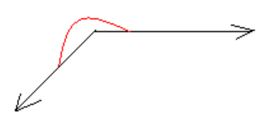
where *r* = number of successes;
p* = probability of success; *q* = 1 - *p

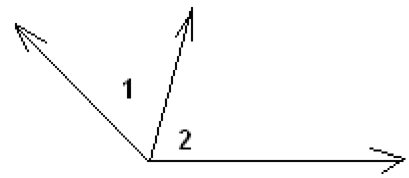
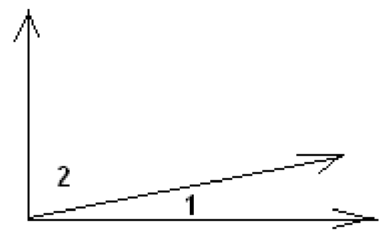
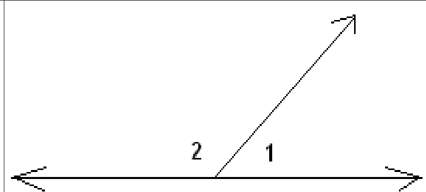
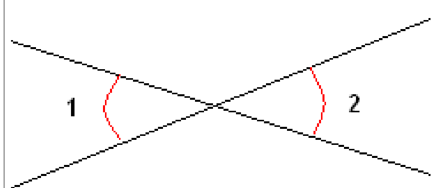
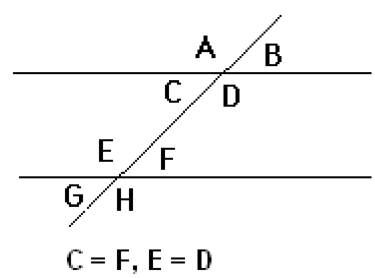
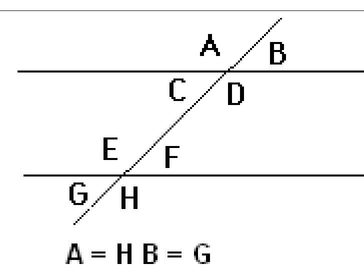
Mean for a binomial distribution
mu = np

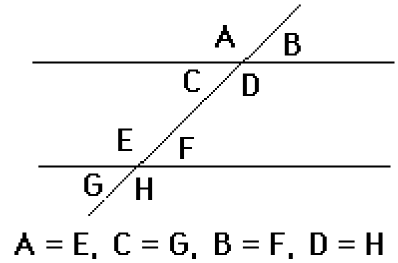
Standard deviation for a binomial distribution

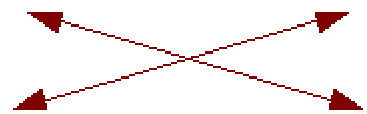
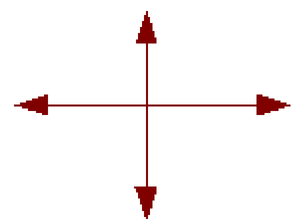
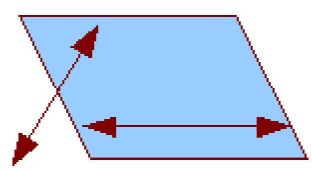
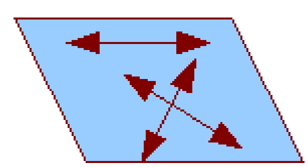
sigma = sqrt(npq)

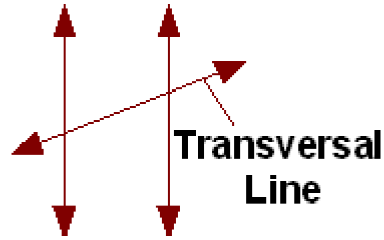
Basic Geometry

Type of Angles	Definition	Diagram
Acute angle	An **acute angle** is greater than 0º and less than 90º.	
Right angle	A **right angle** equals exactly 90º.	
Obtuse angle	An **obtuse angle** is greater than 90º and less than 180º.	
Straight angle	A **straight angle** equals exactly 180º	
Reflex angle	A **reflex angle** is greater than 180º and less than 360º.	

Angle Relationship	Definition	Diagram
Adjacent angles	Angle with a common vertex and one common side	
Complementary angles	Two angles whose measures add to 90 degrees	
Supplementary angles	Two angles whose measures add to 180 degrees	
Vertical angles	Angles that have a common vertex and whose sides are formed by the same lines.	
Alternate interior angles	Pairs of interior angles on opposite sides of the transversal.	
Alternate exterior angles	Pairs of exterior angles on opposite sides of the transversal.	

Corresponding angles	When two lines are crossed by another line (which is called the Transversal), the angles in similar positions are called corresponding angles.	

Type of Lines	**Definition**	**Diagram**
Intersecting Lines	Two or more lines that meet at a point are called intersecting lines.	
Parallel Lines	Type of lines that never meet.	
Perpendicular Lines	Lines intersect to form right angles.	
Skew Lines	Lines that do not lie on the same plane.	
Co planer Lines	Lines that lie on the same plane.	

Transversal Line	A line that intersect two other coplanar Lines.	

[The Relation between the Degree and Radian]

If an angle measured in degree is D and in radian is R, then the relation between D and R is given by
D = (180°/π) * R
R = (π/180°)*D

Triangle

Area of a triangle:

$$A = \frac{1}{2}(bh)$$

Where,

b is the distance along the base

h is the height

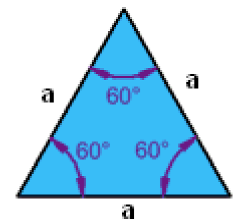
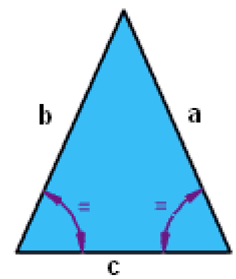
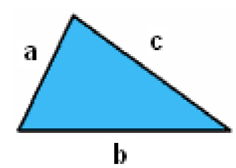
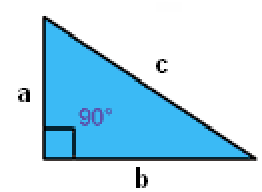
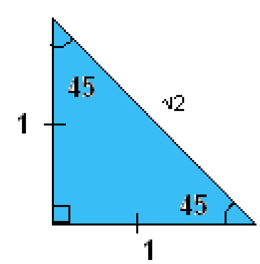
Properties of Triangles

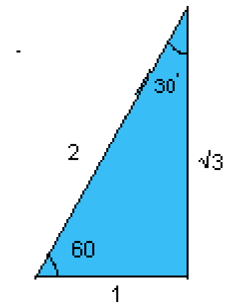
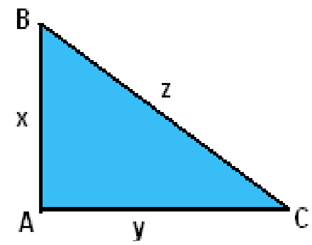
Triangles have the following properties:

- All triangles have 3 straight sides, 3 corners (vertices), and 3 angles.
- All triangles have angles adding up to 180°.

Types of Triangle :

- **Equilateral Triangles**
- **Isosceles Triangles**
- **Scalene Triangles**

Types of Triangle	**Definition**	**Formula**	**Diagram**
Equilateral triangle	A triangle in which all sides have same length or all interior angle have equal measure.	Area $= a^2 \frac{\sqrt{3}}{4}$ Perimeter = 3a Where, a Length of the side.	
Isosceles triangle	If a triangle has at least two sides of equal length or at least two interior angles of equal measure.	Area $= b \frac{\sqrt{4a^2 - b^2}}{4}$ Perimeter = 2a + b Where, a and b are Length of the sides.	
Scalene triangle	In a triangle, if no two sides have equal length or no two interior angles have equal measure.	Area $= \frac{base \times height}{2}$ Perimeter = a+ b+ c Where, a ,band c are Length of the sides.	
Right Triangle	Right angled triangle is a triangle in which one of the interior angle is a right angle.	Area $= \frac{a \times b}{2}$ Perimeter = a + b +c Where, a ,band c are Length of the sides.	
45-45-90 right angled triangle	The measure of the interior angles of this triangle are 45^0, 45^0, 90^0. This is an isosceles triangle.	The ratio of the sides of this triangle is $L_{45} : L_{45} : L_{90} = 1 : 1 : \sqrt{2}$ where L_{45}, L_{45} and L_{90} are the length of the side opposite to the 45^0, 45^0, 90^0 angles respectively.	

30-60-90 right angled triangle	The measure of the interior angles of this triangle are 30^0, 60^0, 90^0. This an scalene triangle	The ratio of the sides of this triangle is: $L_{30} : L_{60} : L_{90} = 1 : \sqrt{3} : 2$. where L_{30}, L_{60} and L_{90} are the length of the side opposite to the 30^0, 60^0, 90^0 angles respectively.	
Pythagorean theorem	The square of the hypotenuse of a right triangle is equal to the sum of the squares on the other two sides. In ΔABC , interior angle BAC is a right angle.	Let length of side AB be x units, length of AC be y units and length of BC be z units. By Pythagorean theorem, $z^2 = x^2 + y^2$.	

Polygon

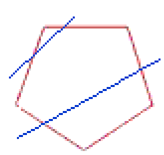
Types of Polygons :

Regular - all angles are equal and all sides are the same length. Regular polygons are both equiangular and equilateral.

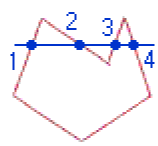
Equiangular - all angles are equal.

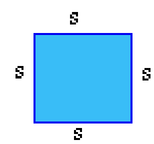
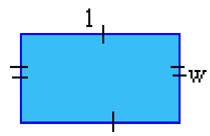
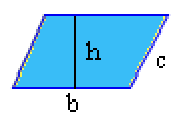
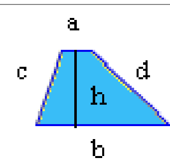
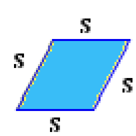
Equilateral - all sides are the same length.

Convex - a straight line drawn through a convex polygon crosses at most two sides. Every interior angle is less than 180°.



Concave - you can draw at least one straight line through a concave polygon that crosses more than two sides. At least one interior angle is more than 180°.



Shapes	Angle	Diagram	Formula
Square	All sides equal, all angles 90°		Area = s^2 Perimeter = 4s Diagonals = s*sqrt(2) Where s is the side
Rectangle	Opposite sides equal, all angles 90°		Area = l*w Perimeter = 2(l + w) $Diagonal = \sqrt{w^2 + h^2}$ where, w is the width h is the height l is the length
Parallelogram	Opposite sides parallel		Area = bh Perimeter = 2(b+c)
Trapezoid	Two sides parallel		Area = [(a+b)h]/2 Perimeter= a+b+c+d
Rhombus	Opposite sides parallel and equal		Area = (1/2)(d1)(d2) Perimeter = 4s

Number of Diagonals for n-sided polygons:

= (n(n-3))/2

Points to remember:

(i) Polygon is a closed figure.It starts with 3 sides and it can have n sides.

(ii) In a polygon, we have 3 types of angles, they are : Internal or Interior angle ; External angle ; Exterior angle.

(iii) Exterior angle is different from external angle.

(iv) Interior angle + Exterior angle = 180

(v) Interior angle + External angle = n × 360

(vi) Smallest interior angle + Largest external angle = 360º and vise versa.

(vii) Sum of the Interior or internal angle of an n-gon = (n-2) × 180

(viii) Sum of the exterior angles of n-gon is 360

(ix) Sum of the external angles of the polygon = (n+2) × 180

(x) There are two types of polygon, they are convex and concave polygon.

(xi) Convex Polygon : It is a polygon, where, the internal angles formed will be less than 180

(xii) Concave Polygon : If any of the internal angle measures greater than 180º, then the polygon formed is a concave polygon.

Circle

Area = Pie (r^2)

Circumference = 2 pie(r)
Where r is the radius f the circle and d is its diameter.

Arc Length = [(degree measure of sector's arc)*(pie(r^2))]/360

Area of the Sector
= [(degree measure of sector's arc)*(pie(r^2)]/360

Coordinate Geometry:

Straight line:

$y = mx + c$

where m is the slope.

The slopes of two parallel lines, m_1 and m_2 are equal if the lines are parallel. If the two lines are perpendicular,

$m_1 * m_2 = -1$.

Finding the y-intercept:- Put x=0, In the above equation, c is the y-intercept.
Finding the x-intercept:- Put y=0. In the above equation, -c/m is the x-intercept.

Equation of a straight line parallel to the y-axis at a distance 'a' from it is x=a.

Equation of a straight line parallel to the x-axis at a distance 'b' from it is y=b.

Equation of a line parallel to the x-axis and passing through the point (a,b) is y=b.

Equation of a line perpendicular to x-axis and passing through (a,b) is x=a.

Equation of a line parallel to the y-axis and passing through (a,b) is x=a.

Equation of a line perpendicular to the y-axis and passing through (a,b) is y=b.

Equation of x-axis is y=0 and equation of y-axis is x=0.

The equation of a straight line which cuts off intercepts a and b on the x-axis and y-axis is

$x/a + y/b = 1$.

The equation of a straight line passing through the origin (0,0) is **y=mx.**

The equation of a straight line passing through the origin and making equal angle with both the axes is **y=±x**

Slope intercept Form:

$y = mx + b$

Point Slope form:

$$y - y_1 = m(x - x_1)$$

Two point form

$$(y - y_1) = [(y_2 - y_1)(x - x_1)/(x_2 - x_1)]$$

Intercept Form:

$$(x/a) + (y/b) = 1$$

A quadratic equation of the form

$y = ax^2 + bx + c$

where a, b, c are constant

If $a \neq 0$ then graph of the equation will be a parabola.

If $a > 0$ then parabola opens upward

If $a < 0$ then parabola opens downward

Ways to find the vertex of the parabola

x coordinate of vertex = $-(b/2a)$

y coordinate of vertex can obtained by substituting the above the x value in the equation.

Hence the coordinate of the vertex is given by (x,y).

Standard form of equation of a Circle

The graph of an equation of the form

$(x - a)^2 + (y - b)^2 = r^2$

is a circle with its center at the point (a , b) and with radius r.

Solid Geometry and Shaded area:

Area/Perimeter :

Area of Rectangle = length * breadth

Perimeter of rectangle = 2 (length + breadth)

Area of square = $(side)^2$

Perimeter of square = 4 * side

Area of triangle =(1/2)* base * height

Area of equilateral triangle = $(\sqrt{3}/4) * (side)^2$
Area of parallelogram = base * height
Area of trapezium = $(1/2) * (a+b) * h$
where a and b are length of the parallel sides , h is distance between them .
Circumference of circle = $2 \pi r$
Area of circle = πr^2
length of Arc = $[\theta / 360] * 2\pi r$
area of circle = $[\theta/360] * \pi * r^2$

Volume :

Volume of cuboid = lbh
Surface area cuboid = 2 (lb + bh + hl)
Body Diagonal = sqrt(l^2 + b^2 + h^2)

Volume of cube = a^3
Surface area = 6 a^2
Body diagonal = $\sqrt{3}\, a$

volume of Sphere = [4/3]*π*r^3
Surface area of Sphere = 4 π*r^2

Volume of Cylinder = π*r^ 2 *h
Curved surface area of cylinder = 2πrh
Total surface area of cylinder = 2πr (h + r)

Slant height of cone = sqrt(h^2 + r^2)
Volume of cone =[1/3]*π*r^2* h
Curved surface area of cone = πrl
Total surface area of cone = πr (r + l)

Generally for any DI question, it is important to analyze the graph first and then check the question.

In the graph, you need to check,
What is the graph talking about.
What is given in the x-axis and what is given in the y-axis
Is the values given in numbers or percentages. If the values are percentages, then definitely a total value will be given somewhere. So, find the total value.
In case, there are more than one graph, the additional thing that you should find is,

what is the relation between the different graphs given.
After finding all these, you check the question and solve it.