



GMAT FE

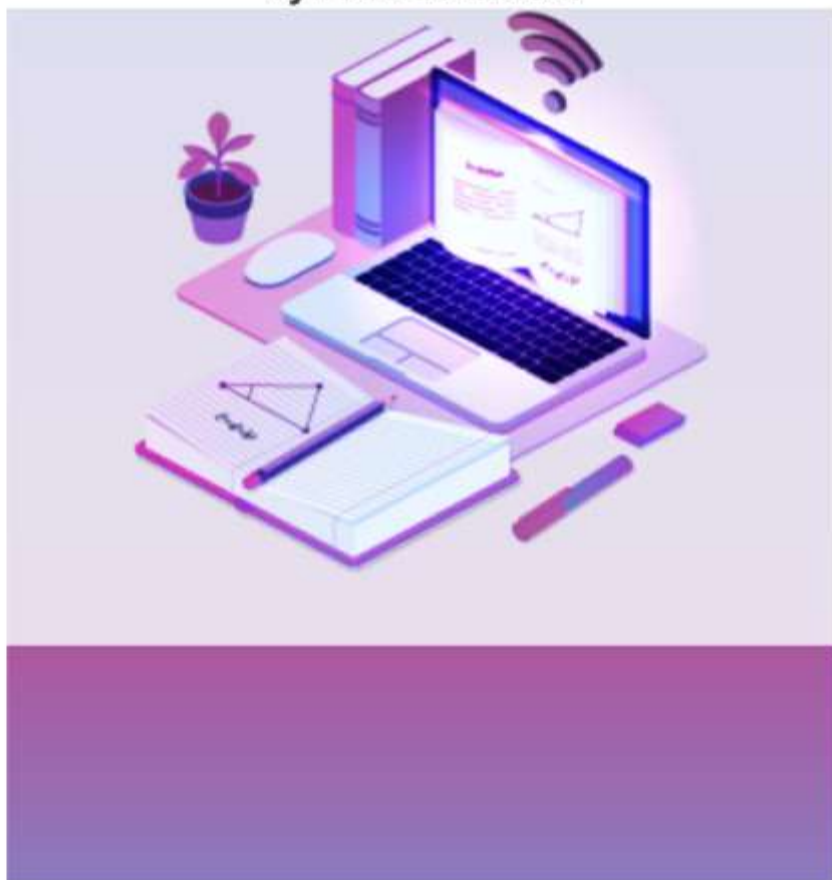
MATH FORMULAS



By Sayali Kale
(GMAT 785)

GMAT Arithmetic Formulas PDF

By GMATPoint.com



GMAT Arithmetic Formulas [PDF]

- Integers $\in \{\dots -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5 \dots\}$
- 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: $29 = 4 \cdot 7 + 1$

- Even integer \rightarrow divisible by 2
- Odd integer \rightarrow not divisible by 2
- $\text{Odd} \pm \text{Odd} = \text{Even}$
- $\text{Even} \pm \text{Even} = \text{Even}$
- $\text{Odd} \pm \text{Even} = \text{Odd}$
- $\text{Even} \pm \text{Odd} = \text{Odd}$
- $\text{Odd} * \text{Odd} = \text{Odd}$
- $\text{Odd} * \text{Even} = \text{Even}$
- $\text{Even} * \text{Even} = \text{Even}$
- $(\text{odd})^n = \text{odd}$
- $(\text{even})^n = \text{even}$

- 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)
- $1 \times n = n \times 1 = n$
- $n/1 = n$
- $n + 0 = n - 0 = n$
- Divisible by 0 is not allowed
- Fractions → $\frac{n}{d} \Rightarrow d \neq 0$

n = numerator, d = denominator

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

- Addition and subtraction of fractions

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

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

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

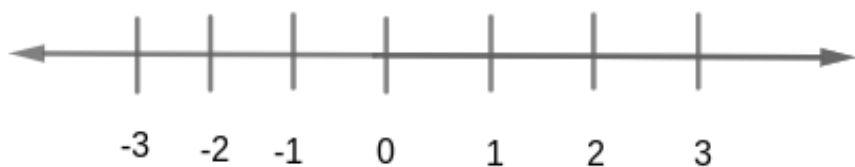
$$\frac{1}{2} + \frac{3}{4} = \frac{2*3}{4(LCM)} = \frac{5}{4}$$

- Multiplication and division of fractions

$$\frac{2}{13} \times \frac{7}{9} = \frac{2 \times 7}{13 \times 9} = \frac{14}{117}$$

$$\frac{2}{5} \div \frac{3}{4} = \frac{2}{5} \times \frac{4}{3} = \frac{2 \times 4}{5 \times 3} = \frac{8}{15}$$

- Mixed Fraction $\rightarrow 17\frac{1}{4} = 17 + \frac{1}{4} = \frac{17 \times 4 + 1}{4} = \frac{69}{4}$
- Decimal = 364.57
- $1.3 + 2.6 = 3.9$ (Addition with carry forward)
- $1.3 \times 2.6 = 0.26$ (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 = $\frac{\text{change in value}}{\text{Initial value}} \times 100\%$
- 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%, %

$$\text{increase} = (20+30+\frac{20 \times 30}{100}) = 56\%$$

$$\rightarrow a^b = a \times a \times a \times \dots \text{(upto } b \text{ times)}$$

$$\rightarrow 5^3 = 5 \times 5 \times 5$$

$$\rightarrow (-5)^3 = -5 \times -5 \times -5$$

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

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

- $(n)^{odd} = \text{Positive (if } n \text{ is positive)}$
 $= \text{Negative (if } n \text{ is negative)}$
- Square root $= \sqrt{a} \rightarrow a \text{ cannot be negative}$
- $\sqrt{25} = \sqrt{5^2} = 5$
- Mean = Average $= \frac{a_1 + a_2 + \dots + a_n}{n}$
- 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

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

$$\rightarrow n! = n(n-1)(n-2)\dots!$$

$$\rightarrow 0! = 1! = 1$$

$$\rightarrow {}^nC_r = \frac{n!}{r! n-r!}$$

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

$$\rightarrow P(A \text{ or } B) = P(A) + P(B)$$

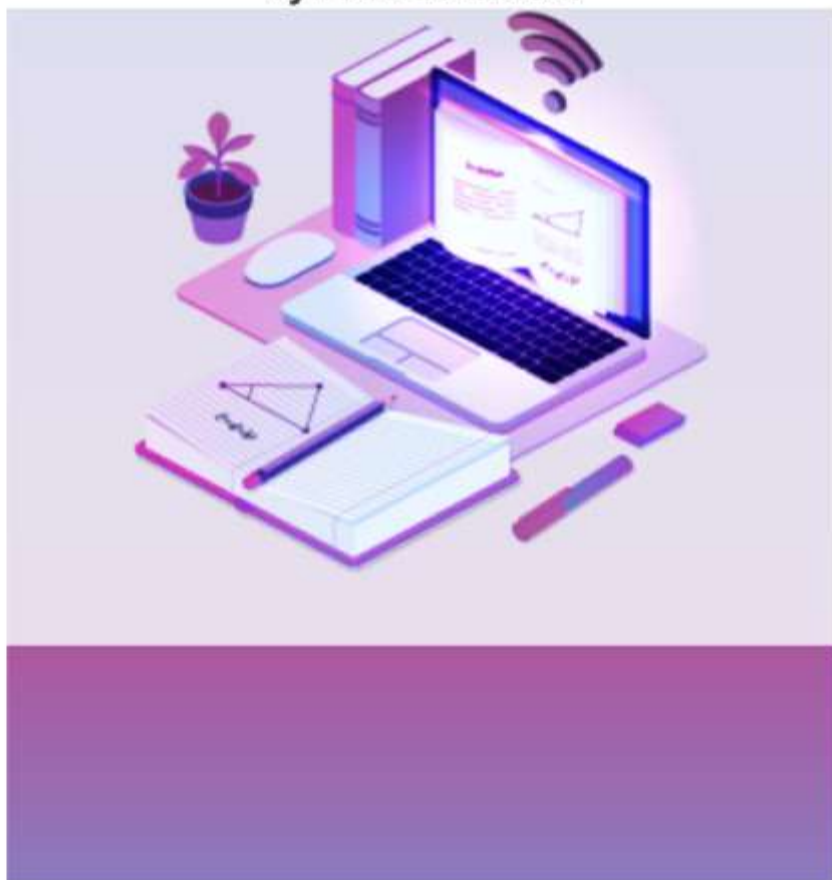
(If A & B are mutually exclusive)

$$\rightarrow P(A \text{ or } B) = P(A) + P(B) - P(A) P(B)$$

(If A & B are not mutually exclusive)

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 $\left(\frac{18}{5}\right) \Rightarrow 1 \text{ m/s} = 3.6 \text{ km/h}$

- 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 $a : b$

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

- 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,

$$\text{Total distance travelled} = S_1 T_1 + S_2 T_2 \text{ km}$$

$$\text{Average Speed} = \frac{S_1 T_1 + S_2 T_2}{T_1 + T_2} \text{ km/hr}$$

- 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,

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

- 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 $d_1 = d_2 = d_3 = \dots = d_n = d$, 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 $t_1 = t_2 = t_3 = \dots = t_n = t$, 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 = $\frac{l}{(m+n)}$

(when they are running in opposite directions)

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

(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

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

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

• Work:

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

⇒ 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 $\frac{x \times y}{x + y}$

⇒ 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:

⇒ If the speed of water is 'W' and speed of a boat in still water is 'B'

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

⇒ 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**.

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

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

⇒ 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 $y > x$)

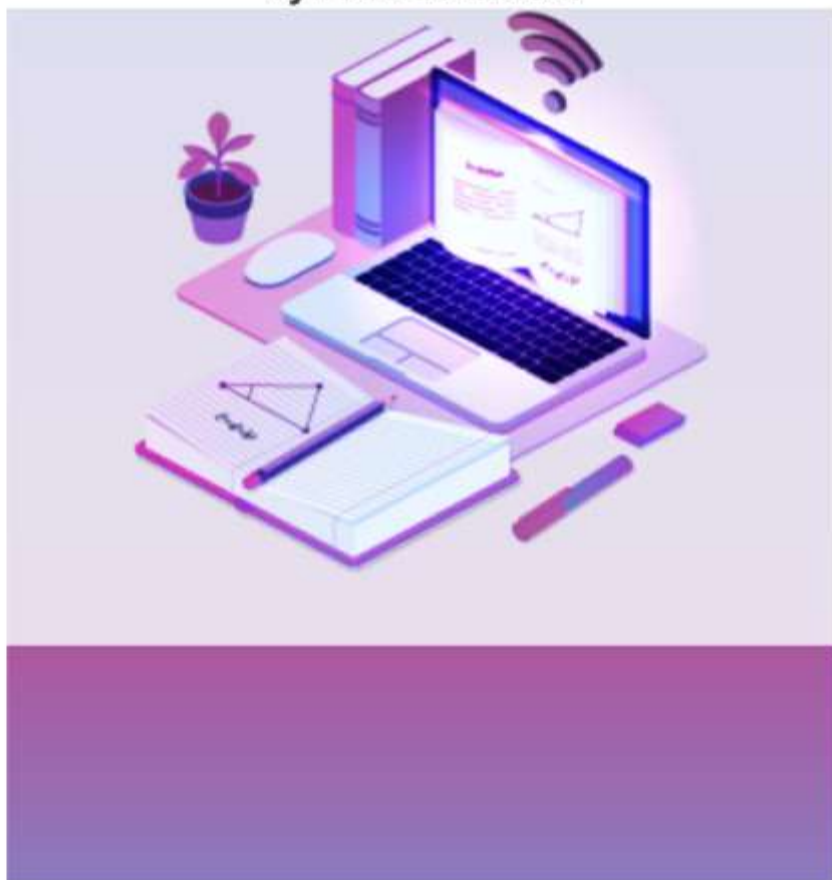
The part emptied per hour = $\frac{1}{y} - \frac{1}{x}$ (If $x > y$)

● **Some Tips and Tricks:**

- Some of the questions may consume a lot of time. While solving, write down the equations without any errors 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 fraction, 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.,

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

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

- 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

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

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

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

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

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

$$\text{then } a:b:c:d:\dots = p:q:r:s:\dots$$

- 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)
 - $\frac{a}{b} = \frac{c}{d} \Rightarrow \frac{a+b}{a-b} = \frac{c+d}{c-d}$ (Componendo-Dividendo)
 - $a/b = c/d \Rightarrow pa+qb/ra+sb = pc+qd/rc+sd$,
for all real p, q, r, s such that $pa+qb \neq 0$ and $rc+sd \neq 0$

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

→ $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \dots$ then each of these ratios is

equal to $\frac{a+c+e\dots}{b+d+f\dots}$

→ $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \dots$ then each of these ratios is

equal to $\frac{pa+qc+re\dots}{pb+qd+rf\dots}$

→ 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, \dots are in continued proportion means, $a:b = b:c = c:d = \dots$
- $a:b = b:c$ 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 $x \propto \frac{1}{y}$

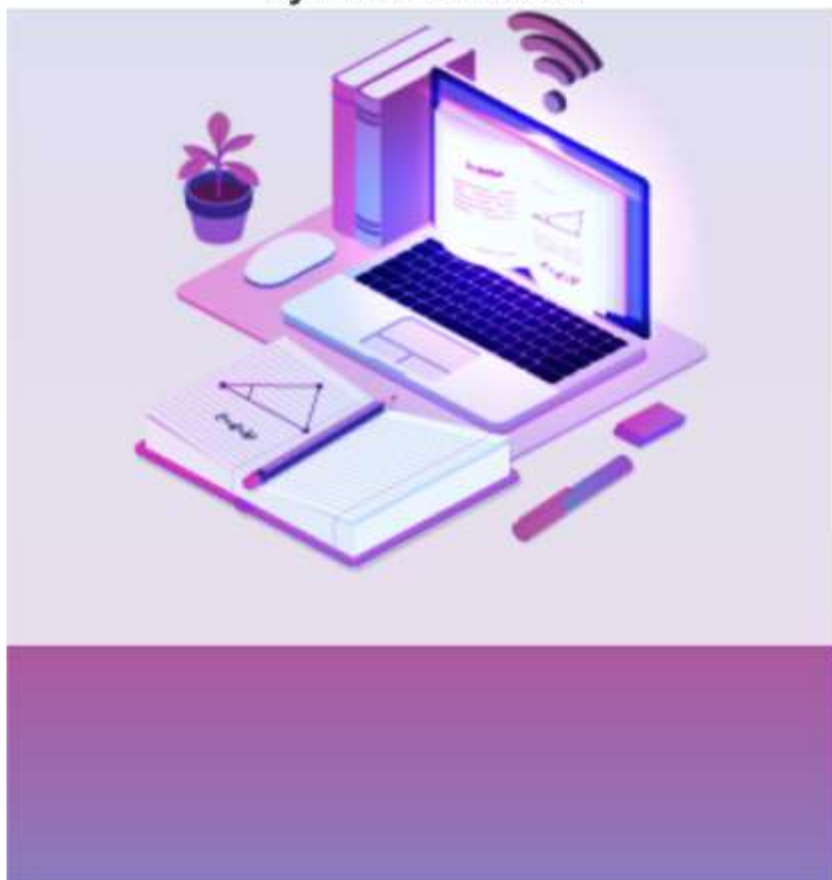
→ $x = k \frac{1}{y}$ (where k is indirect proportionality constant)

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

- If $x \propto y$ and $y \propto z$ then $x \propto z$
 - If $x \propto y$ and $x \propto z$ then $x \propto (y \pm z)$
 - If $a \propto b$ and $x \propto y$ then $ax \propto by$
-

GMAT Mixtures & Alligations Formulas PDF

By GMATPoint.com



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.

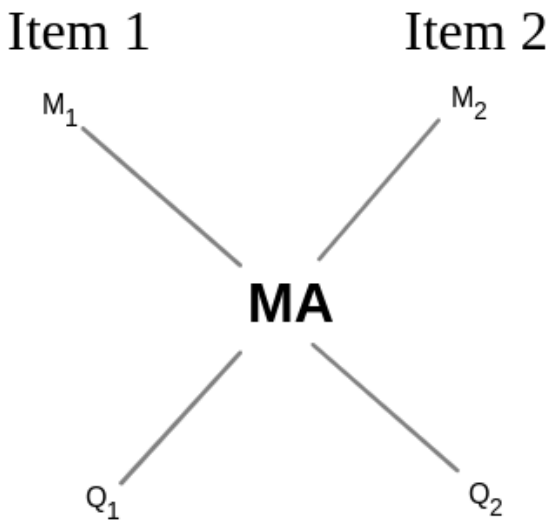
● **Types of mixtures:**

- **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 Q_1 and Q_2 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

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

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

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

- 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,

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

- 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 *n*th operation,

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

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)

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If $S.P > C.P$, then Profit or Gain,

$$P = S.P - C.P$$

If $C.P > S.P$, then Loss,

$$L = C.P - S.P$$

% Profit or Gain percentage or Profit

$$\text{Percentage} = \frac{\text{Profit}}{C.P} \times 100$$

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

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

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

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

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

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

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

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

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

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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,

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

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

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

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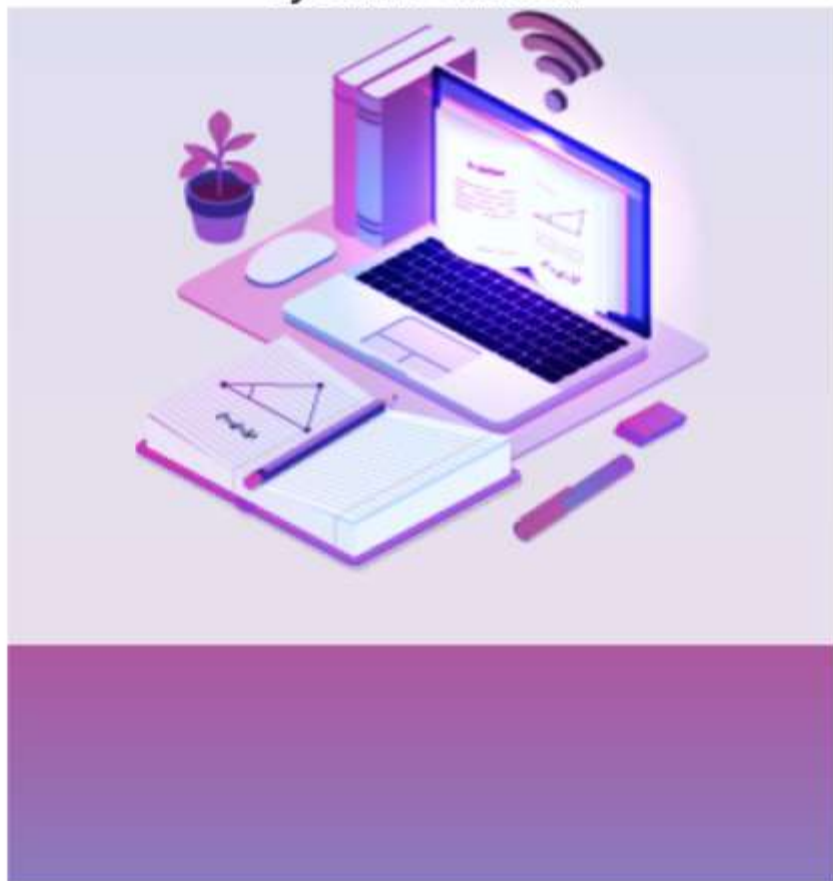
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GMAT Interests (SI & CI)

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.

$$\text{Amount (A)} = \text{Principal (P)} + \text{Interest (I)}$$

- 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

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

- If the interest is compounded quarterly, then

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

- 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

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

- **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

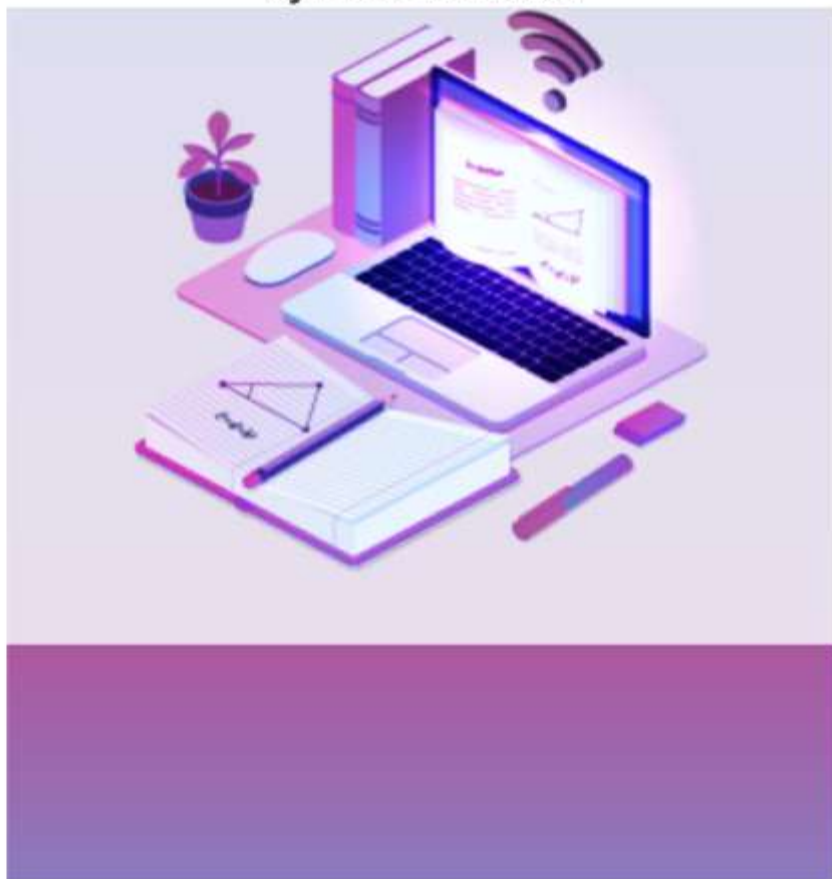
$$\text{Present worth} = \frac{K}{\left(1 + \frac{R}{100}\right)^N}$$

- 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 $x = \frac{P\left(\frac{r}{100}\right)\left(1 + \frac{r}{100}\right)^n}{\left(1 + \frac{r}{100}\right)^n - 1}$

GMAT Algebra Formulas PDF

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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.
- $D = 0 \Rightarrow$ 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 $A_n X^n + A_{n-1} X^{n-1} + \dots + A_1 X + A_0$, 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

$$ax^2 + bx + c = 0, \quad \text{then equation is}$$

$$cx^2 + bx + a = 0$$

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 $-x$

$$-|x| \leq x \leq |x|$$

- For any two real numbers 'a' and 'b',

$$\rightarrow a > b \Rightarrow -a < -b$$

$$\rightarrow |a| + |b| \geq |a + b|$$

$$\rightarrow |a| - |b| \leq |a - b|$$

$$\rightarrow |a \cdot b| = |a| |b|$$

$$\rightarrow |a| > |b| \Rightarrow a > b \text{ (if both are +ve)}$$

$$\Rightarrow a < b \text{ (if both are -ve)}$$

- 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 $|x| \leq k$ then the value of x lies between $-k$ and k , or $-k \leq x \leq k$
- If $|x| \geq k$ then $x \geq k$ or $x \leq -k$
- 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 $x \neq m$

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

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

- Number of terms in

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

- Sum of all terms of an

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

- **Properties of A.P:**

- If a, b, c, d, \dots are in A.P and 'k' is a constant then
 - $a-k, b-k, c-k, \dots$ will also be in A.P
 - ak, bk, ck, \dots 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,

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

● 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,

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

Harmonic progression (H.P):

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

Properties of H.P :

If a, b, c, d, \dots 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 = $\frac{\text{Sum of all the terms}}{\text{Number of terms}}$
- 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 $a, b, c, \dots n$ terms are in G.P then

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

- 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, \dots are the given numbers in H.P then the Harmonic mean of

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

- If two numbers a and b are in H.P then the

$$\text{Harmonic Mean} = \frac{2ab}{a+b}$$

- 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:

$$\rightarrow x^m \times x^n = x^{m+n}$$

$$\rightarrow x^m \div x^n = x^{m-n}$$

$$\rightarrow (x^m)^n = x^{mn}$$

$$\rightarrow x^a \times y^a = (xy)^a$$

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

$$\rightarrow x^{-m} = \frac{1}{x^m}$$

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

$$\rightarrow \sqrt{x^a} = x^{\frac{1}{2}}$$

$$\rightarrow \sqrt[m]{x} = x^{\frac{1}{m}}$$

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

$$\rightarrow x^a = x^b \Rightarrow a = b$$



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