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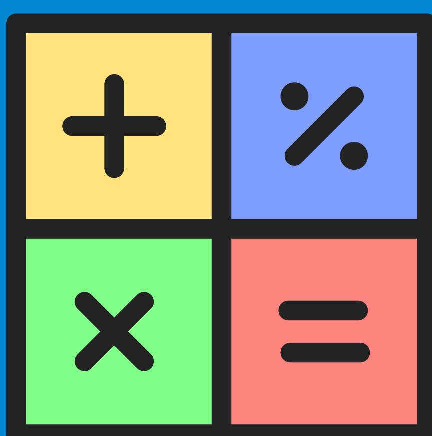
MATH FORMULAS



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(GMAT 760)

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GMAT Arithmetic Formulas PDF

By GMATPoint.com

GMAT Arithmetic Formulas [PDF]

- Integers ∈ {...-5,-4,-3,-2,-1,0,1,2,3,4,5...}
- If integer a is divisible by b, then a = nb, i.e n is a natural number.
- a is a multiple of b; b is a divisor/factor of a.
- a = nb + q
- a = dividend
- n = quotient
- b = divisor
- q = reminder

Ex: 29 = 4*7+1

- Even integer → divisible by 2
- Odd integer → not divisible by 2
- Odd ±Odd = Even
- Even ±Even = Even
- Odd ±Even = Odd
- Even ±Odd = Odd
- Odd*Odd = Odd
- Odd*Even = Even
- Even*Even = Even
- $(odd)^n = odd$
- $(even)^n = even$

- Prime Number→has 2 Factors only (1 and itself). Ex - 2,3,5,7...
- Composite Number→have more than 2 factors.
- 1 ∋- neither nor composite
- 2 - prime (only even number)
- 1 x n = n x 1 = n
- n/1 = n
- n + 0 = n - 0 = n
- Divisible by 0 is not allowed
- Fractions$\rightarrow \frac{n}{2} \Rightarrow d \neq 0$

  n = numerator, d =denomination
- if $\frac{n_1}{d_1} = \frac{n_2}{d_2}$, they are equivalent fractions.

- Addition and subtraction of fractions

$$\frac{13}{5}+\frac{14}{5}=\frac{13+14}{5}=\frac{27}{5}$$

$$\frac{6}{7}-\frac{3}{7}=\frac{6-3}{7}=\frac{3}{7}$$

$$\frac{1}{2}+\frac{3}{4}=\frac{4+2*3}{2*4}=\frac{10}{8}=\frac{5}{4}$$

$$\frac{1}{2}+\frac{3}{4}=\frac{2*3}{4(LCM)}=\frac{5}{4}$$

- Multiplication and division of fractions

$$\frac{2}{13}\mathbf{X}\frac{7}{9}=\frac{2x7}{13x9}=\frac{14}{117}$$

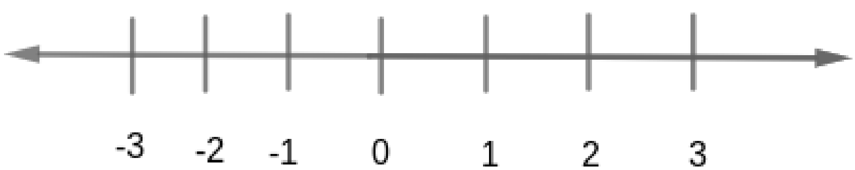
$$\frac{2}{5}\div\frac{3}{4}=\frac{2}{5}\mathbf{X}\frac{4}{3}=\frac{2x4}{5x3}=\frac{8}{15}$$

- Mixed Fraction $\rightarrow 17\frac{1}{4} = 17 + \frac{1}{4} = \frac{17x4+1}{4} = \frac{69}{4}$

- Decimal = 364.57
- 1.3+2.6 = 3.9 (Addition with carry forward)

- 1.3 x 2.6 = 0.26 (Decimal Has as many digits after it as the sum of that of the 2 numbers)

- $5\sqrt{1.7}$ = 0.34
- Real Numbers $\rightarrow$+ve,0,-ve



Absolute Value $\rightarrow$The number without sign

- $|x|$= x if x is positive

    = -x if x negative

- $x + y = y + x$
- $ab = ba$
- $a + (b+c) = (a+b)+c = b + (a + c)$
- $(ab)d = a(bd) = b(ad)$
- $xy+yz = y(x+z)$
- $(+ve) + (+ve) = (+ve)$
- $(-ve) + (-ve) = (-ve)$
- $(+ve) \times (+ve) = (+ve)$
- $(-ve) \times (-ve) = (+ve)$
- $(+ve) \times (-ve) = (-ve)$
- $x \times 0 = 0$
- $|x + y| \leq |x| + |y|$
- $2:3 = \frac{2}{3} = 0.67$

(Ratio can be represented in these ways)

- If a value x is greater than 100% of a value y, x>y

$$130\%=\frac{130}{100}=1.3$$

$$130\% \text{ of } y = 1.3y$$

- If a value x is less than 1% of y

$$x < \frac{1}{100}y$$

- Percentage change = $\frac{change\ in\ value}{Initial\ value} \times 100\%$

- If x becomes y, % change = $\frac{|y-x|}{x} \times 100\%$

- If y > x, % increase, else % decrease

- Successive % change of a% and b% = $(a+b+\frac{ab}{100})\%$

  so, if 100 increases by 20% and then 30%, % increase = $(20+30+\frac{20x30}{100})=56\%$

➔ $a^b = a \times a \times a \times ......(upto\ b\ times)$

➔ $5^3 = 5 \times 5 \times 5$

➔ $(-5)^3 = -5 \times -5 \times -5$

➔ $(0.5)^3 = 0.5 \times 0.5 \times 0.5$

- $a^2 \rightarrow a\ squared$
- $(n)^{even}$ = Positive (if n is positive)

  = Positive (if n is negative)

- $(n)^{odd}$ = Positive (if n is positive)

  = Negative (if n is negative)

- Square root = $\sqrt{a} \rightarrow a\ cannot\ be\ negative$

- $\sqrt{25} = \sqrt{5^2} = 5$

- Mean = Average = $\dfrac{a_1+a_2+......+a_n}{n}$

- Median is the middle number of a list when arranged in ascending/descending order

  (It is the average of the middle 2 numbers if the number of numbers is even)

➔ Mode - The most frequent number in a list

→ $|A \cup B| = |A| + |B| - |A \cap B|$

→ n! = n(n-1)(n-2).....!

→ 0! = 1! = 1

→ $^{n}C_{r} = \frac{n!}{r!\ n-r!}$

→ $P(E) = \frac{\text{The number of favourable outcomes}}{\text{The total number of outcomes}}$

→ P(Aor B) = P(A) + P(B)

(If A & B are mutually exclusive)

→ P(A or B) = P(A) + P(B) – P(A) P(B)

(If A & B are not mutually exclusive)

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GMAT Time & Work Formulas PDF

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GMAT Time & Work Formulas

- Time, Distance and Work is the most important topic for GMAT Quant Section
- The questions from this topic vary from easy to difficult. This formula sheet covers the most importance tips that helps you to answer the questions in a easy, fast and accurate way

$$Distance = Speed \times Time$$

$$Speed = \frac{Distance}{Time}$$

$$Time = \frac{Distance}{Speed}$$

- While converting the speed in m/s to km/hr, multiply it by $\left(\frac{18}{5}\right) \Rightarrow$ 1 m/s = 3.6 km/h

- While converting km/hr into m/sec, we multiply by $\left(\frac{5}{18}\right)$
- If the ratio of the speeds of A and B is a : b, then
  - ➔ The ratio of the times taken to cover the same distance is 1/a : 1/b or b : a.
  - ➔ The ratio of distance travelled in equal time intervals is a : b

$$Average\ Speed = \frac{Total\ Distance\ Travelled}{Total\ Time\ Taken}$$

- If a part of a journey is travelled at speed $S_1\ km/hr$ in $T_1\ hours$ and remaining part at speed $S_2\ km/hr$ in $T_2\ hours$ then,

  Total distance travelled = $S_1T_1 + S_2T_2\ km$

$$Average\ Speed\ = \frac{S_1T_1+S_2T_2}{T_1+T_2} km/hr$$

- If $D_1\ km$ is travelled at speed $S_1\ km/hr$, and $D_2\ km$ is travelled at speed $S_2\ km/hr$ then,

$$Average\ Speed\ = \frac{D_1+D_2}{\frac{D_1}{S_1}+\frac{D_2}{S_2}} km/hr$$

- In a journey travelled with different speeds, if the distance covered in each stage is constant, the average speed is the harmonic mean of the different speeds.
- Suppose a man covers a certain distance at x km/hr and a equal distance at y km/hr

Then the average speed during the whole journey is $\frac{2xy}{x+y} km/hr$

- In a journey travelled with different speeds, if the time travelled in each stage is constant, the average speed is the arithmetic mean of the different speeds.
- If a man travelled for a certain distance at x km/hr and for equal amount of time at the speed of y km/hr then the average speed during the whole journey is $\frac{x+y}{2} km/hr$

- **Constant Distance:**

Let the distance travelled in each part of the journey be d_1, d_2 & d_3 and so on till d_n and the speeds in each part be s_1, s_2, s_3 and so on till s_n

If $d_1 = d_2 = d_3 = ... = d_n = d$, then the average speed is the harmonic mean of the speeds s_1, s_2, s_3 and so on till s_n.

- **Constant Time:**

Let the distance travelled in each part of the journey be d_1, d_2 *and* d_3 and so on till d_n and the speeds in each part be t_1, t_2, t_3 and so on till t_n.

If $t_1 = t_2 = t_3 = ... = t_n = t$, then the average speed is the harmonic mean of the speeds s_1, s_2, s_3 and so on till s_n.

- **Circular Tracks:**

  If two people are running on a circular track with speeds in ratio a:b where a and b are co-prime, then

  ➔ They will meet at $a + b$ distinct points if they are running in opposite directions.

  ➔ They will meet at $|a - b|$ distinct points if they are running in same direction

- If two people are running on a circular track having perimeter 'l', with speeds 'm' and 'n',

  ➔ The time for their first meeting = $\frac{I}{(m+n)}$

(when they are running in opposite directions)

  ➔ The time for their first meeting = $\frac{I}{|(m+n)|}$

(when they are running in the same direction)

- If a person P starts from A and heads towards B and another person Q starts from B and heads towards A and they meet after a time 't' then,

$$t = \sqrt{(x \times y)}$$

where x = time taken (after meeting) by P to reach B and y = time taken (after meeting) by Q to reach A.

- A and B started at a time towards each other. After crossing each other, they took $T_1 hrs,\ T_2 hrs$ respectively to reach their destinations. If they travel at constant speed S_1 and S_2 respectively all over the journey, then

$$\frac{S_1}{S_2} = \sqrt{\frac{T_2}{T_1}}$$

- **Trains:**

$\Rightarrow$ Two trains of length L_1 and L_2 travelling at

speed S_1 and S_2 cross each other in a time

$=\frac{L_1 + L_2}{S_1 + S_2}$ (If they are going in opposite directions)

$=\frac{L_1 + L_2}{|S_1 - S_2|}$ (If they are going in the same directions)

- **Work:**

$\Rightarrow$ If X can do a work in ‘n’ days, the fraction of work X does in a day is $\frac{1}{n}$

$\Rightarrow$ If X can do work in ‘x’ days, and Y can do work in ‘y’ days, then the number of days taken by both of them together is $\frac{x \times y}{x + y}$

$\Rightarrow$ If M_1 men work for H_1 *hours* per day and worked for D_1 days and completed W_1 work, and if M_2 men work for H_2 hours per day and worked for D_2 days and completed W_2 work, then

$$\frac{M_1 H_1 D_1}{W_1} = \frac{M_2 H_2 D_2}{W_2}$$

- **Boats & Streams:**

$\Rightarrow$ If the speed of water is 'W' and speed of a boat in still water is ‘B’

$\Rightarrow$ Speed of the boat (downstream) is B+W

$\Rightarrow$ Speed of the boat (upstream) is B–W

The direction along the stream is called **downstream.**

And, the direction against the stream is called **upstream.**

$\Rightarrow$ If the speed of the boat downstream is x km/hr and the speed of the boat upstream is y km/hr, then

$\Rightarrow$ Speed of the boat in still water = $\frac{x+y}{2}$km/hr

$\Rightarrow$ Rate of stream = $\frac{x-y}{2}\ km/hr$

Pipes & Cisterns:

⇒ Inlet Pipe : A pipe which is used to fill the tank is known as Inlet Pipe.

⇒ Outlet Pipe : A pipe which can empty the tank is known as outlet pipe.

- If a pipe can fill a tank in 'x' hours then the part filled per hour $=\frac{1}{x}$
- If a pipe can empty a tank in 'y' hours, then the part emptied per hour $=\frac{1}{y}$
- If a pipe A can fill a tank in 'x' hours and pipe can empty a tank in 'y' hours, if they are both active at the same time, then

The part filled per hour = $\frac{1}{x} - \frac{1}{y}$ $(If\ y > x)$

The part emptied per hour = $\frac{1}{y} - \frac{1}{x}$ $(If\ x > y)$

- **Some Tips and Tricks:**
- Some of the questions may consume a lot of time. While solving, write down the equations without any eros once you fully understand the given problem. A few extra seconds can help you avoid silly mistakes.
- Check if the units of distance, speed and time match up. If you see yourself adding a unit of distance like m to a unit of speed m/s, you would realise you have possibly missed a term.
- Choose to apply the concept of relative speed wherever possible since it can greatly reduce the complexity of the problem.
- In time and work, while working with equations, ensure that you convert all terms to consistent units like man-hours.

GMAT
Ratio And Proportions Formulas PDF

By GMATPoint.com

Ratio and Proportion Tips Formulae and shortcuts

- **Ratio and Proportion**
- One of the most basic GMAT topics is ratio and proportions. It's merely a continuation of high school math.
- The fundamentals of this notion are significant not only in their own right, but also in answering questions about other concepts.
- All ratio and proportion problems need the use of the ratio proportion formula. We may simplify our work and save a lot of time by using the ratio

proportion formula. So, here are the formulas for proportional ratios.

- A ratio can only compare two numbers with the same unit, and the sign we use to denote a ratio is ":" In a faction, we use "/" and "to" to represent a ratio.
- The Ratio of the number a to the number b (b$\neq$ 0) is $\frac{a}{b}$
- Example: A ratio, for example, can be expressed or represented in a variety of ways. For instance, the ratio of 2 to 3 can be expressed as 2:3 or $\frac{2}{3}$

- The order in which the terms of a ratio are written is important. The ratio of the number of months having precisely 30 days to the number of months with exactly 31 days, for example is $\frac{4}{7}$,not$\frac{7}{4}$
- It is not necessary for a ratio to be positive. When dealing with quantities of objects, however, the ratios will be positive. Only positive ratios will be considered in this notion.
- A ratio remains the same if both antecedent and consequent are multiplied or divided by the same non-zero number, i.e.,

$$\frac{a}{b}=\frac{pa}{pb}=\frac{qa}{qb}, \text{ p,q} \neq 0$$

$$\frac{a}{b}=\frac{a/p}{b/p}=\frac{a/q}{b/q}, \text{ p,q} \neq 0$$

- Two ratios in fraction notation can be compared in the same way that actual numbers can.

$$\frac{a}{b} = \frac{p}{q} \Leftrightarrow aq = bp$$

$$\frac{a}{b} > \frac{p}{q} \Leftrightarrow aq > bp$$

$$\frac{a}{b} < \frac{p}{q} \Leftrightarrow aq < bp$$

- **If a, b, x are positive, then**

If a > b, then $\frac{a+x}{b+x} < \frac{a}{b}$

If a < b, then $\frac{a+x}{b+x} > \frac{a}{b}$

If a > b, then $\frac{a-x}{b-x} > \frac{a}{b}$

If a < b, then $\frac{a-x}{b-x} < \frac{a}{b}$

If $\frac{a}{p} = \frac{b}{q} = \frac{c}{r} = \frac{d}{s} = \dots$,

then a:b:c:d:... = p:q:r:s:...

- **If two ratios $\frac{a}{b}$ and $\frac{c}{d}$ are equal**
  - $\frac{a}{b} = \frac{c}{d} \Rightarrow \frac{b}{a} = \frac{d}{c}$ (Invertendo)
  - $\frac{a}{b} = \frac{c}{d} \Rightarrow \frac{c}{a} = \frac{b}{d}$ (Alternendo)
  - $\frac{a}{b} = \frac{c}{d} \Rightarrow \frac{a+b}{b} = \frac{c+d}{d}$ (Componendo)
  - $\frac{a}{b} = \frac{c}{d} \Rightarrow \frac{a-b}{b} = \frac{c-d}{d}$ (Dividendo)
  - $\frac{a}{b} = \frac{c}{d} \Rightarrow \frac{a+b}{a-b} =$ (Componendo-Dividendo)
  - a/b = c/d ⇒ pa+qb/ra+sb = pc+qd/ rc+sd, for all real p, q, r, s such that pa+qb≠0 and rc+sd≠0

- **If a, b, c, d, e, f, p, q, r are constants and are not equal to zero**

➔ $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \ldots$ then each of these ratios is equal to $\frac{a+c+e\ldots}{b+d+f\ldots}$

➔ $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \ldots$ then each of these ratios is equal to $\frac{pa+qc+re\ldots}{pb+qd+rf\ldots}$

➔ Duplicate Ratio of a : b is $a^2 : b^2$

➔ Sub-duplicate ratio of a : b is $\sqrt{a} : \sqrt{b}$

➔ Triplicate Ratio of a : b is $a^3 : b^3$

➔ Sub-triplicate ratio of a : b is $a^{1/3} : b^{1/3}$

Proportions :

- A proportion is defined as an equalisation of ratios.
- As a result, if a:b = c:d is a ratio, the first and final terms are referred to as extremes, whereas the middle two phrases are referred to as means.
- When four terms a, b, c, and d are considered to be proportionate, a:b = c:d is the result. When three terms a, b, and c are considered to be proportionate, a:b = b:c is the result.
- A proportion is a statement that two ratios are equal; for example $\frac{2}{3}=\frac{8}{12}$ is a proportion.
- One way to solve a proportion involving an unknown is to cross multiply, obtaining a new equality.

- For example, to solve for n in the proportion $\frac{2}{3}=\frac{n}{12}$, cross multiply, obtaining 24=3n, then divide both sides by 3, to get n=8

Properties of proportions :

- If a:b = c:d is a proportion, then Product of extremes = product of means i.e., ad = bc
- Denominator addition/subtraction: a:a+b = c:c+d and a:a−b = c:c−d
- a, b, c, d,.... are in continued proportion means, a:b = b:c = c:d = ...
- a:b = b:c then b is called mean proportional and b^2= ac

- The third proportional of two numbers, a and b, is c, such that, a:b = b:c. d is fourth proportional to numbers a, b, c if a:b = c:d

Variations :

- If x varies directly to y, then x is said to be in directly proportional with y and
  is written as $x \propto y$
  - ➔ x = ky (where k is direct proportionality constant)
  - ➔ x = ky + C (If x depends upon some other fixed constant C)
- If x varies inversely to y, then x is said to be in inversely proportional with y and is written as $x \propto \frac{1}{y}$

➔ $x = k\frac{1}{y}$(where k is indirect proportionality constant)

➔ $x = k\frac{1}{y} + C$ (If x depends upon some other fixed constant C)

- If x ∝ y and y ∝ z then x ∝ z
- If x ∝ y and x ∝ z then x ∝ (y ± z)
- If a ∝ b and x ∝ y then ax ∝ by

GMATPoint

GMAT Mixtures & Alligations Formulas PDF

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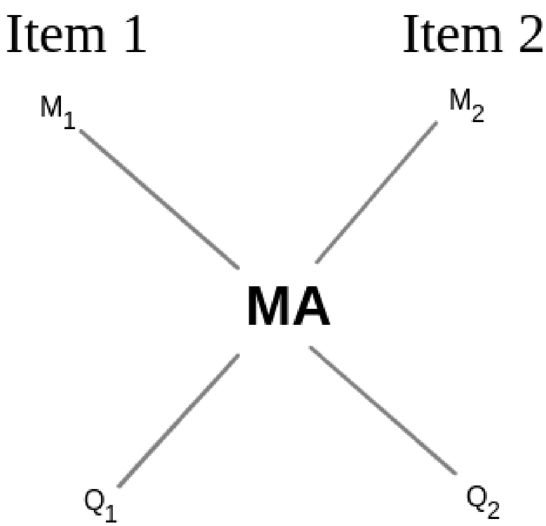
GMAT Mixtures And Alligations Formulas PDF

- Mixtures and alligations are a common type of quantitative problem that may appear on the GMAT. These problems involve mixing two or more substances to form a new mixture, and then finding the ratio or quantity of each substance in the mixture.
- Alligation is a specific method for solving mixture problems that involves representing the ingredients and the mixture as points on a line, and using the distance between these points to find the ratio of the ingredients in the mixture.
- There are many variations of mixture and alligation problems that may appear on the GMAT,

but they all involve some variation of this basic concept. To prepare for these types of problems, it is important to practise solving a variety of mixture and alligation problems, and to become familiar with the basic formulas and methods for solving them.

- **Types of mixtures:**
  - **Simple mixture:** A simple mixture is formed by the mixture of two or more different substances. Example: Water and Wine mixture.
  - **Compound mixture:** A Compound mixture is formed by the mixture of two or more simple mixtures.
    Example: one part of 'water and wine' mixture mixed with two parts of 'water and milk' mixture

- If M_1 and M_2 are the values and Q1 and Q2 are the quantities of item 1 and item 2 respectively, and M_A is the weighted average of the two items, then



$$\frac{Q_1}{Q_2} = \frac{M_2 - M_A}{M_A - M_1}$$

- Weighted average M_A can be calculated by

$$M_A = \frac{Q_1 M_1 + Q_2 M_A}{Q_1 + Q_2}$$

- The alligation rule can also be applied when cheaper substance is mixed with expensive substance

$$\frac{Quantity\ of\ cheaper}{Quantity\ of\ dearer} = \frac{Price\ of\ cheaper - Mean\ price}{Mean\ Price - Price\ of\ cheaper}$$

- If two mixtures M_1 and M_2 , having substances S_1 and S_2 in the ratio a:b and p:q respectively are mixed, then in the final mixture,

$$\frac{Quantity\ of\ S_1}{Quantity\ of\ S_2} = \frac{M_1\left[\frac{a}{a+b}\right] + M_2\left[\frac{p}{p+q}\right]}{M_1\left[\frac{b}{a+b}\right] + M_2\left[\frac{q}{p+q}\right]}$$

- If there is a container with ‘a’ litres of liquid A and if ‘b’ litres are withdrawn and an equal amount of the mixture is replaced with another liquid B and if this operation is repeated ‘n’ times, then after the *nth* operation,

Liquid A in the container = $\left[\frac{a-b}{a+b}\right]^n$ × Initial quantity of A in the container

Profit, Loss & Discounts

Formulas and shortcuts

By GMATPoint.com

Profit, Loss & Discounts Formulas and shortcuts

- Profit, Loss, and Discount is an important topic for the **GMAT**, with questions asked under the Word Problem category.

- The number of concepts in these areas is modest, and the equations may be used to answer the majority of the problems.

- This document provides a variety of profit, loss, and discount formulas, recommendations, and shortcuts.

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Profit and Loss

Cost Price:

The amount paid to purchase an article or the cost of manufacturing an article is called Cost Price (C.P)

Selling Price:

The price at which a product is sold is called Selling price (S.P)

Marked Price:

The price at which an article is marked is called Marked price (M.P)

If S.P>C.P, then Profit or Gain,
P = S.P – S.P

If C.P>S.P, then Loss,
L = C.P – S.P

% Profit or Gain percentage or Profit Percentage = $\frac{Profit}{C.P} \times 100$

%Loss = $\frac{Loss}{C.P} \times 100$

Discount = M.P – S.P (If no discount is given, then M.P = S.P)

%Discount = $\frac{Discount}{M.P} \times 100$

Total increase in price due to two subsequent increases of X% and Y% is (X+ Y+ $\frac{XY}{100}$)%

If two items are sold at same price, each at Rs. x, one at a profit of P% and other at a loss of P% then there will be overall loss of $\frac{P^2}{100}$

The absolute value of loss $= \frac{2P^2x}{100^2 - P^2}$

If C.P of two items is the same, and by selling each item he earned p% profit on one article and p% loss on another, then there will be no loss or gain.

If a trader professes to sell at C.P but uses false weight, then

Gain% $= \frac{Error}{True\ value - Error} \times 100$

S.P = $\left(\frac{100 + Profit\%}{100}\right)$ C.P (If S.P > C.P)

S.P = $\left(\frac{100 - Loss\%}{100}\right)$ C.P (If S.P < C.P)

C.P = $\frac{100 \times S.P}{100 + Profit\%}$(If S.P > C.P)

C.P = $\frac{100 \times S.P}{100 - Loss\%}$(If S.P < C.P)

Buy x get y free, then the %discount = $\frac{y}{x+y} \times$ 100.

(here x+y articles are sold at C.P of x articles.)

When there are two successive discounts of a% and b% are given then the,

Resultant discount = $(a + b - \frac{a*b}{100})$

If C.P of x article is equal to the selling price of y articles then the,

Resultant profit % or loss % = $\frac{y}{x-y} \times 100$

GMAT Interests (SI & CI) Formulas PDF

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GMAT Interests (SI & CI) Formulas [PDF]

- Simple Interest (S.I) and Compound Interest (C.I) is one of the easiest topics in the GMAT quant section.
- One can expect a few questions to appear from this topic and students should definitely aim to get most of these questions right.
- The number of concepts that are tested from these topics is limited and most of the problems can be solved by applying the formulae directly.
- Many students commit silly mistakes in this topic due to complacency, which should be avoided.

- In Simple Interest, the principal and the interest calculated for a specific year or time interval remains constant.
- In Compound Interest, the interest earned over the period is added over to the existing principal after every compounding period and thus, the principal and the interest change after every compounding period.
- For the same principal, positive rate of interest and time period (>1 year), the compound interest on the loan is always greater than the simple interest.

- **Simple Interest**
- The sum of principal and the interest is called Amount.

Amount (A) = Principal (P) + Interest (I)

- The Simple Interest (I) occurred over a time period (T) for R% (rate of interest per annum),

$$I = \frac{PTR}{100}$$

- **Compound Interest**
- The amount to be paid, if money is borrowed at Compound Interest for N number of years,

$$A = P\left(1 + \frac{R}{100}\right)^{N}$$

- The Interest occurred, I = A – P

$$I = P\left(1 + \frac{R}{100}\right)^{N} - P$$

- If the interest is compounded half yearly, then

Amount, A = $P\left(1 + \frac{R/2}{100}\right)^{2N}$

- If the interest is compounded quarterly, then

Amount, A = $P\left(1 + \frac{R/4}{100}\right)^{4N}$

- If interest Rate is R_1% for first year, R_2% for second year and R_3% for 3^{rd} year then the Amount,

$$A = P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)\left(1 + \frac{R_3}{100}\right)$$

- If a difference between C.I and S.I for certain sum at same rate of interest is given, then

$$Principal\ (P) = (difference\ between\ CI\ and\ SI) * (100/R)^2$$

- **Installments and Present Worth:**
- If R is the rate of interest per annum, then the present worth of Rs. 'K' due N years hence is represented as

$$\text{Present worth} = \frac{K}{\left(1+\frac{R}{100}\right)^N}$$

- If an amount of 'P' is borrowed for 'n' years at 'r'% per annum, and 'x' is the installment that is paid at the end of each year starting from the first year, then $x = \frac{P\left(\frac{r}{100}\right)\left(1+\frac{r}{100}\right)^n}{\left(1+\frac{r}{100}\right)^n - 1}$

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GMAT Algebra Formulas PDF

By GMATPoint.com

Linear Equations

- Linear equations is one of the foundation topics in the Quant section on the GMAT. Hence, concepts from this topic are useful in solving questions from a range of different topics.
- A linear equation is an equation which gives a straight line when plotted on a graph.
- Linear equations can be of one variable or two variable or three variable.
- Generally, the number of equations needed to solve the given problem is equal to the number of variables
- Let a, b, c and d are constants and x, y and z are variables. A general form of single variable linear equation is $ax+b = 0$.

- A general form of two variable linear equations is ax+by = c.
- A general form of three variable linear equations is ax+by+cz = d.

Equations with two variables:

➔ Consider two equations ax+by = c and mx+ny = p. Each of these equations represent two lines on the x-y coordinate plane. The solution of these equations is the point of intersection.

➔ If $\frac{a}{m} = \frac{b}{n} \neq \frac{c}{p}$ then the slope of the two equations is equal and so they are parallel to each other. Hence, no point of intersection occurs. Therefore no solution.

→ If $\frac{a}{m} \neq \frac{b}{n}$ then the slope is different and so they intersect each other at a single point. Hence, it has a single solution.

→ If $\frac{a}{m} = \frac{b}{n} = \frac{c}{p}$ then the two lines are the same and they have infinite points common to each other. So, infinite solutions occur.

General Procedure to solve linear equations:

→ Aggregate the constant terms and variable terms

→ For equations with more than one variable, eliminate variables by substituting equations in their place.

- Hence, for two equations with two variables x and y, express y in terms of x and substitute this in the other equation.
- For Example: let $x+y = 14$ and $x+4y = 26$ then $x = 14-y$ (from equation 1) substituting this in equation 2, we get $14-y+4y = 26$. Hence, $y = 4$ and $x = 10$.
- For equations of the form $ax+by = c$ and $mx+ny = p$, find the LCM of b and n. Multiply each equation with a constant to make the y term coefficient equal to the LCM. Then subtract equation 2 from equation 1.
- Example: Let $2x+3y = 13$ and $3x+4y = 18$ are the given equations (1) and (2).
- LCM of 3 and 4 is 12. Multiplying (1) by 4 and (2) by 3, we get $8x+12y = 52$ and $9x+12y = 54$.

  (2)-(1) gives $x=2$, $y=3$

- ➔ If the system of equations has n variables with n-1 equations then the solution is indeterminate.
- ➔ If system of equations has n variables with n-1 equations with some additional conditions (for eg. the variables are integers), then the solution may be determinate.
- ➔ If a system of equations has n variables with n-1 equations then some combination of variables may be determinable.
- ➔ For example, if $ax+by+cz = d$ and $mx+ny+pz = q$, if a, b, c are in Arithmetic progression and m, n and p are in AP then the sum $x+y+z$ is determinable.

Quadratic Equations

- Quadratic Equations is one also a important topic
- The theory involved in this topic is very simple and students should be comfortable with some basic formulas and concepts.
- The techniques like option elimination, value assumption can help to solve questions from this topic quickly.
- General Quadratic equation will be in the form of

$$ax^2 + bx + c = 0$$

- The values of ‘x’ satisfying the equation are called roots of the equation.

- The value of roots, p and q = $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

- The above formula is known as the Shreedhara Acharya's Formula, after the ancient Indian Mathematician who derived it.

- Sum of the roots = p+q = $\frac{-b}{a}$

- Product of the roots = p*q = $\frac{c}{a}$

- If 'c' and 'a' are equal then the roots are reciprocal to each other.

- If b = 0, then the roots are equal and are opposite in sign.

➔ Let D denote the discriminant, D = $b^2 - 4ac$. Depending on the sign and value of D, nature of the roots would be as follows:

- D < 0 and |D| is not a perfect square: Roots will be in the form of p+iq and p-iq where p and q are the real and imaginary parts of the complex roots. p is rational and q is irrational.
- D < 0 and |D| is a perfect square: Roots will be in the form of p+iq and p-iq where p and q are both rational.
- D = 0 ⇒ Roots are real and equal. X = -b/2a
- D > 0 and D is not a perfect square:
  Roots are conjugate surds
- D > 0 and D is a perfect square:
  Roots are real, rational and unequal

Signs of the roots:

Let P be product of roots and S be their sum

- $P > 0, S > 0$: Both roots are positive
- $P > 0, S < 0$: Both roots are negative
- $P < 0, S > 0$: Numerical smaller root is negative and the other root is positive
- $P < 0, S < 0$: Numerical larger root is negative and the other root is positive

- Minimum and maximum values of

$ax^2 + bx + c = 0$

- If $a > 0$: minimum value $= \frac{4ac - b^2}{4a}$ and occurs at

$$x = \frac{-b}{2a}$$

- If a < 0: maximum value = $\frac{4ac-b^2}{4a}$ and occurs at $x = \frac{-b}{2a}$
- If $A_n X^n + A_{n-1} X^{n-1} + ... + A_1 X + A_0$, then
- Sum of the roots = $\frac{-A_{n-1}}{A_n}$
- Sum of roots taken two at a time = $\frac{A_{n-2}}{A_n}$
- Sum of roots taken three at a time = $\frac{-A_{n-3}}{A_n}$ and so on Product of the roots = $\frac{[(-1)^n A_0]}{A_n}$

Finding a quadratic equation:

- If roots are given:

  $(x - a)(x - b) = 0 \Rightarrow x^2 - (a + b)x + ab = 0$

- If sum s and product p of roots are given:

$$x^2 - sx + p = 0$$

- If roots are reciprocals of roots of equation $ax^2 + bx + c = 0$, then equation is $cx^2 + bx + a = 0$

Inequalities

- The topic Inequalities is one of the few sections in the quantitative part which can throw up tricky questions. The questions are often asked in conjunction with other sections like ratio and proportion, progressions etc.
- The theory involved in Inequalities is limited and therefore, students should be comfortable with learning the basics, which involves operations such as addition, multiplication and changing of signs of the inequalities.
- The scope for making an error is high in this section as a minor mistake in calculation (like forgetting the sign) can lead to a completely different answer.

- The modulus of x, $|x|$ equals the maximum of x and $-x$

$$-|x| \le x \le |x|$$

- For any two real numbers 'a' and 'b',
  - ➔ $a > b \Rightarrow -a < -b$
  - ➔ $|a| + |b| \ge |a + b|$
  - ➔ $|a| - |b| \le |a - b|$
  - ➔ $|a \cdot b| = |a|\ |b|$
  - ➔ $|a| > |b| \Rightarrow a > b$ (if both are +ve)

    $\Rightarrow a < b$ (if both are -ve)
- For any three real numbers X, Y and Z; if $X > Y$ then $X+Z > Y+Z$
- If $X > Y$ and
  1. Z is positive, then $XZ > YZ$
  2. Z is negative, then $XZ < YZ$
  3. If X and Y are of the same sign, $1/X < 1/Y$
  4. If X and Y are of different signs, $1/X > 1/Y$

- For any positive real number, $x + \frac{1}{x} \geq 2$
- For any real number x >1, $2\left[1 + \frac{1}{x}\right]^x < 2.8$

  As x increases, the function tends to an irrational number called 'e' which is approximately equal to 2.718
- If |x| ≤ k then the value of x lies between −k and k, or −k ≤ x ≤ k
- If |x| ≥ k then x ≥ k or x ≤ -k
- If $ax^2 + bx + c < 0$ then (x-m)(x-n) < 0, and if n > m, then m < x < n
- If $ax^2 + bx + c > 0$ then (x-m)(x-n) > 0 and if m < n, then x < m and x > n
- If $ax^2 + bx + c > 0$ but m = n, then the value of x exists for all values, except x is equal to m,

  i.e., x < m and x > m but x ≠ m

Progressions & Series

- Progressions and Series is one of the important topics for GMAT.
- Some of the questions from this section can be very tough and time consuming while the others can be very easy.
- The trick to ace this section is to quickly figure out whether a question is solvable or not and not waste time on very difficult questions.
- Some of the questions in this section can be answered by ruling out wrong choices among the options available. This method will both save time and improve accuracy.
- There are many shortcuts which will be of vital importance in answering this section.

- There are 3 standard types of progressions
  - ➔ Arithmetic Progression
  - ➔ Geometric Progression
  - ➔ Harmonic Progression

Arithmetic progression (A.P):

- If the sum or difference between any two consecutive terms is constant then the terms are said to be in A.P (Example: 2,5,8,11 or a, a+d, a+2d, a+3d...)
- If 'a' is the first term and 'd' is the common difference then the general 'n' term is

$$T_n = a(n + 1)d$$

- Sum of first 'n' terms in

$$\text{A.P} = \frac{n}{2}[2a + (n - 1)d]$$

- Number of terms in

$$\text{A. P} = \frac{Last\ term - First\ term}{Common\ Difference} + 1$$

- Sum of all terms of an

$$\text{A. P} = \frac{n}{2}[First\ term + Last\ Term]$$

- **Properties of A.P:**

- If a, b , c, d,.... are in A.P and ‘k’ is a constant then
  - a−k, b−k, c−k,... will also be in A.P
  - ak, bk, ck,...will also be in A.P
  - $\frac{a}{k}, \frac{b}{k}, \frac{c}{k}$ will also be in A.P

Geometric progression (G.P):

- If in a succession of numbers the ratio of any term and the previous term is constant then that number is said to be in Geometric Progression.
- Ex :1, 3, 9, 27 or a, ar, ar^2,ar^3
- The general expression of an G.P, $T_n = ar^{n-1}$

  (where a is the first terms and ‘r’ is the common ratio)
- Sum of ‘n’ terms in G.P,

Sn=$\frac{a(1-r^n)}{1-r}$ (if r<1) or $\frac{a(r^n-1)}{r-1}$ (if r>1)

- **Properties of G.P:**

- If a, b , c, d,.... are in G.P and ‘k’ is a constant then

  1. ak, bk, ck,...will also be in G.P

2. a/k, b/k, c/k will also be in G.P

Sum of term of infinite series in G.P,

$$S_{\infty} = \frac{a}{1-r} (-1 < r < 1)$$

Harmonic progression (H.P):

- If a, b, c, d,……are unequal numbers then they are said to be in H.P if $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$,……are in A.P
- The 'n' term in H.P is 1/(nth term in A.P)

Properties of H.P :

If a, b, c, d,…are in H.P, then

a+d > b+c

ad > bc

Standard Series:

- The sum of first ‘n’ natural numbers

$$= \frac{n(n+1)}{2}$$

- The sum of squares of first ‘n’ natural numbers

$$= \frac{n(n+1)(n+2)}{2}$$

- The sum of cubes of first ‘n’ natural numbers

$$= \left\{\frac{n(n+1)}{2}\right\}^2$$

- The sum of first ‘n’ odd natural numbers = n^2
- The sum of first ‘n’ even natural numbers = n(n+1)
- In any series, if the sum of first n terms is given by S_n, then the n^{th} term $T_n = S_n - S_{n-1}$

Arithmetic Mean:

- The arithmetic mean = $\frac{Sum\ of\ all\ the\ terms}{Number\ of\ terms}$
- If two number A and B are in A.P then arithmetic mean = $\frac{a+b}{2}$
- Inserting 'n' means between two numbers a and b
- The total terms will become n+2, a is the first term and b is the last term
- Then the common difference d = $\frac{b-a}{n+1}$
- The last term b = a+(n+1)d
- The final series is a, a+d, a+2d....

Geometric Mean:

- If a, b, c,... n terms are in G.P then

$$G.M = \sqrt[n]{a * b * c * .... * n\ terms}$$

- If two numbers a, b are in G.P then their

$$G.M = \sqrt{a \times b}$$

- Inserting 'n' means between two quantities a and b with common ratio 'r'
- The final series is $a,\ ar,\ ar^2$

Harmonic Mean:

- If a, b, c, d,.. are the given numbers in H.P then the Harmonic mean of

$$\text{'n' terms} = \frac{Numbers\ of\ terms}{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+.......}$$

- If two numbers a and b are in H.P then the Harmonic Mean = $\frac{2ab}{a+b}$
- Relationship between AM, GM and HM for two numbers a and b,
- A.M=$\frac{a+b}{2}$
- G.M=$\sqrt{a\ *\ b}$
- H.M= $\frac{2ab}{a+b}$
- G.M=$\sqrt{AM\ *\ HM}$
- A.M $\geq$ G.M $\geq$ H.M

Exponents & Roots

- Exponent is nothing but a repeated multiplication.
- In x^a, x is the base and 'a' is the power or exponent.
- Some important formulas are as follows:

➔ $x^m \times x^n = x^{m+n}$

➔ $x^m \div x^n = x^{m-n}$

➔ $(x^m)^n = x^{mn}$

➔ $x^a \times y^a = (xy)^a$

➔ $\frac{x^a}{y^a} = \left(\frac{x}{y}\right)^a$

➔ $x^{-m} = \frac{1}{x^m}$

➔ $\left(\frac{x}{y}\right)^{-m} = \left(\frac{y}{x}\right)^{m}$

➔ $\sqrt{x^{a}} = x^{\frac{1}{2}}$

➔ $\sqrt[m]{x} = x^{\frac{1}{m}}$

➔ $\sqrt[n]{x^{m}} = \left(\sqrt[n]{x^{m}}\right) = x^{\frac{m}{n}}$

➔ $x^{a} = x^{b} \Rightarrow a = b$

GMAT Geometry Formulas PDF

By GMATPoint.com

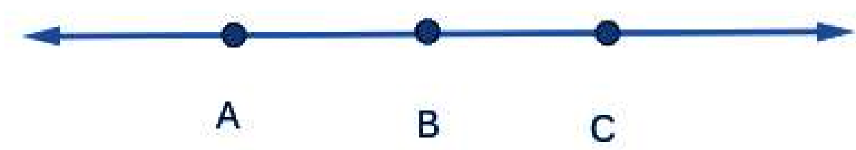
GMAT Geometry Formulas

- Geometry is often considered to be one of the hardest sections to crack without preparation; however, that is not necessarily the case - with consistent preparation, geometry questions would become easier to handle.
- With so many formulas to learn and remember, this section is going to take a lot of time to master.
- A good way to utilize this formula collection: read a formula, try to visualize it and solve as many questions related to the formula as you can.
- Remember that knowing a formula and knowing when or where to apply it are two different abilities. You could gain the first ability by going through reading this formulae list, but the latter will come only through solving problems.
- In this document, we provide an exhaustive list of GMAT Geometry formulas to make the geometry section a lot easier for GMAT aspirants.

Lines and Angles

Collinear points:

Three or more points lying on the single straight line. In this diagram the three points A,B and C are collinear



Concurrent lines:

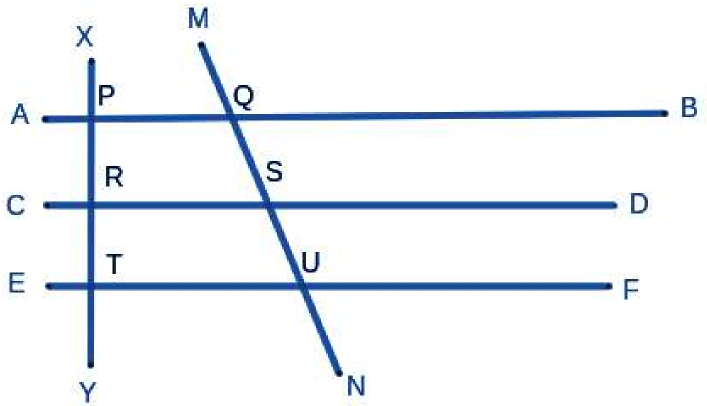
If three or more lines lying in the same plane intersect at a single point then those lines are called concurrent lines.

The three lines X, Y and Z are concurrent lines here.

- When two angles A and B are complementary, sum of A and B is 90°
- When two angles A and B are supplementary,

sum of A and B is 180°

- ➢ When two lines intersect, opposite angles are equal. Adjacent angles are supplementary
- ➢ When any number of lines intersect at a point, the sum of all the angles formed = 360°
- ➢ Consider parallel lines AB, CD and EF as shown in the figure.



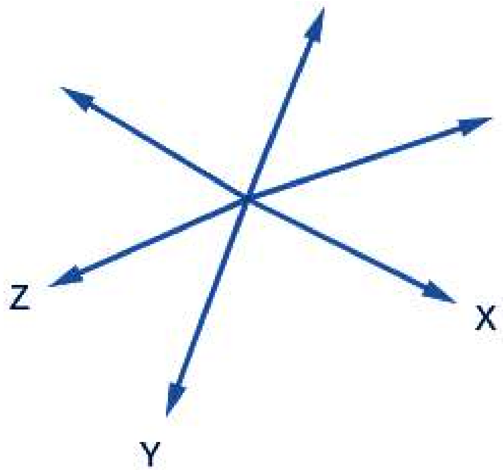
- ➢ XY and MN are known as transversals
- ➢ $\angle XPQ = \angle PRS = \angle RTU$ as corresponding angles are equal

➢ Interior angles on the side of the transversal are supplementary. i.e. $\angle PQS + \angle QSR = 180°$

➢ Exterior angles on the same side of the transversal are supplementary. i.e. $\angle MQB + \angle DSU = 180°$

➢ Two transversals are cut by three parallel lines in the same ratio i.e. $\frac{PR}{RT} = \frac{QS}{SU}$

Co-ordinate Geometry



- The distance between two points with coordinates (X1,Y1), (X2,Y2) is given by

$$D = \sqrt{(X2 - X1)^2 + (Y2 - Y1)^2}$$

- Slope, m= $\frac{y2-y1}{x2-x1}$ (If $x_2 = x_1$ then the lines are perpendicular to each other)

- Mid point between two points A(x_1, y_1) and B (x_2, y_2) is $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$
- When two lines are parallel, their slopes are equal

  i.e. $m_1 = m_2$

- When two lines are perpendicular, product of their

  slopes = -1 i.e, $m_1 * m_2 = -1$

- If two intersecting lines have slopes m1 and m2 then the angle between two lines will be

  $\tan\theta = \frac{m_1 - m_2}{m_1 m_2}$

  (where θ is the angle between the lines)

- The length of perpendicular from a point (X_1, Y_1) on the line AX+BY+C = 0 is $P = \frac{AX_1 + BY_2 + C}{\sqrt{A^2+B^2}}$

- **Equations of a lines :**

General equation of a line	$Ax + By = C$
Slope intercept form	$y = mx + c$ $(c\ is\ y\ intercept)$
Point-slope form	$y - y_1 = m(x - x_1)$
Intercept form	$\frac{x}{a} + \frac{y}{b} = 1$
Two point form	$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$

Triangles

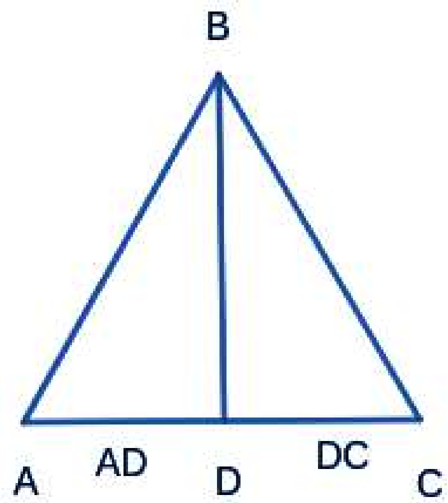
- Sum of all angles in a triangle is 180°
- An angle less than 90° is called an acute angle.

  An angle greater than 90° is called an obtuse angle.
- A triangle with all sides unequal is called scalene triangle
- A triangle with two sides equal is called an isosceles triangle.
- The two angles of an isosceles triangle that are not contained between the equal sides are equal
- A triangle with all sides equal is called an equilateral triangle. All angles of an equilateral triangle equal 60°.
- If in a triangle all of its angles are less than 90° than that triangle is called as acute angled triangle
- A triangle with one of its angle equal to 90° than that triangle is called as Right angled triangle

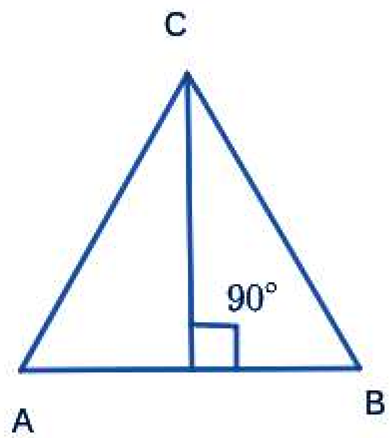
➔ A triangle with one of its angles greater than 90° than that triangle is called an Obtuse angled triangle.

➔ If one side of a triangle is produced then that exterior angle formed is equal to the sum of opposite remote interior angles

➔ A line joining the mid point of a side with the opposite vertex is called a median. (Here D is the midpoint of the AC side or AD = DC). BD is the median of this triangle ABC.



- A perpendicular drawn from a vertex to the opposite side is called the altitude



- A line that bisects and also makes right angle with the same side of the triangle is called perpendicular bisector
- A line that divides the angle at one of the vertices into two parts is called angular bisector
- All points on an angular bisector are equidistant from both arms of the angle.
- All points on a perpendicular bisector of a line are equidistant from both ends of the line.

- In an equilateral triangle, the perpendicular bisector, median, angle bisector and altitude (drawn from a vertex to a side) coincide.
- The point of intersection of the three altitudes is the Orthocentre.
- The point of intersection of the three medians is the centroid.
- The three perpendicular bisectors of a triangle meet at a point called the Circumcentre. A circle drawn from this point with the circumradius would pass through all the vertices of the triangle.
- The three angle bisectors of a triangle meet at a point called the incentre of a triangle. The incentre is equidistant from the three sides and a circle drawn from this point with the inradius would touch all the sides of the triangle.
- Sum of any two sides of a triangle is always greater than its third side

- Difference of any two sides of a triangle is always lesser than it's third side
- **Pythagoras theorem:**

In a right angled triangle ABC where

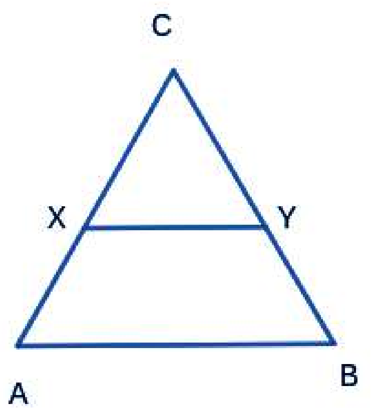
$\angle B = 90°, AC^2 = AB^2 + BC^2$

- **Mid Point Theorem :**

The line joining the midpoint of any two sides in a triangle is parallel to the third side and is half the length of the third side.

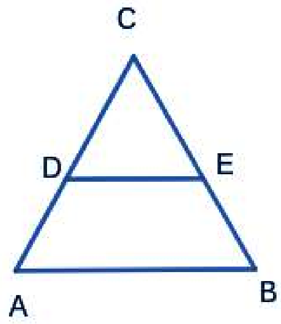
If X is the midpoint of CA and Y is the midpoint of CB.

Then XY will be parallel to AB and XY = ½ * AB



- **Basic proportionality theorem :**

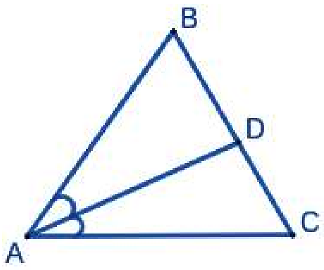
  If a line is drawn parallel to one side of a triangle and it intersects the other two sides at two distinct points then it divides the two sides in the ratio of respective sides. If in a triangle ABC, D and E are the points lying on AB and BC respectively and DE is parallel to AC then AD/DB = EC/BE



- **Interior Angular Bisector theorem :**

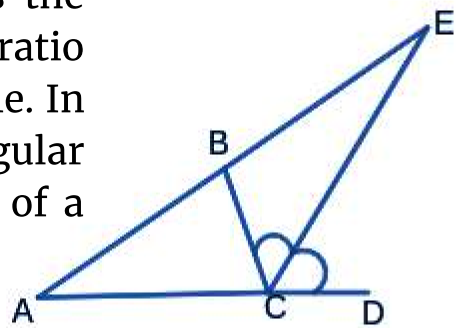
  In a triangle the angular bisector of an angle divides the side opposite to the angle, in the ratio of the remaining two sides. In a triangle ABC if AD is the angle bisector of angle A then AD divides the side BC in the same ratio as the other two sides of the triangle.

  i.e. BD/ CD= AB/AC.



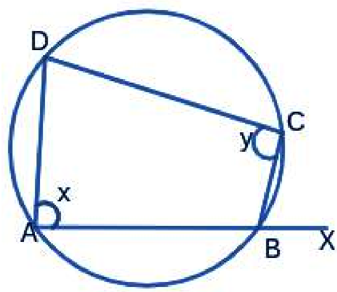
- **Exterior Angular Bisector theorem :**

The angular bisector of the exterior the angle of a triangle divides the opposite side externally in the ratio of the sides containing the angle. In a triangle ABC, if CE is the angular bisector of exterior angle BCD of a triangle, then AE/BE = AC/BC



- **Cyclic Quadrilateral :**

If a quadrilateral has all its vertices on the circle and its opposite angles are supplementary (here x+y = 180o) then that quadrilateral is called cyclic quadrilateral. In a cyclic quadrilateral the opposite angles are supplementary.



Exterior angle is equal to its remote interior opposite angle. (here ∠CBX = ∠ADC)

- If x is the side of an equilateral triangle then the

Altitude (h) = $\frac{\sqrt{3}}{2}x$

Area = $\frac{\sqrt{3}}{4}x^2$

Inradius = $\frac{1}{3} * h$

Circumradius = $\frac{2}{3} * h$

Similar triangles :

If two triangles are similar then their corresponding angles are equal and the corresponding sides will be in proportion.

For any two similar triangles :

- Ratio of sides = Ratio of medians = Ratio of heights = Ratio of circumradii = Ratio of Angular bisectors

- Ratio of areas = Ratio of the square of the sides.

Tests of similarity : (AA / SSS / SAS)

Congruent triangles:

If two triangles are congruent then their corresponding angles and their corresponding sides are equal.

Tests of congruence : (SSS / SAS / AAS / ASA)

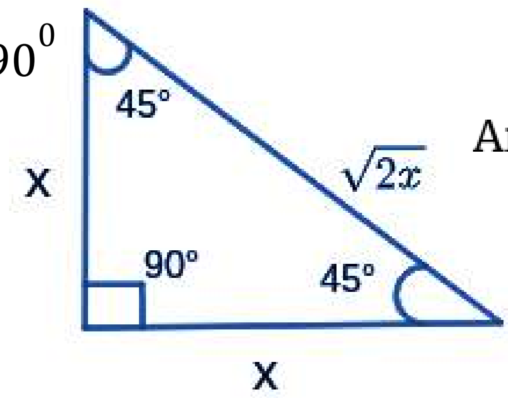
Area of a triangle:

- A = $\sqrt{s(s-a)(s-b)(s-c)}$ where s = $\frac{(a+b+c)}{2}$
- A = $\frac{1}{2} * base * altitude$
- A = $\frac{1}{2} * ab * sinC$ (C is the angle formed between sides a and b)
- A = $\frac{abc}{4R}$ where R is the circumradius

- A = r * s where r is the inradius and s is the semi perimeter. (where a, b and c are the lengths of the sides BC, AC and AB)

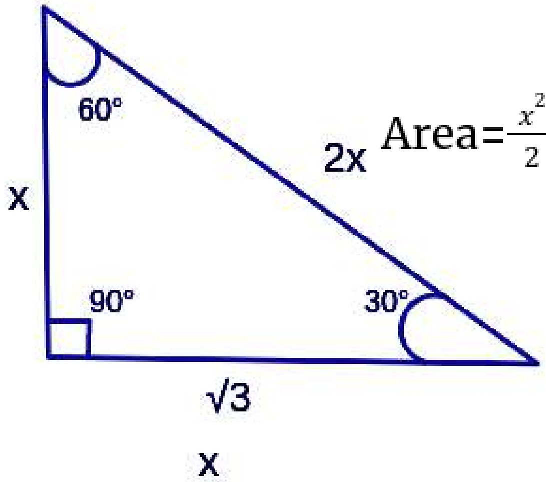
Special triangles :

- $30^0,\ 60^0, 90^0$



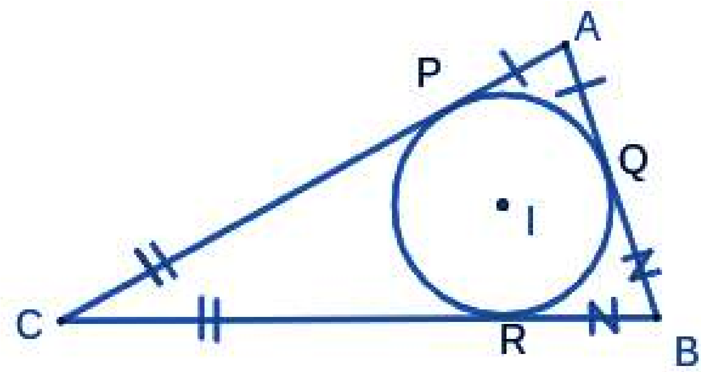
$\text{Area}=\frac{\sqrt{3}}{2}x^2$

- $45^0,\ 45^0, 90^0$



$\text{Area}=\frac{x^2}{2}$

- Consider the triangle ABC with incentre I, and the incircle touching the triangle at P,Q,R as shown in the diagram. As tangents drawn from a point are equal, AP=AQ, CP=CR and BQ=BR.



- In an equilateral triangle, the centroid divides the median in the ratio 2:1. As the median is also the perpendicular bisector, angle bisector, G is also the circumcentre and incentre.

- If a is the side of an equilateral triangle, circumradius $=a/\sqrt{3}$ and inradius $= a/(2\sqrt{3})$

Circles

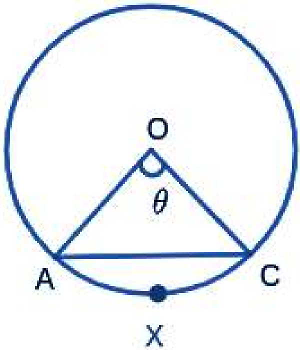
- The angle subtended by a diameter of circle on the circle = 90^0
- Angles subtended by an equal chord are equal. Also, angles subtended in the major segment are half the angle formed by the chord at the center

- Equal chords of a circle or equidistant from the center

- The radius from the center to the point where a tangent touches a circle is perpendicular to the tangent

- Tangents drawn from the same point to a circle are equal in length

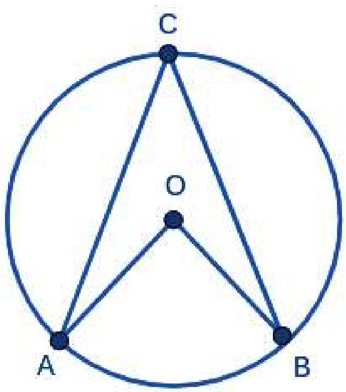
- A perpendicular drawn from the center to any chord, bisects the chord



Area of sector OAXC = $\frac{\theta}{360} * \pi r^2$

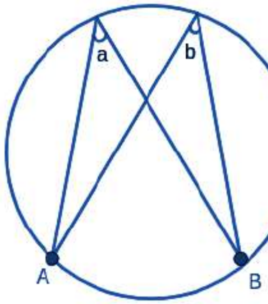
Area of minor segment AXC = $\frac{\theta}{360\pi r^2} - \frac{1}{2r^2 Sin\theta}$

Inscribed angle Theorem :



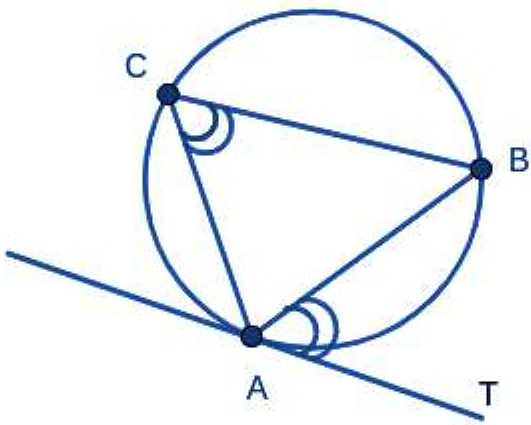
$$2\angle ACB = \angle AOB$$

The angle inscribed by the two points lying on the circle, at the center of the circle, is twice the angle inscribed at any point on the circle by the same points.



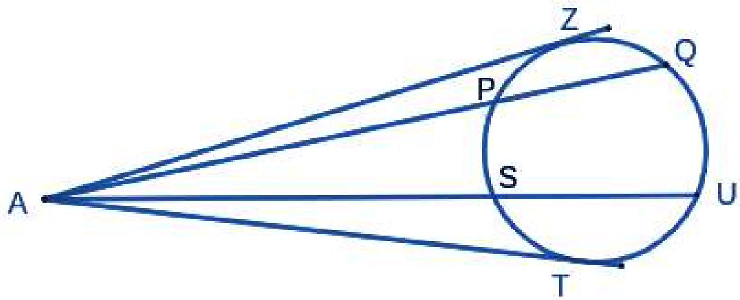
Angles subtended by the same segment on the circle will be equal. So, here angles a and b will be equal.

The angle made by a chord with a tangent to one of the ends of the chord is equal to the angle subtended by the chord in the other segment.
As shown in the figure, ∠ACB = ∠BAT.



Consider a circle as shown in the image.

Here, $AP * AQ = AS * AU = AT^2$

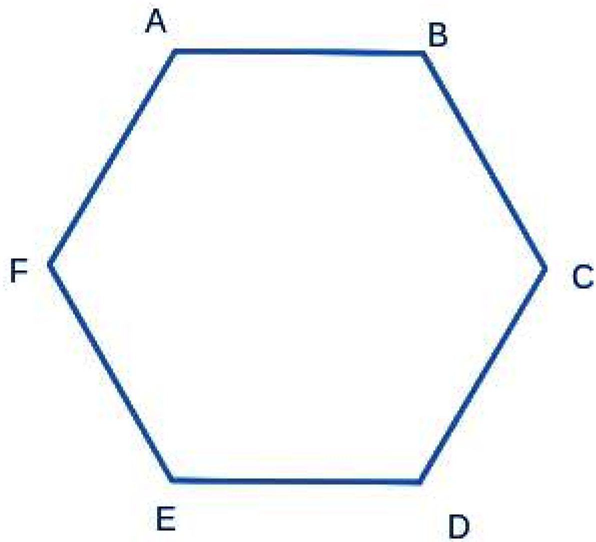


Two tangents drawn to a circle from an external common point will be equal in length. So here AZ = AT

Polygons and Quadrilaterals

- If all sides and all angles are equal, then the polygon is a regular polygon
- A regular polygon of n sides has $\frac{n(n-3)}{2}$ diagonals
- In a regular polygon of n sides, each exterior angle is $\frac{360}{n}$ degrees.
- Sum of measure of all the interior angles of a regular polygon is 180 (n-2) degrees (where n is the number of sides of the polygon)

- Sum of measure of all the exterior angles of regular polygon is 360 degrees



ABCDEF is a regular hexagon with each side equal to ‘x’ then

- Each interior angle = 120^0
- Each exterior angle = 60^0
- Sum of all the exterior angles = 360^0
- Sum of all the interior angles = 720^0
- Area = $\frac{3\sqrt{3}}{2}a^2$

Areas of different geometrical figures:

Triangles	$\frac{1}{2} * base * height$
Rectangle	$length * width$
Trapezoid	$\frac{1}{2} * sum\ of\ bases * height$
Parallelogram	$base * height$
Circle	$\pi * radius^2$
Rhombus	$\frac{1}{2} * product\ of\ diagonals$
Square	$side^2\ or\ \frac{1}{2} diagonals^2$
Kite	$\frac{1}{2} * product\ of\ diagonals$

Solids

Volume of different solids:

Cube	$length^3$
Cuboid	$length * base * height$
Prism	$Area\ of\ base * height$
Cylinder	$\pi r^2 h$
Pyramid	$\frac{1}{3} * Area\ of\ base * height$
Cone	$\frac{1}{3} * \pi r^2 * h$
Cone Frustum (If R is the base radius, r is the upper surface radius and h is the height of the frustum)	$\frac{1}{3} * \pi(R^2 + Rr + r^2)$
Sphere	$\frac{4}{3} * \pi * r^3$
Hemi-sphere	$\frac{2}{3}\pi r^3$

Total Surface area of different solids:

Prism	$2 * base\ area * base\ perimeter * height$
Cube	$6 * length^2$
Cuboid	$2(lh + bh + lb)$
Cylinder	$2\pi rh + 2\pi r^2$
Pyramid	$\frac{1}{2} * Perimeter\ of\ base * slant\ height + Area\ of\ base$
Cone (l is the slant height)	$\pi r(l + r)$
Cone Frustum (where R & r are the radii of the base faces and l is the slant height)	$\pi r(R^2 + r^2 + Rl + rl)$
Sphere	$4\pi r^2$
Hemi-sphere	$3\pi r^2$

Lateral/Curved surface area:

Prism	$base\ perimeter\ *\ height$
Cube	$4\ *\ length^2$
Cuboid	$2\ length\ *\ height\ +$ $2\ breadth\ *\ height$
Cylinder	$2\pi rh$
Pyramid	$\frac{1}{2}\ *\ Perimeter\ of\ base\ *$ $slant\ height$
Cone (l is the slant height)	πrl
Cone Frustum (where R is the base radius, l is the slant height)	$\pi(R\ +\ r)L$