

**USEFUL FORMULAE & CONCEPTS FOR**

# CAT

## QUANTITATIVE APTITUDE

An iQuanta Presentation

# INDEX

**1** Number System

**2** Arithmetic

**3** Algebra

**4** Geometry

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## NUMBER SYSTEM



### Important points to remember:

1. The product of 'n' consecutive natural numbers is always divisible by n!
2. Square of any natural number can be written in the form of  $3n$  or  $3n+1$ .
3. Square of a natural number can only end in 0, 1, 4, 5, 6 or 9. Second last digit of a square of a natural number is always even except when last digit is 6. If the last digit is 5, second last digit has to be 2.
4. Any prime number greater than 3 can be written as  $6k+1$  or  $6k-1$ .
5. Any two-digit number 'mn' can effectively be written as  $10m+n$  and a three-digit number 'lmn' can effectively be written as  $100l+10m+n$ .
6. Sum of 1<sup>st</sup> n natural number,  $1+2+3+\dots+n = \Sigma n = n(n+1)/2$
7. Sum of 1<sup>st</sup> n positive even numbers,  $2+4+6+\dots+2n = n(n+1)$
8. Sum of 1<sup>st</sup> n positive odd numbers,  $1+3+5+\dots+(2n-1) = n^2$
9. Sum of squares of 1<sup>st</sup> n natural numbers:  
 $1^2+2^2+3^2+\dots+n^2 = n(n+1)(2n+1)/6$
10. Sum of cubes of 1<sup>st</sup> n natural numbers:  
 $1^3+2^3+3^3+\dots+n^3 = (\Sigma n)^2 = [n(n+1)/2]^2$
11. 0 and 1 are neither composite nor prime.
12. There are 25 prime numbers less than 100.
13. There are 15 prime numbers less than 50.

# Adarsh Khandelwal, **CAT 99.93%ler** from iQuanta shares gratitude



Adarsh Khandelwal

21 December at 22:44 · 🌐



"Ups and downs in life are very important to keep us going, because a straight line even in an ECG means we are not alive." - Ratan Tata. A quote very close to my heart.

From scoring 99.90%ile in JEE Main to being diagnosed with a chronic health problem and not being able to take JEE Advanced and being ill for about 4 years, due to which I had to take up a distance-learning course from IGNOU and graduated as BA(Pol Science) in 2019 along with battling my disease up till September 2021 and finally winning. But I always knew that "Apna time aayega". Fast forward to June 2022, though not able to get into IITs, I started paving way for my ultimate goal of getting into IIMs and took a challenge from my brother to crack CAT 2022 with a percentile greater than that of JEE Main's (so yay!).

I started looking for the best coaching out there and stumbled upon a Quora article that directed me towards [iQuanta](#). I enrolled in CAT 2022 Batch 2, at this point I must mention that at first I was a bit skeptical about [iQuanta](#) and thought that how can any CAT coaching has a fee which is 25-30k less than some of the big names, but nevertheless I decided to buy it and I must say I would have regretted not joining [iQuanta](#). The dual pedagogy, 24x7 doubt solving and peer-to-peer learning helped me grow a lot in a very short time. I scored 99.93%ile and for that I would like to thank [Jeet Singh](#), [Abhishek Leela Pandey](#) and [Sajjan Barnwal](#) for always being there and taking us through a truly awesome journey 😊.

P.S. - [Jeet Singh](#) Sir, ab GDPI ki naao bhi paar lagwa dijiye 🙏🙏??

Section		Section		Section		Total	
Verbal Ability & Reading Comprehension		Data Interpretation & Logical Reasoning		Quantitative Ability			
Scaled Score	Percentile	Scaled Score	Percentile	Scaled Score	Percentile	Overall Scaled Score	Overall Percentile
16.46	77.59	48.31	99.99	49.38	99.95	114.15	99.93

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## Divisibility rules

- 2 – when last digit of the number is 0, 2, 4, 6, 8.
- 4 – when last two digits of the number is 00 or divisible by 4.
- 8 - when the last three digits of the number is 000 or divisible by 8.
- 5 – when last digit is 0 or 5.
- 2<sup>n</sup> - when last n digits of the numbers are divisible by 2<sup>n</sup>.
- 5<sup>n</sup> - when last n digits of the number are divisible by 5<sup>n</sup>.

Divisibility rule for 3 and 9

3 – Sum of the digits should be divisible by 3.

9 – Sum of digits should be divisible by 9.

Divisibility rule for 7 and 11

7 - the difference between twice the unit digit of the given number and the remaining part of the given number should be a multiple of 7 or it should be equal to 0”.

For example, 798 is divisible by 7.

11 - if the difference between the sums of the alternate digits of the given number is either 0 or divisible by 11, then the number is divisible by 11.

### **Divisibility rules of 6, 12, 14, 15, 18, etc.**

Whenever we have to check the divisibility of a number N by a composite number C, the number N should be divisible by all the prime factors (the highest power of every prime factor) present in C.

### **Properties of factors and co-prime numbers**

For any natural number  $N = a^x * b^y * c^z \dots$ , where a, b, c.... are prime numbers and x, y, z are their powers which are natural numbers. (N is prime factorized here).

**Number of factors of N** =  $(x+1) (y+1) (z+1) \dots$

**Number of even factors** = same as above, but just consider one power of 2 less while calculating.

**Number of odd factors** = (Total – even) OR do not consider 2 in finding factors.

### **Remainders and Remainder Theorems**

Dividend = Divisor x Quotient + Remainder

**Mod**, which stands for modulus simply means ‘remainder’. So, the value of a mod b is simply the remainder obtained on dividing a by b.

If  $\text{Rem } [N_1/D] = R_1, \text{Rem } [N_2/D] = R_2, \dots, \text{Rem } [N_m/D] = R_m$  then

i.  $\text{Rem } [(N_1+N_2+\dots+N_m)/D] = \text{Rem } [(R_1+R_2+\dots+R_m)/D]$

ii.  $\text{Rem } [(N_1*N_2*\dots*N_m)/D] = \text{Rem } [(R_1*R_2*\dots*R_m)/D]$

iii. **Negative Remainder:** Sometimes we use negative remainder to find the actual remainder easily. Let us try to understand it:-  
We know that remainder when 19 is divided by 10 is 9 but we can also take the remainder as  $-1$  which is  $(9 - 10)$ .

## Remainder Theorems:

### 1. Wilson's Remainder Theorem

For any prime number  $P$ ,

$$\text{Rem} \left[ \frac{(P-1)!}{P} \right], \text{ i.e.,}$$

$$(P-1)! \bmod P = (P - 1) \text{ or } -1$$

E.g.,  $\text{Rem} \left[ \frac{18!}{19} \right] = 18 \text{ or } -1$

### 2. Euler's Totient Theorem

For two coprime numbers  $N$

$$\text{and } D, \text{ Rem} \left[ \frac{N^{k \cdot E(D)}}{D} \right] = 1,$$

where  $k$  is a natural number and  $E(D)$  is Euler of the number  $D$ . (Calculation of how to calculate Euler mentioned above).

**Example:** What is the remainder when  $47^{32}$  is divided by 51?

**Solution:**  $51 = 3 \cdot 17$  so  $E(51) = 51 \cdot \frac{2}{3} \cdot \frac{16}{17} = 32$ .

We can see that 47 and 51 are coprime, so using Euler's remainder theorem,

$$\text{Rem} \left[ \frac{47^{32}}{51} \right] = 1.$$

## Finding the Last digit or Unit's Digit (UD) of a Number:

Unit's digit of a number, i.e., the last digit is the remainder when the number is divided by 10.

E.g. Unit's digit of 2345 is  $2345 \bmod 10 = 5$

Unit's digit of  $(234 + 567) = \text{Unit digit of } (4 + 7) = \text{Unit Digit of } 11 = 1$

Similarly, to find the unit's digit of  $(234 \cdot 567)$ , we just need to consider the unit's digits of these two numbers viz:  $4 \cdot 7 = 28$ . Hence the unit's digit of the given product is 8.

**How to calculate the unit's digit of numbers of the form  $a^b$  such as  $2^{253}$ ,  $3^{93}$ ,  $4^{74}$  etc.?**

**Case 1:** When  $b$  is NOT a multiple of 4.

We find the remainder when  $b$  is divided by 4.

Let  $b = 4k + r$ , where  $r$  is the remainder when  $b$  is divided by 4, and  $0 < r < 4$ .

The unit's digit of  $a^{4k+r}$  is the unit digit of  $a^r$ .

**Case 2:** When  $b$  is a multiple of 4.

We observe the following conditions:

Even numbers 2, 4, 6, 8 when raised to powers which are a multiple of 4 give the unit's digit as 6.

Odd numbers 3, 7, and 9 when raised to powers which are a multiple of 4 give the unit's digit as 1.

Unit's digit of  $a^{4k} =$  units digit of  $a^4$

**From 60%ile to 96%ile after joining iQuanta's CAT Course**



www.iQuanta.in

**Anubhav Satapathy**  
6 Jan 2020 · 📷

A journey from 60 to 96 percentile dedicated to iQuanta

**Disclaimer** - 96 percentile is not that big an achievement, but still I thought of sharing it. I will be more than happy if it inspires even a single aspirant. 😊😊

My preparation had started last year (CAT - 18) when I was barely prepared for the D-Day. But a percentile in the 60s was certainly not what I was expecting. That broke me up completely and I was suggested by many to give up on my CAT dream and pursue my job and look for other career opportunities. But something inside me kept the fire burning and I decided to embrace the struggle and challenge my limits. I sought motivation from Indrajeet sir and I am thankful to him as he stood with me for support. This year was a journey of ups and downs. I learned the real meaning of struggle and overcame the fear of failure. Though I expected a lot more than what I achieved, still I am happy that I scored this and even more motivated to score more given another chance.

Joining iQuanta was one of my best decisions. I can never forget the late-night classes, 24 hrs doubt solving, peer interaction and learning and the motivational sessions. The crash course was a great help too.

**Finding the Last Two Digits (LTD) of a number:**

Last two digits of a number is the remainder when the number is divided by 100.

E.g. LTD(123456) = 56, LTD(123\*456) = LTD(23\*56) = LTD(1288) = 88

**How to calculate last two digits of numbers in the form  $a^b$  such as  $24^{356}$ ,  $53^{903}$ ,  $79^{714}$  etc.?**

**Case 1:** When the unit's digit of  $a$  is 1, multiply the ten's digit of the number with the last digit of the exponent to get the ten's digit and it is easy to understand that the unit's digit is equal to one.

**Example:** Find the last two digits of  $21^{43}$ .

Solution: We know that unit's digit of the given number will be 1.

As mentioned above, to find the second last digit we need to multiply the ten's digit of the number (2) to the unit's digit of the exponent (3),  $2 \times 3 = 6$ .

So LTD of  $21^{43}$  is 61.

**Case 2:** When  $a = 2^n$  while finding last two digits of  $a^b$ .

$2^{10} = 1024$ ,  $24^1 = 24$ ,  $24^2 = 576$ , .....,  $24^3 = \text{xxx}24$ ,  $24^4 = \text{xxxxx}76$

Following the pattern, it can be noticed that,

$\text{LTD}(24^{\text{odd}}) = 24$  and  $\text{LTD}(24^{\text{even}}) = 76$ .

**Example:**

$\text{LTD}(16^{125}) = \text{LTD}(2^{500}) = \text{LTD}(\text{xx}24^{50}) = \text{LTD}(24^{\text{even}}) = 76$ .

**Case 3:** When the unit's digit of  $a$  is 5 while finding the last two digits of  $a^b$ .

$\text{LTD}(\text{xx}A5^B) = 75$ , when  $A$  and  $B$  are odd.

$\text{LTD}(\text{xx}A5^B) = 25$ , otherwise.

$\text{LTD}(35^{125}) = 75$ ,  $\text{LTD}(45^{242}) = 25$ ,  $\text{LTD}(85^{775}) = 25$ ,  $\text{LTD}(75^{364}) = 25$ .

## LCM, HCF AND THEIR APPLICATIONS

**Important points to remember:**

1. For two natural numbers  $x$  and  $y$  where  $x = h \cdot a$  and  $y = h \cdot b$  where  $a, b$  are co-prime numbers and  $\text{HCF}(x, y) = h$ ,  $\text{LCM}(x, y) = h \cdot a \cdot b$  and  $\text{Product}(x, y) = h^2 \cdot a \cdot b$

It can be noticed that:

(i)  $\text{Product}(x, y) = \text{LCM}(x, y) \cdot \text{HCF}(x, y)$

(ii) LCM is always a multiple of HCF.

2. If  $N$  is a positive integer which leaves remainder ' $r$ ' each time when divided by  $x, y$  or  $z$  then  $N = \{\text{LCM}(x, y, z) \cdot k\} + r$ , where  $k$  is a whole number.

E.g. Find the smallest number which leaves a remainder of 3 when divided by 4, 5 or 6.

Solution:  $\text{LCM}(4, 5, 6) \cdot 1 + 3 = 63$

3. If  $N$  is a positive integer which leaves remainders  $r_1, r_2$  and  $r_3$  when divided by  $x, y$  and  $z$  respectively, where  $x - r_1 = y - r_2 = z - r_3 = r$  then



$N = \{\text{LCM}(x, y, z) * k\} - r$ , where  $k$  is a natural number.

E.g. Find the smallest number which when divided by 8, 9, 10 leaves remainders 3, 4, 5 respectively.

Solution: We see that  $8-3 = 9-4 = 10-5 = 5$

So, smallest number =  $\text{LCM}(8, 9, 10)*1 - 5 = 355$

4.  $N$  is the greatest positive integer which divides  $x$  and  $y$ , leaving remainder  $r_1$  and  $r_2$  respectively, then  $N = \text{HCF}(x-r_1, y-r_2)$ .

5.  $N$  is the greatest positive integer which divides  $x$ ,  $y$  and  $z$ , leaving a remainder  $r$  in each case, then  $N = \text{HCF}(y-x, z-y)$ .

### Index of Greatest Power

The highest power of a number  $m$  that can divide another number  $n$  is known as IGP of  $m$  in  $n$ .

For any prime number  $p$ ,  
 $\text{IGP}(p)$  in  $n! = \left[ \frac{n}{p} \right] + \left[ \frac{n}{p^2} \right] + \left[ \frac{n}{p^3} \right] + \left[ \frac{n}{p^4} \right] + \dots$  where  $[x]$

denotes the greatest integer less than or equal to  $x$ .

There is another way to get the IGP. It is shown in the example below.

**Example:** What is highest power of 2 that can divide  $40!$ ?

Solution: IGP of 2 in  $40! = \left[ \frac{40}{2} \right] + \left[ \frac{40}{2^2} \right] + \left[ \frac{40}{2^3} \right] + \left[ \frac{40}{2^4} \right] + \left[ \frac{40}{2^5} \right] = 20+10+5+2+1 = 37$

**OR**

$\left[ \frac{40}{2} \right] \rightarrow \left[ \frac{20}{2} \right] \rightarrow \left[ \frac{10}{2} \right] \rightarrow \left[ \frac{5}{2} \right] \rightarrow \left[ \frac{2}{2} \right] \rightarrow 1$

Answer =  $20+10+5+2+1 = 37$

### CAT 99.63%er from iQuanta shares gratitude

Hi sir,  
 Wanted to thank you for all that you and the team have done for all the students...Just checked my results. With a scaled score of 96.37, I secured 99.63 percentile. I dedicate this to 'our hardwork that we put day and night, looking always ahead. I am grateful to have joined this amazing institute and had an amazing experience throughout the journey. That said, the journey is not fully done...Looking forward to XAT and the gdpis eagerly. ❤️



**Rishab Rahiman** (iQuanta Student)

Rishab Rahiman (iQuanta Student)

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# ARITHMETIC

Averages

Percentages

SI & CI

Profit & Loss

Mixtures & Alligation

Ratio & Proportion

Time, Speed & Distance

Races

Time & Work

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## AVERAGES



$$\text{Average} = \frac{\text{Sum of all the observations}}{\text{Number of observations}}$$

Note: Average of a set of values always lies between minimum to maximum.  
i.e., Minimum  $\leq$  Average  $\leq$  Maximum

### Remember the following points about averages:

- i. Average on 1<sup>st</sup> n natural number =  $\frac{n+1}{2}$  (i.e.,  $n(n+1)/2/n = (n+1)/2$ )
- ii. Average of 1<sup>st</sup> n odd numbers (1, 3, 5, .....,  $2n - 1$ ) = n (i.e.,  $n^2/n = n$ )
- iii. Average of 1<sup>st</sup> n even numbers (2, 4, 6, .....,  $2n$ ) =  $n + 1$
- iv. Average of n terms in Arithmetic Progression =  $\frac{n+1}{2}$ th term = middle term, when n is odd.

For example: Average (3, 7, 11, 15, 19, 23, 27) = 15

- v. Average of n terms in Arithmetic Progression =  $\frac{\frac{n}{2}\text{th term} + (\frac{n}{2}+1)\text{th term}}{2}$  = Average of middle terms, when n is even.

For example: Average of (6, 10, 14, 18, 22, 26, 30, 34) =  $\frac{18+22}{2} = 19$

- v. Average of n terms of an Arithmetic Progression =  $\frac{1\text{st term} + \text{last term}}{2}$

$$= \frac{2\text{nd term} + 2\text{nd last term}}{2}$$

$$= \frac{3\text{rd term} + 3\text{rd last term}}{2}$$

and so on.....

vi. If each term in a set is increased by the value k, then their average is also increased by k.

vii. If each term in a set is decreased by the value k then their average is also decreased by k.

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HEENAL RAGHVANI  
CAT 99.63%iler  
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viii. If each term in a set is multiplied by the value  $k$  then their average is also multiplied by  $k$ .

ix. If each term in a set is divided by the value  $k$  then their average is also divided by  $k$ .

**Concept of assumed average:**

**Example:** Find the average of 54, 55, 57, and 61

Solution: Let us assume average is 57 (We pick the assumed average in such a way that it lies around the middle of min and max values)

Next, we find deviation of the values from this assumed average.

$$54 - 57 = -3$$

$$55 - 57 = -2$$

$$57 - 57 = 0$$

$$61 - 57 = 4$$

$$\text{Average of all the deviations} = \frac{(-3)+(-2)+(0)+4}{4} = -0.25$$

Hence, actual average will be  $57 - 0.25 = \mathbf{56.75}$ .

## PERCENTAGES



**The percentage equivalents of fractions:**

Fraction	Percentage	Fraction	Percentage	Fraction	Percentage
1/2	50%	1/8	12.50%	1/14	7.14%
1/3	33.33%	1/9	11.11%	1/15	6.66%
1/4	25%	1/10	10%	1/16	6.25%
1/5	20%	1/11	9.09%	1/17	5.88%
1/6	16.16%	1/12	8.33%	1/18	5.56%
1/7	14.28%	1/13	7.69%	1/19	5.26%

**Important points:**

i.  $x$  is what % of  $y = \frac{x}{y} * 100\%$

ii.  $x\%$  of  $y = y\%$  of  $x$

iii.  $x$  is what % more than  $y = \frac{(x-y)}{y} * 100, x > y$ .

iv.  $x$  is what % less than  $y = \frac{(y-x)}{y} * 100, x < y$ .

## v. Multiplication Factor (MF)

For example, increase x by 10%:

$$x + 10\% \text{ of } x = x(1+10\%) = x\left(1 + \frac{10}{100}\right) = x(1 + 0.1) = 1.1x$$

Here we are basically multiplying x by 1.1 which is known as multiplication factor for 10% increase.

So next time if we want to decrease a quantity by 10% we can directly multiply that quantity by  $(1 - 10\%) = 0.9$  and get the desired value.

E.g. Find the resultant value when 100 is increased by 20%, decreased by 30% and then increased by 12%.

Solution:  $100 \times 1.2 \times 0.7 \times 1.12 = 94.08$

**Here are a few multiplication factors for the respective % changes:**

Percentage Change	Multiplication Factor	Percentage Change	Multiplication Factor
+5%	1.05	-5%	0.95
+10%	1.1	-10%	0.9
+15%	1.15	-15%	0.85
+20%	1.2	-20%	0.8
+25%	1.25	-25%	0.75
+30%	1.3	-30%	0.7
+40%	1.4	-40%	0.6
+50%	1.5	-50%	0.5
+60%	1.6	-60%	0.4

### From **74%ile** to **99.2%ile** after joining iQuanta's CAT Course



Syed Abdus Sattar

Last Year in CAT 2019, I got 74 percentile. That year I started preparing in March and thought would do self preparation. Then I studied for 10-15 days with Arul Sharma but was unable to manage job and work. I got demotivated and left preparation. Bas exam ke din jake paper diya and got 74 percentile and did not even want to attempt the paper after 1 and half hours and then I thought I am not going to waste 1 more year and will prepare sincerely. 2020 me same cycle repeat hui. I started preparing in and March with Arul Sharma and left after 10 days. Socha ki I am not giving test year. Then work from home ki wajah se I went to home and I was following Iquanta on Fb. Jab 4.5 months bache the tab my sister and mother asked me to join any coaching and then see whatever happens. I joined in the last batch of Iquanta and started preparing from scratch in the last batch. I attended all the events and practised as much I could after whatever time was left after job. Started giving mocks 2 weeks before CAT 2020. I think if I practised more mera LRD me confidence better hota but still I do not have any regrets. Mocks me marks kharab hi the but CAT tension free hokar diya and I think tough CAT examination helped my cause. I got 99.2 percentile this year. Want to thank Jeet Singh sir and Iquanta for teaching me but more importantly for getting me to start the preparation systematically and get into a schedule

51w Love Reply

8

# iQuanta's CAT Result 500+ 99%ilers & 1000s of CAT Toppers



**Rishi Mittal**  
CAT Percentile: 100



**Prateek Bajpai**  
CAT Percentile: 100



**Mridul Agrawal**  
CAT Percentile: 99.99



**Shikhar Sachdeva**  
CAT Percentile: 99.98



**Dhruv Gupta**  
CAT Percentile: 99.98



**Mihir Kapse**  
CAT Percentile: 99.97



**Kislay Jha**  
CAT Percentile: 99.96



**Gauravi Kabadi**  
CAT Percentile: 99.95



**Shivam Kumar**  
CAT Percentile: 99.95



**Rahul Das**  
CAT Percentile: 99.94



**Pratik Sahoo**  
CAT Percentile : 99.94

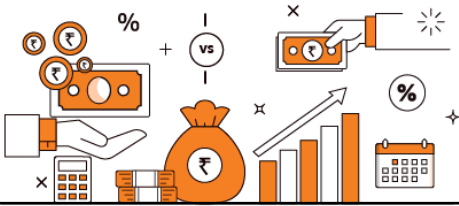


**Adarsh Khandelwal**  
CAT Percentile: 99.93

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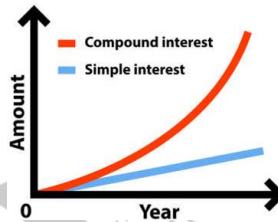
# SIMPLE & COMPOUND INTEREST



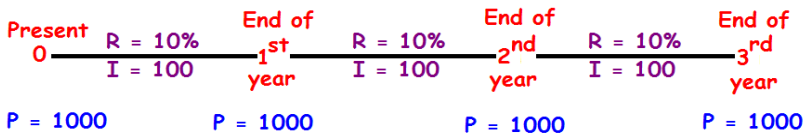
## Difference & Graphical Presentation of Simple and Compound Interest:

- Simple interest is always charged on a sum (original principal) at a particular rate and specified period of time.
- Simple interest for all years is the same.

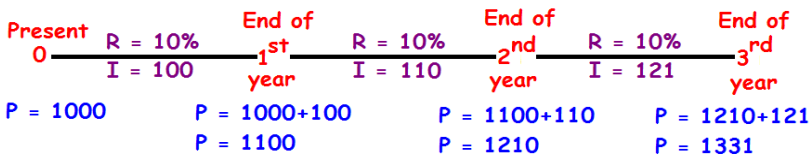
- Compound interest is charged on principle and accumulated interest.
- Compound interest for all years is different.



### SIMPLE INTEREST :



### COMPOUND INTEREST :



Let  $P$  be the principal,  $R$  be the interest rate % Per annum, and  $T$  be the time period (in years)



## Simple Interest :

$$S.I = \frac{P \times R \times T}{100}$$

## Compound Interest:

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

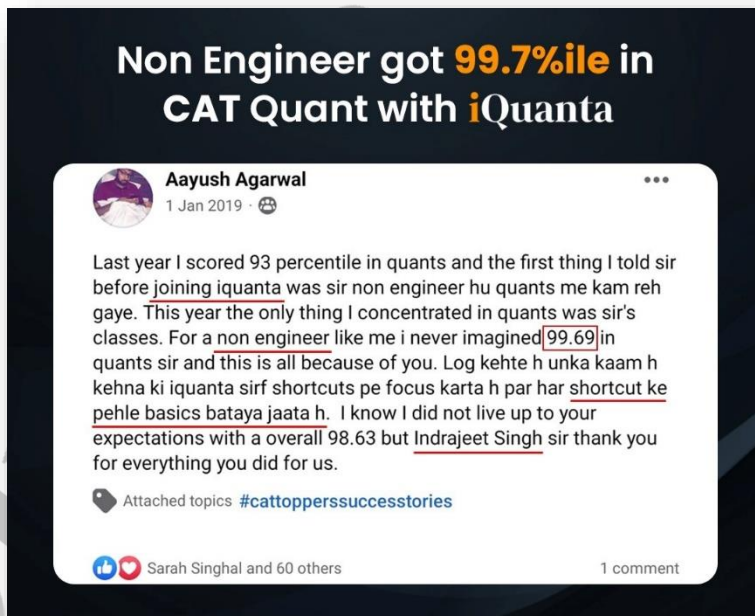
$$\text{Amount, } A = P \left(1 + \frac{r}{100}\right)^T$$

If interest is being compounded n-times a year then  $A = P \left(1 + \frac{r/n}{100}\right)^{n \times T}$

### Difference between Compound Interest and Simple Interest

For Principal = P, Rate of interest per annum = R%  
 $= \frac{R}{100}$

- i. Difference between C.I and S.I after 1 year = 0
- ii. Difference between C.I and S.I after 2 years =  $P \left(\frac{R}{100}\right)^2$
- iii. Difference between C.I and S.I after 3 years =  $P \left(\frac{R}{100}\right)^2 \left(3 + \frac{R}{100}\right)$



## PROFIT & LOSS



### i. Keywords

- a. **Cost Price (CP):** Price of an article at which it is bought.
- b. **Selling Price (SP):** Price of an article at which it is sold.

**c. Marked Price (MP):** It is also known as listed price or printed price or maximum retail price of an article which is decided by the seller so that he can sell it to a customer and make profit.

**d. A Profit** is earned when selling price of an article is greater than the cost price of the same article. Profit % is calculated on the cost price.

$$\text{Profit} = \text{SP} - \text{CP}, \text{Profit \%} = \left(\frac{\text{SP}-\text{CP}}{\text{CP}}\right)*100 = \left(\frac{\text{Profit}}{\text{CP}}\right)*100.$$

**e. A Loss** occurs when selling price of an article is lesser than the cost price of the same article. Loss % is also calculated on the cost price.

$$\text{Loss} = \text{CP} - \text{SP}, \text{Loss \%} = \left(\frac{\text{CP}-\text{SP}}{\text{CP}}\right)*100 = \left(\frac{\text{Loss}}{\text{CP}}\right)*100.$$

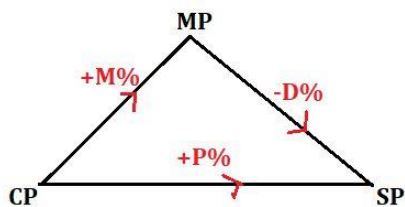
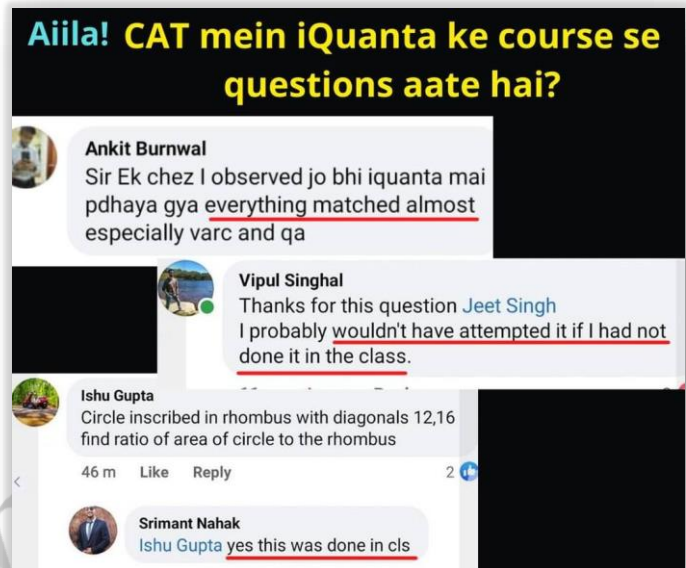
**f. Mark up** is the difference between marked price and cost price of an article. Mark up % is also calculated on the cost price.

$$\text{Mark up value} = \text{MP} - \text{CP},$$

$$\text{Mark up \%} = \left(\frac{\text{MP}-\text{CP}}{\text{CP}}\right)*100$$

**g. Discount** is the difference between marked price and selling price. Discount % is calculated on marked price.

$$\text{Discount} = \text{MP} - \text{SP}, \text{Discount \%} = \left(\frac{\text{MP}-\text{SP}}{\text{MP}}\right)*100.$$



If there are two articles, one of them is sold at x% profit and other is sold at x% loss then overall profit OR loss % on overall transaction will be

1. 0, when both articles have same CP.
2. Loss =  $\frac{x^2}{100}$  %, when both articles have same SP.

### iii. Dishonest Seller & Faulty Measurements

These are cases when a shopkeeper uses lesser weights or measurements than what is promised to the customer while selling goods to get some profit out of it.

In these types of situations,

$$\text{Profit \%} = \frac{\text{Claimed weight} - \text{Actual weight}}{\text{Actual weight}} \times 100$$

E.g. A seller sells 800g for the price of 1000g.

$$\text{Profit \%} = (1000 - 800) / 800 \times 100 = 25\%$$

#### iv. Partnerships:

When n number of people invest  $A_1, A_2, A_3, \dots, A_n$  amounts for  $T_1, T_2, T_3, \dots, T_n$  time periods in the same business then profits are shared in the ratio  $A_1T_1 : A_2T_2 : A_3T_3 : \dots : A_nT_n$ .

## ALLIGATION & MIXTURE



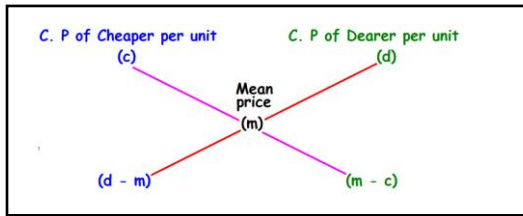
**Alligation:** The rule allows us to determine the ratio of quantity in which two or more ingredients at the given price must be combined to produce the desired price.

#### Rule of Alligation:

If two ingredients are mixed, then

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

**Cross proportion representation:**



$\therefore (\text{Cheaper quantity}) : (\text{Dearer quantity}) = (d - m) : (m - c)$

**Shivam Kumar,**  
**IIM ABC Convert (99.95%ler) from iQuanta.**



Shivam Kumar  
1 hr · 🌐



Holy Trinity ( IIM A,B,C) Converted

2020 was a year of uncertainty, CAT was no exception to it. With high hopes, I started my preparation. The initial few mocks were pretty similar to Team India's batting performance against Australia in the 2nd innings of 1st test (India Tour of Australia 2020-21). But initial push from the mentors and the peers helped me gain some momentum. I had been a silent observer but I closely followed the discussion which took place in the paid group. All the mentors were approachable 24\*7 and that was the best part. I would get to learn unique approach to tackle the problems everytime I opened the group and the comments. As I said I was a silent spectator, most of my learnings happened through amazing peers and mentors. Every discussions led to new insights which proved to be very helpful. The mocks were pretty similar to the actual level. The analysis helped me reassess my strategies and increase my efficiency. iQuanta 250 & LRDI 70 series helped me buckle up for the final hustle. iQuanta 250 acted as a cherry on top, one place to revise the entire syllabus. The unparalleled hard work put by the team motivated me to take that extra step. And the cumulation of those steps mattered in the end. I would like to thank the entire iQuanta team for their relentless efforts and their selfless service. And to my peers: you are awesome, unknowingly all of you have taught me a lot. Hope all of you do well in your life.

FYI,  
Converted IIM Ahmedabad, IIM Bangalore, IIM Calcutta, Kozhikode, Shillong, Indore, IIT B, NITIE !  
CAT'20: 99.95%ile



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## Removal and Replacement

Let us say a container has  $x$  units of liquid, and  $y$  units are removed and replaced by water.

After  $n$  operations, the quantity of the pure liquid =  $x \left(1 - \frac{y}{x}\right)^n$  units.

- **General formula for  $n$  operations:**

Final or reduced concentration  
= initial concentration  $\left(1 - \frac{\text{amount being replaced in each operation}}{\text{total amount}}\right)^n$

- **Weighted Average method:**

Two mixtures having weights  $f_1, f_2$  and corresponding averages  $A_1, A_2$ , their weighted average  $A_w = \frac{A_1 * f_1 + A_2 * f_2}{f_1 + f_2}$

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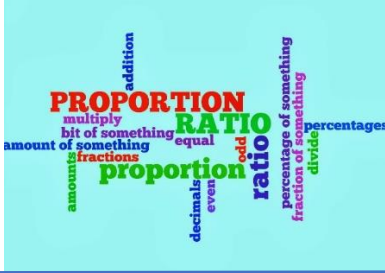
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# RATIO & PROPORTION



## Properties of ratio:

i. If  $0 < \frac{A}{B} < 1$ , then  $\frac{A}{B} < \frac{A+x}{B+x}$  where  $x > 0$ .

For example:  $\frac{9}{11} < \frac{109}{111}$

ii. If  $\frac{A}{B} > 1$ , then  $\frac{A}{B} > \frac{A+x}{B+x}$  where  $x > 0$ .

For example:  $\frac{17}{13} > \frac{57}{53}$

iii. If  $\frac{A}{B} = \frac{C}{D} = \frac{E}{F} = \dots = K$  then

a.  $\frac{A+C+E}{B+D+F} = K$

b.  $\frac{pA+qC+rE}{pB+qD+rF} = K$

c.  $\frac{pA^n+qC^n+rE^n}{pB^n+qD^n+rF^n} = K^n$

Note: In points a, b, and c none of the denominators should be equal to zero.

## Merging Ratios

Ratios are merged to compare all the quantities at once. Usually, ratios are merged by making the common term equal or multiplying all the ratios together.

**E.g. If  $a : b = 3 : 5$  and  $b : c = 4 : 5$  then find  $a : b : c$ .**

### Solution:

**Method – 1:** firstly, it can be noticed that b is common in both so we can make it equal in both ratios, LCM (4, 5) = 20.

$a : b = 3 : 5 = 12 : 20$ ,  $b : c = 4 : 5 = 20 : 25$

Hence,  $a : b : c = 12 : 20 : 25$ .

**Method – 2:**

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

$$\text{or, } \frac{a}{c} = \frac{3}{5} * \frac{4}{5} = \frac{12}{25},$$

when  $a = 12$ ,  $b = 20$  and  $c = 25$ .

Hence,  $a : b : c = 12 : 20 : 25$ .

This method is very useful when there are more than two ratios to be merged.

**Proportion:**

i. If  $a$ ,  $b$  and  $c$  are in continued proportion, then  $\frac{a}{b} = \frac{b}{c}$  and vice-versa is also true.

Here  $a$  is known as the first proportion,  $b$  is known as the mean proportion and  $c$  is known as the third proportion.

ii. If  $a$ ,  $b$ ,  $c$  and  $d$  are in continued proportion, then  $\frac{a}{b} = \frac{c}{d}$  and vice-versa.

iii. If  $\frac{a}{b} = \frac{c}{d}$ , then  $\frac{a+b}{a-b} = \frac{c+d}{c-d}$  which is also known as Componendo & Dividendo.

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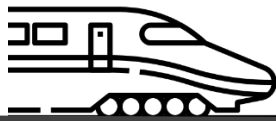
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## TIME, SPEED & DISTANCE:



**General formula:** Distance = Speed × Time

### Unit conversion:

Unit of speed =  $\frac{\text{km}}{\text{hr}}$

$$1 \frac{\text{km}}{\text{hr}} = \frac{5}{18} \text{ m/sec}, \quad 1 \frac{\text{m}}{\text{sec}} = \frac{18}{5} \text{ km/hr}$$

### Proportionality:

1. When distance is constant:  $s \propto \frac{1}{t}$  or  $t \propto \frac{1}{s}$  so,  $st = \text{constant}$ ,  $s_1t_1 = s_2t_2$

	A	B	P	Q	R
<b>Speed</b>	3	4	3	4	6
<b>Time</b>	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{6}$
	4	3	4	3	2

**Note:** If speed is being multiplied by a factor  $x$ , then time will be multiplied by  $\frac{1}{x}$ .

2. When speed is constant:  $D \propto t$  or  $D_1 : D_2 = t_1 : t_2$

3. When time is constant:  $D \propto s$  or  $D_1 : D_2 = s_1 : s_2$

**Average Speed:** Total Distance/Total time taken

### Relative speed:

The relative speed of two objects moving with speeds  $S_1$  &  $S_2$  when they are moving in:

1. Same direction,  $S_R = S_1 - S_2$ ,  $S_1 > S_2$



2. Opposite direction,  $S_R = S_1 + S_2$



### Special Cases for Trains:

- When a train passes a pole (or, any stationary object of negligible length), it covers a distance which is equal to its own length.
- When a train passes a platform, it covers a distance which is equal to the sum of the length of the platform and its own length.
- When a train A passes a moving train B, it covers a distance which is equal to the sum of the length of both the trains A and B with relative speed.
- When a train A crosses a stationary train B, it covers a distance which is equal to the sum of the length of both the trains.

### Special Cases for Boats:

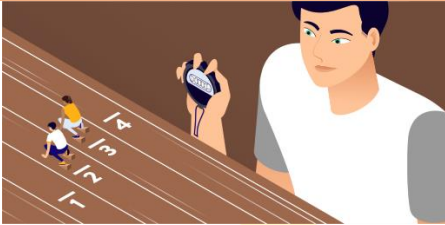
Speed of Boat = B, Speed of river or stream = R (in still water)

$$\text{Speed in downstream (D)} = B + R$$

$$\text{Speed in upstream(U)} = B - R$$

In the case of boats and streams, as the distance is constant in upstream and downstream movements, time taken is inversely proportional to the upstream and downstream speeds.

## LINEAR & CIRCULAR RACES:



### Linear races:

1. In a race of d meters A beats B by x metres:

$$S_A/S_B = d/(d-x)$$

2. In a race, A beats B by t seconds:

$$S_A/S_B = (t_A + t)/t_A$$

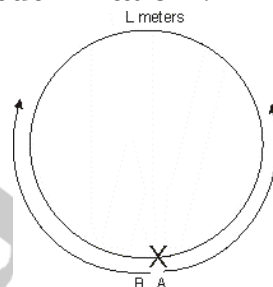
**3. In a race, A beats B by x meters or t sec.**

$$S_B = \frac{x}{t} \text{ m/sec}$$

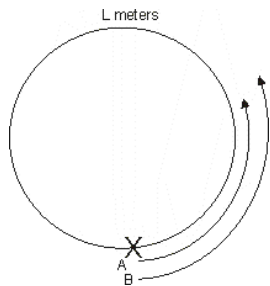
### **Circular Races:**

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 direction.



- 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 =  $L/(m + n)$  (when they are running in opposite directions)
- The time for their first meeting =  $L/(|m - n|)$  (when they are running in the same direction)
- Time when 3 objects meet for the first time: Find the time taken for any 2 pairs to meet for the first time and then take the LCM of those times.
- Time when 2 objects meet for the first time at the starting point after moving = LCM ( $L/m, L/n$ )

**Note:** LCM of Fractions  $LCM(a/b, c/d) = LCM(a, c)/HCF(b, d)$

## TIME & WORK



**t – time, e – efficiency, a – amount of work**

**Case 1: When a is constant,  $t \propto \frac{1}{e}$  or  $e \propto \frac{1}{t}$**

**Case 2: When t is constant,  $a \propto e$  or  $e \propto a$**

**Case 3: When e is constant  $t \propto a$  or  $a \propto t$**

Wages  $\propto$  amount of work done by worker

- If A can do a piece of work in n days, then A's 1 day's work =  $\frac{1}{n}$
- If A can do a piece of work in x days and B in y days, and together they take z days to complete the work. Then,  

$$1/z = 1/x + 1/y$$

$$\Rightarrow z = \frac{xy}{x+y}$$

**Concept of Man-days:** If  $M_1$  men can do  $W_1$  work in  $D_1$  days working  $H_1$  hours per day and  $M_2$  men can do  $W_2$  work in  $D_2$  days working  $H_2$  hours per day (where all men work at the same rate), then

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

**Points to Remember for Pipe & Cistern questions:**

- If we are filling the tank, the Inlet pipes do positive work while the Outlet pipes do negative work.
- If the goal is to empty the tank, the Outlet Pipes do positive work while the Inlet Pipes perform negative work.

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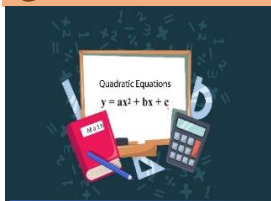
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## QUADRATIC & OTHER EQUATIONS



Some important Algebraic Identities:

- $(a + b)^2 = a^2 + b^2 + 2ab$
- $(a - b)^2 = a^2 + b^2 - 2ab$
- $(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$
- $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$
- $(a - b)^3 = a^3 - b^3 - 3ab(a - b)$
- $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
- $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$
- $a^2 - b^2 = (a + b)(a - b)$
- $(a + b + c)^3 = a^3 + b^3 + c^3 + 3(a + b)(b + c)(c + a)$
- $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$   
If  $a + b + c = 0$ , then  $a^3 + b^3 + c^3 = 3abc$



A quadratic equation is represented as

$$\boxed{ax^2 + bx + c = 0} \text{ (if } a = 0, \text{ then equation becomes linear)}$$

$$\boxed{x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}}$$

All values of 'x' satisfying the equation are known as roots/zeros of the equation.

**Note:** An equation of degree 'n' will have n roots (real and imaginary) (E.g. Cubic equation has 3 roots)

- If 'c' and 'a' are equal then the roots are reciprocal to each other.
- A quadratic whose roots are reciprocal of the roots of  $ax^2+bx+c = 0$  is  $cx^2+bx+a = 0$
- If  $b = 0$ , then the roots are equal and are opposite in sign
- **Discriminant :**

It is denoted by **D**, and  $D = b^2 - 4ac$ . Depending on the sign and value of D, nature of the roots would be as follows:

- If  $D < 0$ , Roots will be imaginary. The graph would not touch x axis.
- If  $D > 0$ , Roots will be real and distinct. Graph cuts X axis at two distinct points.
- If  $D = 0$ , Roots are real and equal. Graph just touches the x axis at one point.

**Note:** Complex or irrational roots always occur in pair i.e., they are conjugate. E.g.:  $x^2 - 4x - 1 = 0$

$x = (2 \pm \sqrt{5})$  i.e., roots are  $2 + \sqrt{5}$  and  $2 - \sqrt{5}$  which are conjugate pairs.

	<b>Quadratic Equation</b> $ax^2 + bx + c = 0$	<b>Cubic Equation</b> $ax^3 + bx^2 + cx + d = 0$
<b>Sum of roots</b>	$\alpha + \beta = -b/a$	$\alpha + \beta + \gamma = -b/a$
<b>Product of roots</b>	$\alpha\beta = c/a$	$\alpha\beta\gamma = -d/a$
<b>Pairwise sum of Product of roots</b>	-	$\alpha\beta + \beta\gamma + \lambda\alpha = c/a$
<b>A quadratic eq. can be written as <math>x^2 - Sx + P = 0</math></b> where S = sum of roots and P = product of roots		



- For any given equation  $y = f(x) = 0$  the number of times the graph of this equation cuts the X axis is equal to the distinct real roots of this equation. For Exp:  $(x-1)(x+2)(x-2) = 0$  will intersect x axis at 3 distinct points: 1, -2, 2
- Any quadratic equation will be of the form  $(x-a)(x-b) = 0$  and will cut the axis at a and b.
- When  $a > 0$ ,  $ax^2 + bx + c$  has minimum at  $x = -b/2a$  & that minimum is  $-D/4a = (4ac-b^2)/4a$
- When  $a < 0$ ,  $ax^2 + bx + c$  has maximum at  $x = -b/2a$  & that maximum is  $-D/4a = (4ac-b^2)/4a$

**Initially confused, impressed by iQuanta's Doubt Solving, gets CAT 99.03%ile with iQuanta**




**Karal Maheshwari**


4 Jan 2020 · 🌐

99.03%ile, Jitna expected tha usse kam aaya but want to thank Indrajeet Singh sir 🙏🙏  
 Left my job in June and started preparing for cat, was confused about joining online coaching, but then I saw sir clearing doubts of students in Iquanta group and after 10 days i decided to join iquanta, it was a big step for me cause I had to give my best. Thanks to iquanta team and especially indrajeet sir for great sessions and proper direction one needs for exam like CAT ❤️ I am not in a position to take a drop else I would have with iquanta team besides me.


# 24x7 Doubt Solving

 **Aniket Singh Rajput**  
Although I have not performed well in CAT 2020 while I was and I am the student of I quanta but I can guarantee that the approach, the way of teaching and the best thing 24X7doubt solving can not be questioned at any time in any case. #Iquanta is the best ❤️


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 **Tanmay Pandey**  
KI raat 2 bje bhi doubt solve ho gye the


Like Reply 19 m

 **Sattwik Sarma**  
**Tanmay Pandey** ye shayad aur koi coaching provide nhi karta jese IQuanta karta hai


Like Reply 8 m

 **Santiago Bernaleo**  
Love how iquanta doesn't let any question slip. Never actually seen a question go unsolved by iquanta


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 **Roger Shah**  
Speed of light = Speed of IQuanta solving doubts 🚀

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 **Supratim Chatterjee**  
I'll never know how iQuanta does it despite such a large number of aspirants in the group but yeah! not a single doubt remains unaddressed! Kudos to Jeet Sir and iQuanta! ❤️

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 **Supratim Chatterjee**  
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 **Siddhanta Mishra**  
actually this is my favourite part when a post appears asking to solve competition lag jata hai who can solve it first and 80% time mai by the time i type the ans iquanta posts the ans. still competition among us with team iquanta continues. that's the best part of this group ❤️

1y Love Reply 6

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## INEQUALITIES

### If Roots are Real,

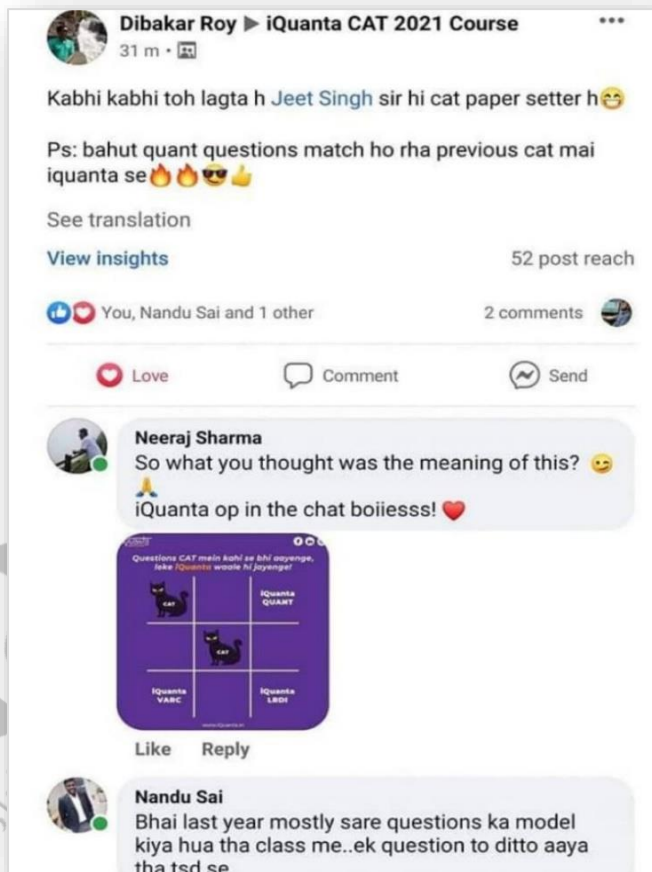
- when  $(x-a)(x-b) > 0$   
 $x \in (-\infty, a) \cup (b, \infty)$
- when  $(x-a)(x-b) < 0$   
 $x \in (a, b)$

### Note:

- If product of  $n$  positive numbers is constant, then their sum will be minimum when all are equal or close to each other.
- If the sum of  $n$  positive numbers is constant, then their product will be maximum when all are equal or close to each other.
- In case of equations, for example  $3x = 5y$ , multiplying with  $-1$  on both sides results in  $-3x = -5y$ .

But in the case of inequalities, for example  $3x > 5y$ , on multiplying with  $-1$  on both sides, the inequality changes to  $-3x < -5y$   
For example  $7 > 4$ , but  $-7 < -4$ .

- In inequalities, one cannot cancel the common multiple on both sides. For example, cancelling the common multiple 'x' in  $x(x-1) > x(y-2)$  is not allowed.



## SURDS & INDICES

### Important points to remember:

- In surd questions, every surd is an irrational number.  
Ex:  $\sqrt{4}$ ,  $\sqrt[2]{5^3\sqrt{7}}$
- Any integer raised to the power zero will always equal one.

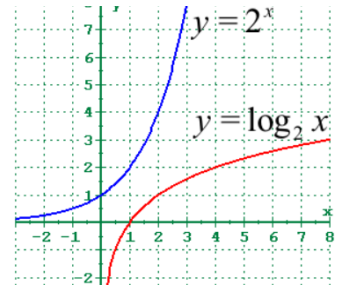
Law of surds	Law of indices
$\sqrt{m \times n} = \sqrt{m} \times \sqrt{n}$	$a^n \cdot a^m = a^{m+n}$
	$a^n \cdot b^n = (a \cdot b)^n$
$\sqrt{\frac{m}{n}} = \frac{\sqrt{m}}{\sqrt{n}}$	$a^m / a^n = a^{m-n}$
	$a^n / b^n = (a / b)^n$
$\frac{r}{\sqrt{s}} = \frac{r}{\sqrt{s}} \times \frac{\sqrt{s}}{\sqrt{s}} = \frac{r\sqrt{s}}{s}$	$(a^n)^m = a^{n \cdot m}$
$p\sqrt{q} \pm r\sqrt{q} = \sqrt{q}(p \pm r)$	$a^n m = a^{(n^m)}$
$\frac{r}{p \pm q\sqrt{n}}$ : Multiply num and den by $p \mp q\sqrt{n}$ to rationalise the denominator	$m\sqrt{(a^n)} = a^{n/m}$
	$n\sqrt{a} = a^{1/n}$
	$a^{-n} = 1 / a^n$

## LOGARITHMS

- $a^x = N$  can be expressed in logarithmic form as  $x = \log_a N$   
 $\log_a a = x$  means that  $a = 10^x$
- **Natural Logarithm:**  $\log_e N$  is called Natural logarithm, denoted by  $\ln N$  i.e., when the base is 'e' then it is called as Natural logarithm.
- **Common Logarithm:**  $\log_{10} N$  is called **common logarithm** i.e., when base of log is 10, then it is called as common logarithm.
- **Both functions are graphed below: Base of 2 and base of e**

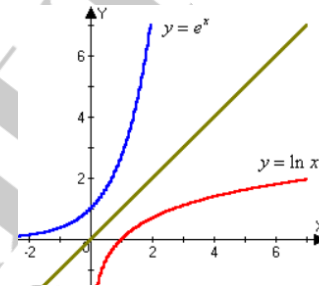
### Logarithm Properties:

- $\log(mn) = \log m + \log n$ ,  $m > 0$ ,  $n > 0$  **(Addition)**
- $\log\left(\frac{m}{n}\right) = \log m - \log n$ ,  $m > 0$ ,  $n > 0$  **(Subtraction)**
- $\log m^n = n(\log m)$  **(Logarithm of a power)**
- $\log_x y = \frac{\log_a y}{\log_a x}$  **(Change of base rule)**
- $\log_x y = \frac{1}{\log_y x}$  **(Inverse)**
- $\log_x 1 = 0$  ( $x \neq 0, 1$ ).

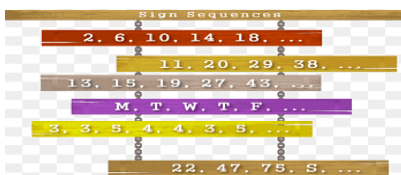


**Note: The logarithm of "0" and negative numbers is not defined.**

- 
- $\log_b 1 = 0$  ( $\because b^0 = 1$ )
- $\log_b b = 1$  ( $\because b^1 = b$ )
- $y = \ln x \rightarrow x = e^y$
- $x = e^y \rightarrow \ln x = y$
- $x = \ln e^x = e^{\ln x}$
- **$\log_b b^y = y$**



## SEQUENCES, SERIES & PROGRESSIONS



### Arithmetic Progression (A.P)

An A.P. is of the form  $a, a+d, a+2d, a+3d, \dots$  where  $a$  is called the 'first term' and  $d$  is called the 'common difference'.

$n^{\text{th}}$  term of an A.P:

$$T_n = n^{\text{th}} \text{ term} = a + (n - 1) d$$

( $d$  = common difference,  $n$  = numbers of terms)

Sum of the first  $n$  term of an A. P:

$$S_n = \frac{n}{2} [2a + (n - 1)d] = \frac{n}{2} [a + L]$$

( $L$  = last term,  $a$  = first term)

Arithmetic Mean (A.M):  $A.M = \frac{1}{2}(\text{Sum of all terms}) = \frac{1}{2}(\text{first term} + \text{last term})$

### Geometric Progression (G.P)

A G.P. is of the form  $a, ar, ar^2, ar^3, \dots$  where  $a$  is called the 'first term' and  $r$  is called the 'common ratio'.

$n$ th term of a G.P:

$$T_n = a r^{n-1}$$

Sum of the first  $n$  terms in a G.P:

$$S_n = \frac{a|1-r^n|}{|1-r|}$$

; Sum of  $\infty$  terms:

$$S_\infty = \frac{a}{|1-r|}$$

Geometric Mean (G.M):

$$b = \sqrt{ac}$$

( $a, b, c$  are the 3 consecutive terms of a GP)

### Harmonic Progression (H.P.)

If the reciprocals of the terms of a sequence are in arithmetic progression, the sequence is called harmonic progression.

**For E.g.**  $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots$  is in harmonic progression. If we write it in form of H.P

i.e.,  $\frac{1}{a}, \frac{1}{a+d}, \frac{1}{a+2d}, \dots$

$$\text{Harmonic Mean (H.M) of } x, y = \frac{2xy}{x+y}$$

For any two positive number  $a$  and  $b$ ,

$$A.M \geq G.M \geq H.M$$

### Some useful results:

- Sum of first  $n$  natural numbers =  $\frac{n(n+1)}{2}$
- Sum of the squares of first  $n$  natural numbers =  $\frac{n(n+1)(2n+1)}{6}$
- Sum of the cubes of first  $n$  natural nos. =  $\left[\frac{n(n+1)}{2}\right]^2$
- Sum of first  $n$  natural odd numbers =  $n^2$
- Sum of first  $n$  even numbers =  $n(n+1)$

## FUNCTIONS & GRAPHS

A function is a special relationship where each input has a single output (but 2 different inputs can have the same output). It is often written as " $y = f(x)$ " where  $x$  is the input value in the function  $y$ .

**Domain:** Set of real and finite values that  $x$  can take.

**Range:** Set of real and finite values that  $y$  can have corresponding to the values of  $x$ .

**From 85%ile to 99.9%ile in CAT, that's what relevant Content at iQuanta helps you to get :**

**Geetsaisumant Jupudi**  
21 December at 23:00 · 🌐

A journey from 85 percentile to 99.89 percentile.  
My first CAT attempt in 2020 during my final year and landed up getting 85 percentile without any preparation.  
I decided to appear for CAT again, but this time with preparation. I started to search for an online coaching institute and got to know about Iquanta through quora. I decided to join iQuanta(Second Batch) for two reasons, one was the positive reviews and second that it was pocket friendly.  
I joined iQuanta and prepared for 5-6 months, but during last 2 months of CAT preparation I took frequent breaks, and finally got to 96.68 percentile. On the day response sheet was released, I realized that I had underperformed. I was still hopeful that I would get an admission in a decent college. But fortunately I didn't. Then somewhere around June 2022, I decided to give CAT a last attempt and give everything to it. I joined Iquanta course(Last Batch) again, this time because I was confident of the content and rigorous practice at Iquanta. I did not repeat the same mistake again and here it is, the day I was waiting for. I cannot explain the my feeling when I saw my result. 2 years long wait came to an end, still I believe far to go(GDPI), but one stage is cleared and after seeing the result, I am more pumped up for GDPI Preparation.

Most important thing that I learnt in during my journey is that CONSISTENCY is the key to crack CAT.  
You will have bad days during preparation, I had, everyone has. But never get disheartened, believe in the process and work hard till the end.

The best part I feel about Iquanta is the huge amount of RELEVANT content, whether it is LRDI sets, RCs or Quant questions, everything is at par with CAT level. Then the rigorous practice and peer learning complement your preparation and keep you motivated.

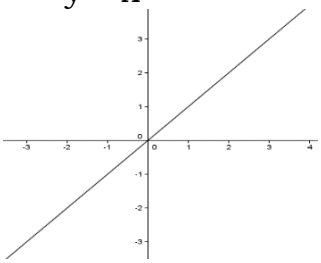
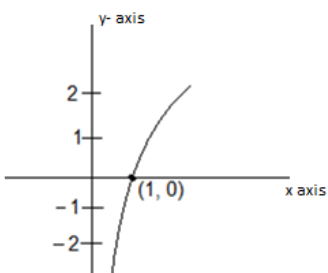
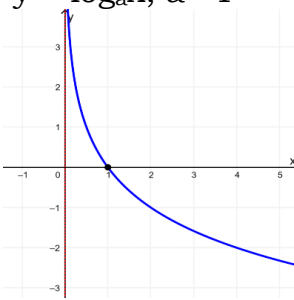
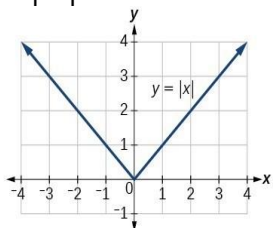
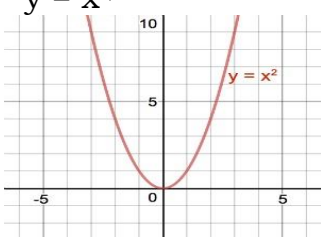
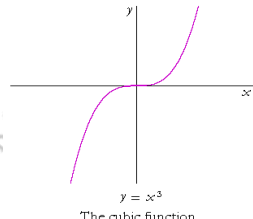
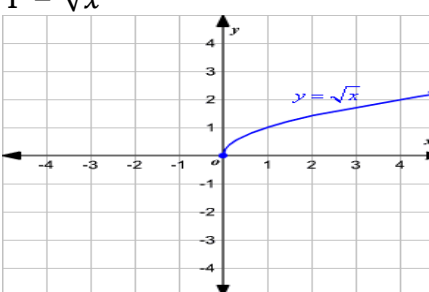
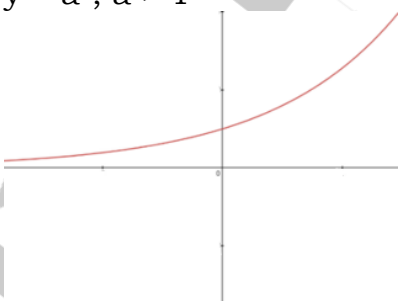
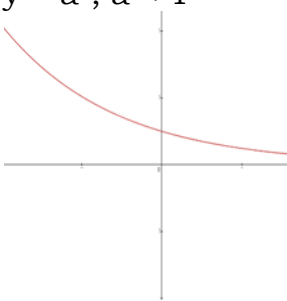
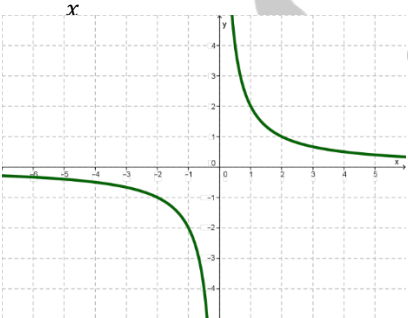
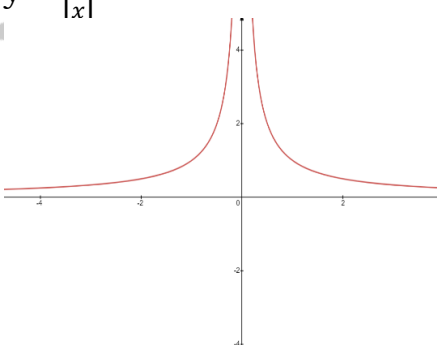
NOTE- Those who are planning to take Iquanta course, don't miss the final marathon sessions, those are score boosters.

Saying thanks won't be enough to express my gratitude to [Jeet Singh](#) sir, [Sajjan Barnwal](#) sir, [Abhishek Leela Pandey](#) Sir and all the iQuanta team, who guided us throughout our journey and kept us motivated. Couldn't have got a better institute that this.



**Note:** Set A has  $m$  elements & set B has  $n$  elements then no. of functions possible from set A to set B =  $n^m$

**Some important graphs:**

<p><math>y = x</math></p> 	<p><math>y = \log_a x, a &gt; 1</math></p> 	<p><math>y = \log_a x, a &lt; 1</math></p> 
<p><math>Y =  x </math></p> 	<p><math>y = x^2</math></p> 	<p><math>y = x^3</math></p>  <p>The cubic function</p>
<p><math>Y = \sqrt{x}</math></p> 	<p><math>y = a^x, a &gt; 1</math></p> 	<p><math>y = a^x, a &lt; 1</math></p> 
<p><math>Y = \frac{1}{x}</math></p> 	<p><math>y = \left  \frac{1}{x} \right </math></p> 	



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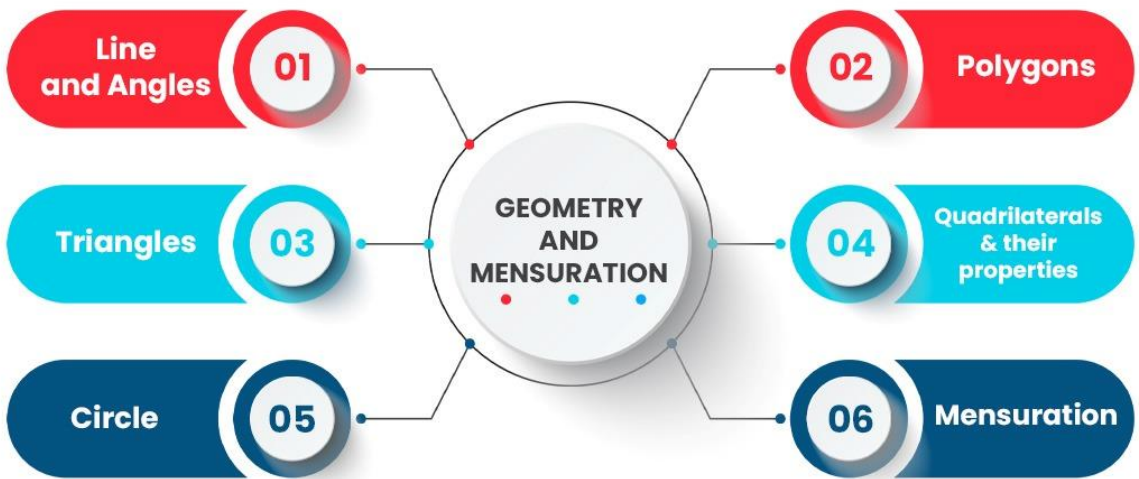
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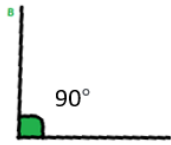
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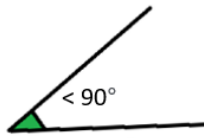


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# GEOMETRY



Right Angle



Acute Angle



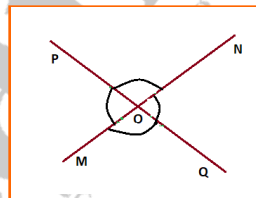
Obtuse Angle

## Complementary & Supplementary Angles:

Two angles which add up to 90 degrees are called complementary angles and two angles which add up to 180 degrees are called supplementary angles.

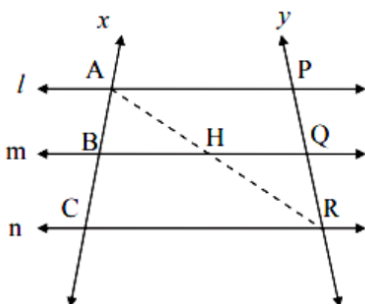
## Vertically Opposite Angles:

$$\angle POM = \angle NOQ \text{ \& } \angle PON = \angle MOQ$$



## Point to be remember:

The ratio of intercepts formed by a transversal intersecting three parallel lines is the same as the ratio of intercepts formed by any other transversal.



$$i.e., \quad \frac{AB}{BC} = \frac{PQ}{QR}$$

## Polygons:

Straight sided, 2-D shapes that close in a space are known as polygons.

- Number of diagonals in an n-sided polygon =  $\frac{n(n-3)}{2}$
- Sum of all the exterior angles of any polygon =  $360^\circ$
- Measure of each exterior angle of a regular polygon =  $\frac{360^\circ}{n}$
- Sum of all interior angles of any polygon =  $(n-2) \times 180^\circ$
- Measure of each interior angle in a regular polygon =  $\frac{(n-2)180^\circ}{n}$

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## Triangle:

Type of triangles	Characteristics	Figure
<b>Scalene Triangle</b>	A triangle with sides of differing lengths.	
<b>Isosceles Triangle</b>	Is one with two sides that have the same length.	
<b>Equilateral Triangle</b>	A triangle with all sides of equal length	
<b>Right-angled Triangle</b>	One angle of 90°	
<b>Obtuse-angled Triangle</b>	One of the angles of the triangle is more than 90°	
<b>Acute-angled Triangle</b>	All the angles of the triangle are less than 90°	
<b>Isosceles Right-angled Triangle</b>	A right-angled triangle, whose two sides containing the right angle are equal in length.	

## Pythagoras Theorem:

Pythagoras theorem is applicable in the case of a right-angled triangle. It says that the square of the hypotenuse is equal to the sum of the squares of the other two sides.

$$\text{Hypotenuse}^2 = \text{Base}^2 + \text{Perpendicular}^2$$

# iQuanta = Relevant Content!

**Jeet Singh** • CAT Preparation - iQuanta  
3d

Another CAT 22 Slot 1 same & simple question done in iQuanta Course ...

Q. 20 identical chocolate to be distributed among 4 children such that each get some chocolate and they don't get odd number of chocolate

Soln : Not Odd means even =>  $2a + 2b + 2c + 2d = 20$

$$a + b + c + d = 10$$

Now each gets some so natural soln =>  $(10-1)C(4-1) = 9C3$

**Jeet Singh** • PNC Application 3  
18 Apr

QA: 49c3

Soln: As all even numbers are multiples of 2, so we can express all as even numbers that is

Let's take  $x = 2a, y = 2b, z = 2c, w = 2d$

$$2a + 2b + 2c + 2d = 100,$$

$$a + b + c + d = 50,$$

so its natural solutions will be

$$(50-1)C(4-1) = 49C3$$

Clear ?

Amrat Sharma and 217 others

27 comments

**Jeet Singh** • PNC Application 3  
18 Apr

Q4. Number of even natural solutions of  $x+y+z+w = 100$  is ?

Amrat Sharma and 152 others

64 comments



**Inika Singh**

I was so worried about quants but almost every single question was something I had already practised several times in class, so relieved 😊

7m Love Reply



**Mohammad Omar Farooq**

Ek rc karva rakha tha practice mai Moderate tha 3-4 question gk ke iift ke gk session mai the

2 h Love Reply

11 🍌❤️😲



**Manish Khandelwal**

Parajumble Competitive advantage wala which I have seen before in course

Just now Like Reply



**Manish Khandelwal**

Stoicism RC yeh v pehle dekha hai

Just now Like Reply



**CAT Preparation - iQuanta**

Jeet Singh · 22 h · 📷

#iQuanta250\_QA Series by INDRA

Q132. PNC !

CAT Preparation - iQuanta

iQuanta 250 Series

In how many ways can 7 chocolates of type A, 6 chocolates of type B and 5 chocolates of type C be distributed among 4 children such that each child receives at least one chocolate of each type?



Yeh waala Aaya tha slot 2 me



**Shreya Rathi**

Kafi quant ka questions match kia and Irdi ka ek set to pura same class me krwaya tha...Lrdi k kafi similar questions...

Thankyou iQuanta team..

Jeet Singh Jainam Shah Yogesh Joshi Hitesh Hariramani ❤️❤️❤️

43 m Love Reply



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### Properties of a triangle:

- The sum of all the angles of a triangle =  $180^\circ$  ( $\angle a + \angle b + \angle c = 180$ )
- The sum of lengths of any two sides > length of the third side
- The difference of any two sides of any triangle < length of the third side

### The area of any triangle formula:

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = r \times s = (a \times b \times c)/4R = \frac{1}{2} \times a \times b \times \sin C$$

where a, b and c are the sides of the triangle, r is the inradius, R is circumradius, and s is the semi perimeter.

By Heron's formula, the area of the triangle is given by:

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

where 's' is the semi perimeter

$$s = \frac{a + b + c}{2}$$



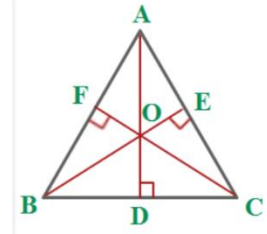
### Some important Definitions:

**Altitude of Triangle:** Perpendicular drawn from a vertex of a triangle to the side opposite side.

**Median of triangle:** The straight lines drawn from the vertex of triangle that bisect the opposite sides of the triangles is called median of a triangle.

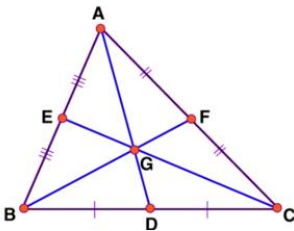
**Orthocentre:** The point inside a triangle where the altitudes meet is called orthocentre of the triangle.

AD, BE and CF are altitudes of the triangle and O is the orthocentre of the triangle.



**Circumcentre:** The point inside a triangle where the perpendicular bisectors of each side meet.

**Centroid:** The place/point where all the medians meet is called centroid of the triangle. The Centroid divides each median in the ratio 2: 1.



AD, BF, CE – medians of  $\Delta ABC$ .

G is the centroid of the  $\Delta$ .

AG: GD = 2: 1

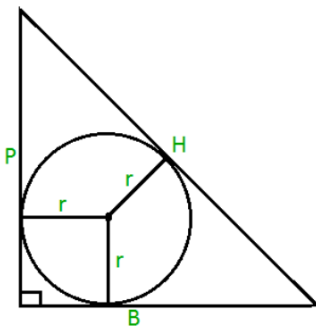
CG: GE = 2: 1

BG: GF = 2: 1

Centroid divides the line joining the circumcentre & orthocentre in ratio 2:1.

**Incentre:** The point inside a triangle where the angle bisectors meet.

**Note:** All the above points are same in case of Equilateral triangle.



**Right angle triangle:**

$$\text{Circumradius} = \frac{H}{2}$$

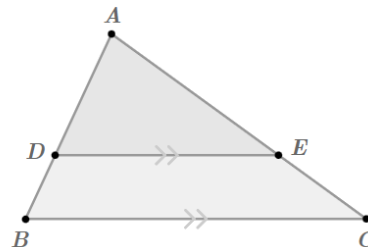
$$\text{Inradius (r)} = \frac{P+B-H}{2}$$



## Important Theorems for Triangles

### Basic Proportionality Theorem (BPT):

Any line parallel to one side of a triangle divides the other two sides proportionally. So, if DE is drawn parallel to BC, then it would divide sides AB and AC proportionally.

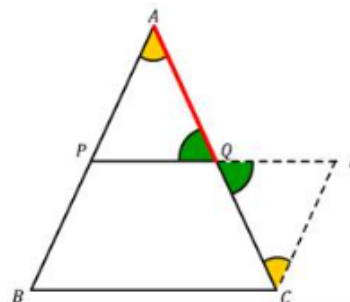


$$\text{i.e., } AD/DB = AE/EC$$

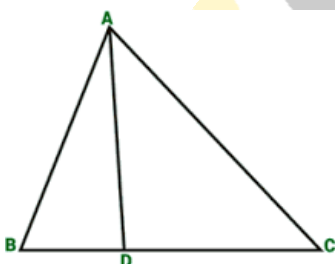
**Mid-point theorem:** The line segment joining mid-points of two sides of a triangle is parallel to the third side of the triangle and is half of it.

P and Q are the mid points of AB and AC respectively.

$$PQ \parallel BC \text{ \& } PQ = BC/2$$



**Apollonius' theorem:** In a triangle, the sum of the squares of any two sides of a triangle is equal to twice the sum of the square of the median to the third side and square of half the third side.



$$AB^2 + AC^2 = 2(AD^2 + BD^2)$$

(AD is median)

### Journey from 51% in Grads to converting IIM Ranchi, Trichy & 8 other IIMs.



Prateek Gupta  
1 hr · 0

"Have the courage to follow your heart and intuition. They somehow know what you truly want to become" - Steve Jobs

Back in 2018, when I graduated from the University of Delhi with a mere 51% in English Literature, I felt like my life was over. I somehow managed to get a basic job at a big company and worked 13 hours a day sometimes. But I realized that an arts degree limits you to grow in a face-paced organization. That was when I decided to go for CAT in 2019. I started self-study and somehow managed to diligently put 2 hours daily. But my strategy was so random and without any guidance that ultimately resulted in a 76 percentile.

And that's when I decided to switch to a more lenient job, a decision which everyone around me graciously rejected. But the strategy was still random and chaotic. When there were only 4 months left to the D-day, I decided to join iQuanta. It provided me everything I needed: Regular classes, 24/7 doubt solving, updated portal (new pattern mocks), and the most important thing - very helpful and kind Indrajeet sir. Moreover, I bought a white-board and went berserk over every doubt posted on the group to prepare for my final attempt.

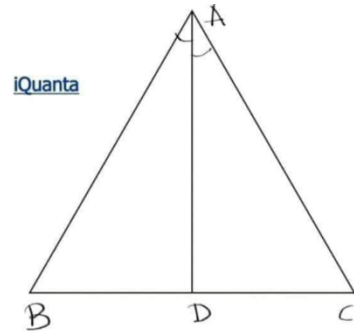
But when life gives you a lemon, you find the best possible to deal with it. I was having a 100-degree fever on D-Day and somehow managed the paper sitting in an isolated portion of the examination hall. Honestly, I lost all hopes after that. I started focusing on my job and was completely astonished on 2nd Jan. I scored a 95.45 percentile and got calls from IIM Rohtak, CAP (IIM Trichy, Ranchi, etc), Vizag, IIM ND, and Nagpur.

After the interviews, the same astonishment struck me yesterday when I cleared all the IIM CAP colleges in the first list. And while writing this post, I converted IIM Rohtak as well. I am at a loss of words for the seamless support and guidance that iQuanta offered. The best thing you can take from iQuanta is the positivity that is departed from the people teaching you. I know it's hard for each and every aspirant, but with proper guidance and hard work you can push your past mistakes. I wish that everyone who is reading this converts their dream b-school. Also, I will be glad to help in any way possible. All the best and remember that you can't work on the past but only on a better future.

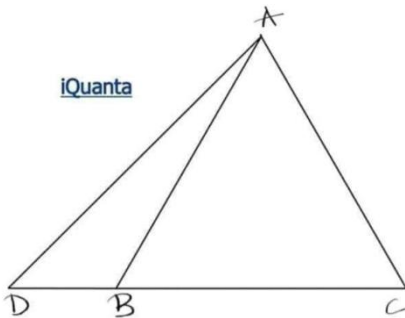


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**Interior angle Bisector theorem:** In a triangle, the angle bisector of an angle divides the opposite side to the angle in the ratio of the remaining two sides.



$$AB/BD = AC/CD$$



AD being the exterior angle bisector of angle A

$$\Rightarrow DC/DB = AC/AB$$

**Exterior angle Bisector theorem:** In a triangle, the angle bisector of any exterior angle of a triangle divides the side opposite to the external angle in the ratio of the remaining two sides

### Similarity of Triangles:

- AA similarity (angle – angle)
- SSS similarity (side – side – side)
- SAS similarity (side – angle – side)

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## DUAL PEDAGOGY

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### Types of Quadrilaterals

Quad = four. So, quadrilaterals are polygons with 4 sides. Square & Rectangle are the most basic quadrilaterals.

**Parallelogram:** A parallelogram is a quadrilateral when its opposite sides are equal and parallel. The diagonals of a parallelogram bisect each other.

**Perimeter** =  $2 \times$  sum of adjacent sides

**Area** =  $b \times h$

( $b$  – width,  $h$  – length of perpendicular)



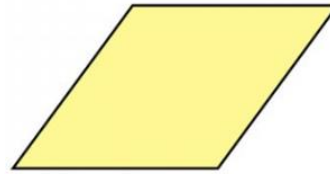
Parallelogram

**Rhombus:** A rhombus is a quadrilateral when all sides are equal. The diagonals of a rhombus bisect each other at right angles ( $90^\circ$ )

**Perimeter** =  $4 \times$  Side

**Area** =  $\frac{1}{2} \times d_1 \times d_2$

( $d_1$  and  $d_2$  are diagonals)

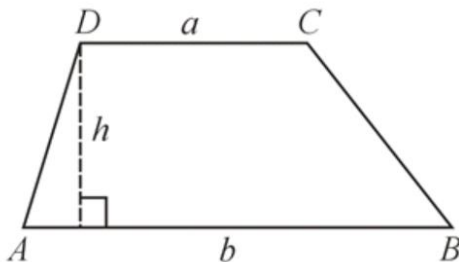


Rhombus

**Trapezium:** A trapezium is a quadrilateral in which only one pair of the opposite sides is parallel.

**Area** =  $\frac{1}{2} \times (a + b) \times h$

**Perimeter** = Sum of all four sides



”

“Thanks a lot Indrajeet Sir & Quanta team. You were an integral part of this journey.

Those tips, shortcuts and rigorous practice sessions made this possible.”



**Mayank**  
CAT - 99.76%iler

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# Why Students LOVE iQuanta:



**Daksh Malhotra**

The thing that matters is your helping nature which I have seen in the group for past few months. **Jeet Singh** have seen you counselling/helping/motivating students no matter a student of iquanta or not and this is all what a good teacher needs in him. The quote haters gonna hate sets good in this case sir. Keep going 100

44m Like Reply



**Prateek Ayush**

The amount of practice questions that iquanta provides is unmatched. Even if you know how to solve a question, sometimes, you can find an amazingly different approach in here. I am saying this from my own experience.

2h Like Reply



**Mani Malavan**

Learned many shortcuts and tricks in a very short time. Moreover, much importance was given to the derivation of each shortcut and each concept which in turn helped us to understand better. Classes were crisp and there was no redundancy.

Like Reply · 13 h



**Ashish Maurya**

All the apprehensions after first class disappeared after the next class itself. Your methods are out of the box and so are your tricks. Happy to be a part of iQuanta. Feeling a bit more confident about acing CAT now.

Like Reply · 13 h · Edited



**Poorva Shukla**

The sessions are great 🔥 non maths wale samjh paa rhe hain, that too sab log that is a big hit. I'm not from maths background, I would run away maths dekh k, for the first time mujhe actually samjh aa rha hai kya chal rha hai. **#JeetSingh** yesterday and today I didn't attend the class unfortunately, because I work in night shifts and I'm into trainings, so can't fool the trainer 😭 I'll try poora karne ka asap. Other classes were awesome without a doubt 🙌

Like Reply · 13 h · Edited



**Siddhanta Mishra**

actually this is my favourite part when a post appears asking to solve competition lag jata hai who can solve it first and 80% time mai by the time i type the ans iquanta posts the ans. still competition among us with team iquanta continues. that's the best part of this group ❤️

3w Love Reply



**Ritesh Kunwar**

One thing.. Kbi socha nhi tha ki FB p b pdhayi ki jaa skti h.. Jin jin ko btaya.. Everyone were surprised to knw about this way of teaching.. Such a unique one so far i have seen.. Nt like allen.. Resonance.. Vibrant.. Chutiya kaat jaa jaate h.. Thoda sa improvise krenge.. To will touch the sky.. ❤️❤️❤️

8h Like Reply



**Roger Shah**

The Concepts and shortcuts that i have learned here are second to none ❤️ Thank you sir **Jeet Singh** . Eagerly waiting for the common batch practice sessions 100

8h Like Reply



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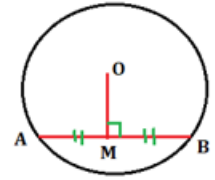
## CIRCLE:

Area =  $\Pi r^2$

Perimeter =  $2\Pi r = \Pi d$  (as we know  $d = 2r$ )

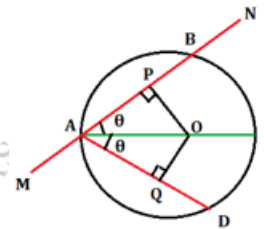
### Properties of circles:

1.  $\perp$  bisector of any chord always passes through centre & vice – versa is also true.



2. If the  $\perp$  distances from the centre are equal then chords are equal

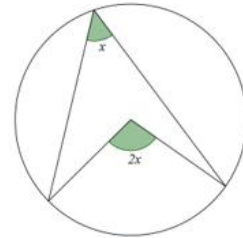
If  $OP = OQ$ , then  $AB = AD$



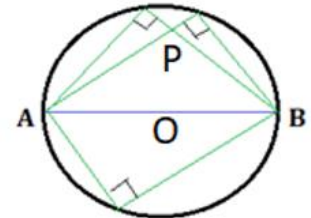
( $MN =$  secant,  $AB$  &  $AD$  are chords. Arc  $AB =$  minor arc, Arc  $ADB =$  major arc.)

3. The angle bisector of two equal chords always passes through the centre.

4. The angle at the center of a circle is twice the angle at the circumference.

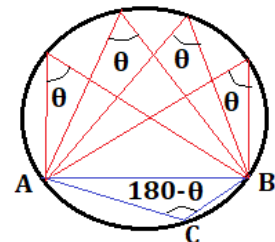


a) So, angle made by the diameter on the circumference =  $180^\circ/2 = 90^\circ$



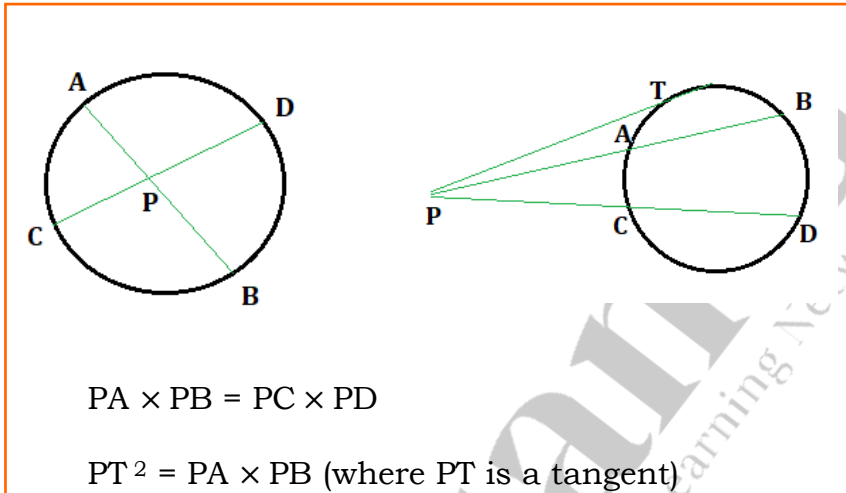
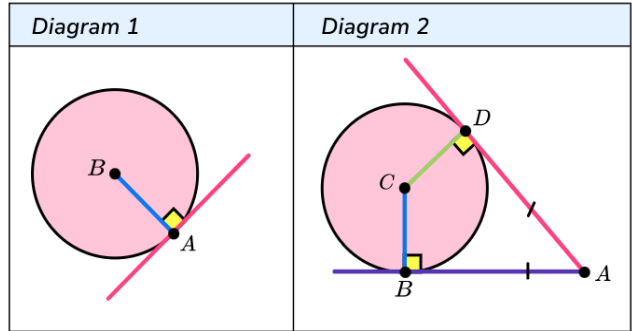
b) Angle made by a chord in the major arc is & in minor arc is obtuse & these angles are supplementary.

c) Angles made by a chord or chords of equal lengths on the circumference are equal.



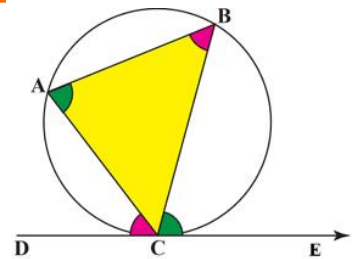
**Tangent of circle:** A straight line that touches the circumference of the circle at only one point.

- The angle between a tangent and radius is 90 degrees.
- Tangents drawn by a point on circle are always equal.  $AB = AD$



**Alternate segment theorem:**

For any circle, the angle formed between the tangent and the chord through the point of contact of the tangent is equal to the angle formed by the chord in the alternate segment



**Mensuration:**

**Cube:**

$V = a^3$

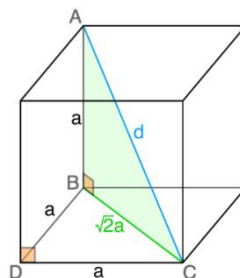
$L.S.A = 4a^2$

$T.S.A = 6a^2$

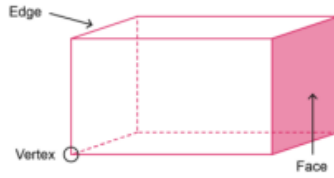
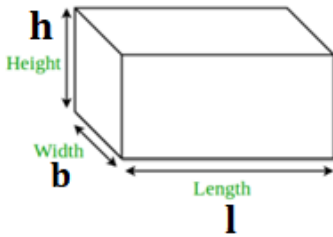
Length of each face diagonal

$= a\sqrt{2}$

Length of body diagonal  $= a\sqrt{3}$



**Cuboid:**



$$V = l.b.h$$

$$LSA = 2 (lh + bh) = 2h (l + b)$$

$$TSA = 2 (lb + bh + hl)$$

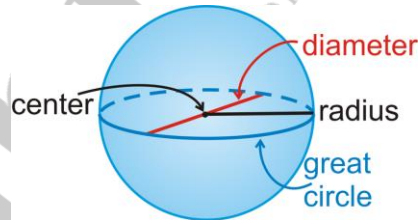
Lengths of face diagonals are  $\sqrt{l^2 + b^2}$ ,  $\sqrt{l^2 + h^2}$ ,  $\sqrt{b^2 + h^2}$

Length of body diagonal =  $\sqrt{l^2 + b^2 + h^2}$

**Sphere:**

$$\text{Volume} = \frac{4}{3} \pi r^3$$

$$\text{Total surface area} = 4 \pi r^2$$



**Hemisphere:**

$$\text{Volume} = \frac{2}{3} \pi r^3$$

$$\text{C.S.A} = 2 \pi r^2$$

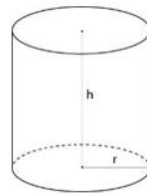
$$\text{T.S.A} = 3 \pi r^2$$

**Cylinder:**

$$V = \pi r^2 h$$

$$LSA = 2 \pi r h$$

$$TSA = 2 \pi r^2 + 2 \pi r h = 2 \pi r (r + h)$$



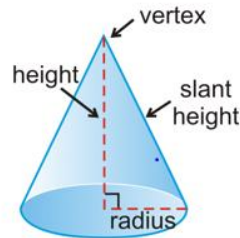
**Cone:**

$$\text{Volume} = \frac{1}{3} \pi r^2 h$$

$$LSA = \pi r l$$

$$TSA = \pi r^2 + \pi r (r + l)$$

$$\text{Slant height} = \sqrt{r^2 + h^2}$$



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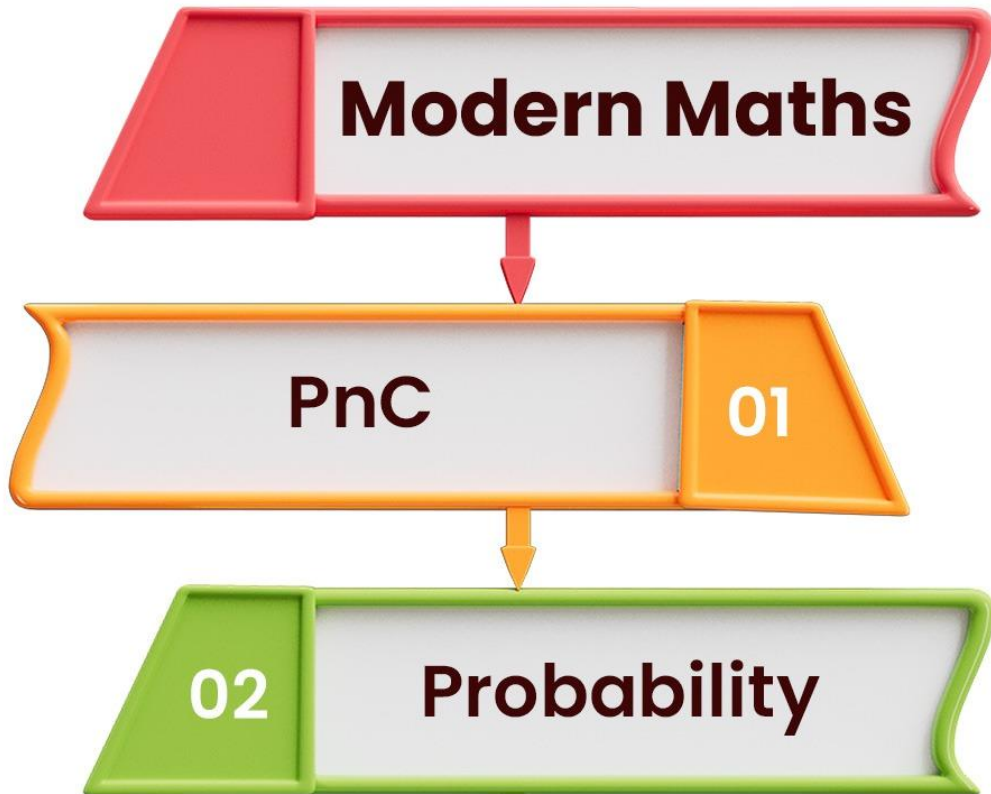
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# PERMUTATION & COMBINATION



## P&C Basics:

When two tasks are performed in succession, i.e., they are connected by an 'AND', to find the total number of ways of performing the two tasks, you must **MULTIPLY** the individual number of ways.

When only one of the two tasks is performed, i.e., the tasks are connected by an 'OR', to find the total number of ways of performing the two tasks you must **ADD** the individual number of ways.

▪ **Arrangement:** n items can be arranged in n! ways

▪ **Permutation:** A way of selecting and arranging r objects out of a set of n objects. Denoted as  ${}^n P_r = \frac{n!}{(n-r)!}$

▪ **Combination:** A way of selecting r objects out of n (arrangement does not matter)  ${}^n C_r = \frac{n!}{(n-r)!r!}$

▪ Number of ways of selecting r things out of n distinct things is  ${}^n C_r = {}^n C_{n-r}$

▪ No. of ways of choosing any number of things out of n distinct things is  $2^n$

▪ No. of ways of choosing any number of things out of n identical things is  $n+1$

▪ No. of ways of distributing n identical things among r distinct groups such that all may get any number of things is  $(n+r-1)C_{(r-1)}$

**IIM Ahmedabad & Bangalore Convert Rupesh Gupta shares his Journey with iQuanta!!**

 **Rupesh Gupta**  
1 hr · 🌐

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"To be in the top 1%, you need to do what the other 99% won't!" - Anonymous

My Journey with CAT (and Iquanta) began in Sept 2019 when I left my job at Edelweiss to give my best attempt at CAT 2019. Even after putting my best foot forward, I screwed up on the exam day and managed to score 91%. The best call I could manage was SP Jain (Profile Based). I was convinced I wanted to re-attempt and pursue an MBA from the Holy Trinity.

Jump to CAT 2020, after 3 super-tedious months of prep, with constant support from **Jeet Singh sir**, **Akash Pandey sir**, and the entire Iquanta team, I managed to substantially improve my score and receive calls from major B-schools. The mentors work harder than you as the exam day approaches but they never get exhausted (unlike you). Due to Iquanta, I managed to score 99% in QA ( My weakest section).

I was hysteric about getting calls from IIM – A/B. The days of 14-16 study hours seem like a distant memory now. My biggest takeaway is – Not focusing on Mock scores and only using them as stepping stones to master your preparation. I cannot underline enough the importance of self- belief in this tumultuous path. But you'll be glad when everything pays off in the end!!

#IIMA #IIMB #Converted



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- No. of ways of distributing  $n$  identical things among  $r$  distinct groups such that all get at least 1 is  ${}^{(n-1)}C_{(r-1)}$
- No. of ways of distributing  $n$  distinct things among  $r$  distinct groups is  $r^n$
- If  $x$  items out of  $n$  items are repeated, then the number of ways of arranging these  $n$  items is  $n!/x!$  ways. If  $a$  items,  $b$  items and  $c$  items are repeated within  $n$  items, they can be arranged in  $\left(\frac{n!}{a!b!c!}\right)$  ways.

▪ **Derangement:** If  $n$  distinct items are arranged, the number of ways they can be arranged so that they do not occupy their intended spot is

$$D = n! \left( \frac{1}{0!} - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \dots \dots \frac{(-1)^n}{n!} \right)$$

▪ **Circular arrangement of 'n' distinct items:** Fix the first item and then arrange all the other items linearly with respect to the first item. This can be done in  $(n-1)!$  ways.

**Note:** In a necklace, it can be done in  $\frac{(n-1)!}{2}$  ways.

## PROBABILITY



Probability is nothing but determining the chance, that event might occur. It is denoted by  $P(E)$ , where  $P$  is probability and  $E$  is the event.

$0 \leq P(E) \leq 1$  by definition

$$\text{Probability of event occurring} = \frac{\text{Number of favourable outcomes}}{\text{Total no. of outcomes}}$$

E.g. The **sample space** for the tossing of three coins simultaneously is given by:

$$S = \{(T, T, T), (T, T, H), (T, H, T), (T, H, H), (H, T, T), (H, T, H), (H, H, T), (H, H, H)\}$$

Total outcomes =  $2 \times 2 \times 2 = 8$  since each coin can have 2 outcomes.