Aptitude Notes for Placements and Interview Preparation

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GENERAL APTITUDE AND REASONING

Trigonometry Ratio Table								
Angles (In Degrees)	0°	30°	45°	60°	90°	180°	270°	360°
Angles (In Radians)	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	0	-1	0
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	-1	0	1
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not Defined	0	Not Defined	1
cot	Not Defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0	Not Defined	0	Not Defined
csc	Not Defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1	Not Defined	-1	Not Defined
sec	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not Defined	-1	Not Defined	1

Reciprocal relations of Trigonometric Ratios

- 1 / sin x = cosec x
- 1 / cos x= sec x
- 1 / sec x= cos x
- 1 / tan x= cot x
- 1 / cot x= tan x
- 1/ cosec x = sin x

Sin cos tan

P	B	P
H	H	B

Cosec sec cot

Number System:

Rational number : Non terminating repeating (10/3)
Irrational Number : Non terminating, non repeating (22/7)
Real Number : (Rational + Irrational) - All numbers are Real Numbers.
Integers : integers are whole numbers (not fractions) that can be positive, negative or zero.
Whole Number : whole numbers are natural numbers including 0.
Natural Number : natural numbers starts from 1……

> **Number=** $a^p \times b^q \times c^r$
>
> **Total Factors=** (p+1) (q+1) (r+1)

Where a, b, c are distinct prime numbers and p, q, r are natural numbers.

Q1.) N= 9000 = $2^3*3^2*5^3$

Total factors =(3+1)*(2+1)*(3+1) = 4*3*4= 48
Odd factors =(2+1)*(3+1)= 3*4=12 **{ 3 & 5 are odd numbers }**
Even factors = **Total factors – odd factors = 48-12=36**
Prime factors= 3 **{2,3 and 5}**
Composite factor= **totalFactors – primeFactors – 1**
Not prime Not Composite: 1

- ✓ **Sum of all factors:** Number= $a^p \times b^q$

> Sum= $\frac{(a^{p+1}-1)}{(a-1)} \times \frac{(b^{p+1}-1)}{(b-1)}$

- ✓ **Product of all factors:** Numbers$^{(\text{total factors}/2)}$

FACTORIAL

$\frac{(X!)}{(P)^n}$ = (P is Prime Number)

Q1.) What is the Highest Power of 7 in 100!
Ans.) 16

Q2.) what is the highest power of 15 in 100!
Ans) 100! / 15 = 100! / ($\mathbf{3^{48} \times 5^{24}}$) = 100!($3^{24} \times 5^{24}$) x 3^{24} = 100!/ (15^{24}) x 3^{24} =**24**

(IF NUMBER IS NOT DIVIDED BY PRIME NUMBER, BREAK IT IN THE FORM OF PRIME NUMBERS

NOTE: $2^{97} * 3^{48} * 5^{24} * 7^{16} * 11^{9} * 13^{7} * 17^{5}$

CYCLICITY

UNIT PLACE	2	3	7	8
4N+1	2	3	7	8
4N+2	4	9	9	4
4N+3	8	7	3	2
4N	6	1	1	6

UNIT PLACE	4	9
ODD POWER	4	9
EVENPOWER	6	1

0,1,5,6 = no change

Q1.) $(732)^{635}$ = $(732)^{635/4}$ = REMAINDER 3.

{ divide the last two digits of the power by 4 i.e. 35/4}

When unit place is 2, and remainder is 3, check in table, answer is 8.

Q2.)$(523)^{222}$= 22/4=remainder 2 = **9**

Q3.) $(76)^{237}$ x $(74)^{51}$ = 6x4=4

CALENDER

1.) Multiple of 4 is Leap Year (4,8, 12, 16,….)
2.) Century Year is Non Leap year (100,200,300).
3.) 4^{th} century year is Leap Year (400, 800, 1200, 1600….)
4.) 100 years= 5 odd days
 200 years = 10/7 =3 odd days
 300 years = 15/7 = 1 odd day
 400 years= 20/7 = 6 + 1 more extra day= 0 odd day
5.) 1^{st} odd day is Monday.

Jan	Feb	March	April	May	June	July	Augu	Sept	Oct	Nov	dec
0	3	3	6	1	4	6	2	5	0	3	5

NOTE: If leap year add 1 in every column from feb month…otherwise take same days for months. For ex, for 22 october 1997, take no of days from table = 0, now calculate odd days for 22 days= 1, so total odd days till in 22 october is 0+1=1;

PERCENTAGE

$$\uparrow \frac{x}{100+x} = \frac{x}{100-x} \downarrow$$

$\uparrow$ 10 = 9.09 $\downarrow$

$\uparrow$ 20 = 16.6 $\downarrow$

$\uparrow$ 25 = 20 $\downarrow$

$\uparrow$ 33.3 = 25 $\downarrow$

$\uparrow$ 50 = 33.3 $\downarrow$

R = A x B {WHERE A IS X%, B IS Y%}

CHANGE IN R% = X + Y + XY/100

PROFIT AND LOSS

P% = $\frac{(SP-CP)}{CP}*100$

L% = $\frac{(CP-SP)}{CP}*100$

1.) *Two articles are sold at a common selling price of Rs $ each. One is sold at a profit of p percent and another at a loss of p percent. Then effectively, there is always a loss during the entire transaction.*

$$\textbf{Loss value} = \left(\frac{2p^2\$}{100^2-p^2}\right)$$

$$\textbf{Loss\%} = \frac{p^2}{100}*100$$

2.) *Two articles are bought at common CP. One is sold at the profit of P% and another at a loss of P%, then effectively there is* **<u>NO PROFT NO LOSS.</u>**

MIXTURE

$$\frac{Qc}{Qd} = \left(\frac{PD - MP}{MP - PC}\right)$$

Where Qc =

Qd=

PD=

PC=

MP=

Replacements: $$\frac{\textbf{Quantity of milk left after } \mathbf{n^{th}} \textbf{operation}}{\textbf{initial quantity of milk}} = \left[\frac{a-b}{a}\right]^n$$

Quantity of milk left after n^th operation = Initial Quantity $\left[1 - \frac{b}{a}\right]^n$

Where a is initial quantity, b is quantity taken out and replace by water every time, n is no of operations.

NOTE: this formula is valid when volume is conserved, when volume is not conserve, do manualy.

TIME, SPEED AND DISTANCE

If equal distances covered with different but uniform speeds. average speed will be harmonic mean of individual speed.

HARMONIC SPEED = $$\frac{N}{\frac{1}{x_1} + \frac{1}{x_2} + \frac{1}{x_3} + \frac{1}{x_4} + \dots\dots\dots\dots\dots\dots \frac{1}{x_n}}$$

GEOMETRIC MEAN = $(X_1 * X_2 * \dots\dots\dots\dots\dots X_M)^{1/N}$

RACES

LINEAR RACES:

CIRCULAR RACES:

1.) **Meeting at starting point for first time:**

$$LCM = (Time_a, Time_b)$$

$$LCM = \left(\frac{Circumference}{SP_A}, \frac{Circumference}{SP_B}\right)$$

2.) **Meeting for the first time(Orientation: clockwise/ anti clockwise)**

$$\frac{Circumference}{\mathrm{Rel}(SP_a \pm SP_b)}$$

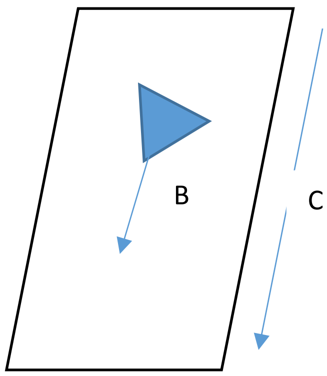
(+ symbol when opposite direction and – symbol when both are in same direction)

Let p be the starting point time, q is the meeting for first time (Orientation), then $\frac{p}{q}$ is the number of distinct points where they meet.

BOATS:

Downward Speed=B+C (HIGH)

Upward speed = B-C (LOW)



Train passes a pole = $\frac{L_T}{SP_T}$

Train passes a platform = $\frac{L_T + L_P}{SP_T}$

Two Train crossing/ overtaking each other = $\frac{L_1 + L_2}{\text{Relative}(S_A \pm S_B)}$

(+ symbol when opposite direction and – symbol when both are in same direction)

CLOCK

MINUTE HAND

60 MINUTES= 360 °

1 MINUTE - 6°

1° = 1/6 MINUTES

HOUR HAND

12 HOURS= 360°
1 HOUR= 30°
1 MINUTE= (1/2) °

RELATIVE GAIN WITH THE MINUTE HAND OVER HOUR HAND = $(5\frac{1}{2})°$

FOR RELATIVE GAIN OF $(5\frac{1}{2})°$ = MINHAND(6)

FOR RELATIVE GAIN OF 1° = $\frac{12}{11}$

(IN 12 HOURS)	
COINCIDENCES -	11
OPPOSITE-	11
RIGHT ANGLE-	22

(IN 24 HOURS)	
COINCIDENCES -	22
OPPOSITE-	22
RIGHT ANGLE-	44

- **(X) & (X+1) O' clock (when time is given in minutes)**

COINCIDENCES - $5x * \frac{12}{11}$

OPPOSITE- $(5x \pm 30) * \frac{12}{11}$

RIGHT ANGLE- $(5x \pm 15) * \frac{12}{11}$

- **(X) & (X+1) O' clock (when time is given in degree form)**

COINCIDENCES - $\left[(5x \pm (\frac{0}{6})^\circ\right] * \frac{12}{11}$

OPPOSITE- $\left[(5x \pm (\frac{180}{6})^\circ\right] * \frac{12}{11}$

RIGHT ANGLE- $\left[(5x \pm (\frac{90}{6})^\circ\right] * \frac{12}{11}$

NOTE: GENERALIZED FORMULA:

$$\boxed{\left[(5x \pm (\frac{D}{6})^\circ\right] * \frac{12}{11}}$$

ALGEBRA:

1.) $\log_n m$ = $\frac{\log m}{\log n} = \frac{1}{\frac{\log m}{\log n}} = \frac{1}{\log_m n}$

2.) $a^x = p$

$x \log a = \log p$

$x = \log_a p$

Loops

(1) $1 + 2 + 3 + 4 + ... + n = \sum_{i=1}^{n} i = \frac{n(n+1)}{2}$

(2) $1^2 + 2^2 + ... + n^2 = \sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$

(3) $1^3 + 2^3 + ... + n^3 = \sum_{i=1}^{n} i^3 = \left[\frac{n(n+1)}{2}\right]^2$

(4) $1+3+5+.......+(2n-1)=n^2$

(5) $\frac{1}{1.2}+\frac{1}{2.3}+\frac{1}{3.4}+.............\frac{1}{n(n+1)}=\frac{n}{n+1}$

(6) $\frac{1}{}+\frac{1}{2}+\frac{1}{3}+.............\frac{1}{n}=\log n.$

(4) **A.P.**

$T_n=a+(n-1)d \qquad (d=T_n-T_{n-1})$

$S_n=\frac{n}{2}[2a+(n-1)d]=\frac{n}{2}[a_1+a_n]=\frac{n}{2}[a+a+(n-1)d]$

(5) **G.P.**

$T_n=ar^{n-1}$

$a,\ ar,\ ar^2,......\qquad \left(r=\frac{T_n}{T_{n-1}}\right)$

$S_n=\frac{a(1-r^n)}{1-r} \qquad |r|<1$

$S_n=\frac{a(r^n-1)}{r-1} \qquad |r|>1$

$S_\infty=\frac{a}{1-r}$ when infinite terms are there.

QUADRATIC EQUATION

Y= aX²+bX+c=0

D= b^2-4ac
D>0 = Real and distinct roots
D=0 = Real and equal roots
D<0 = Non-real roots

1.) Ax² + Bx + c=0

$\alpha+\beta=\frac{-B}{A}$

$\alpha\beta=\frac{C}{A}$

2.) Ax³+Bx²+Cx+d=0

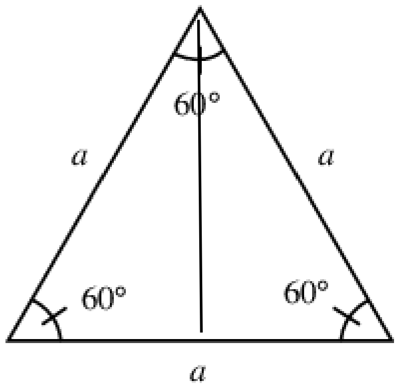
$\alpha+\beta+\gamma=\frac{-B}{A}$

$\alpha\beta+\beta\gamma+\lambda\alpha=\frac{C}{A}$

$\alpha\beta\gamma=\frac{-d}{A}$

GEOMETRY

1.) EQUILATERAL TRIANGLE:

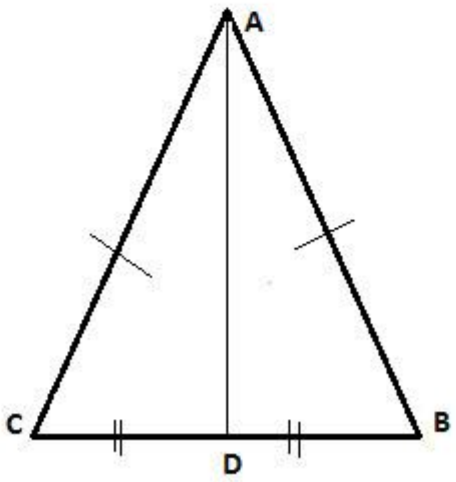


H= $\sqrt{a^2 - \frac{a^2}{4}}$

H= $\frac{\sqrt{3}}{2}a$

A= $\frac{\sqrt{3}}{4}a^2$

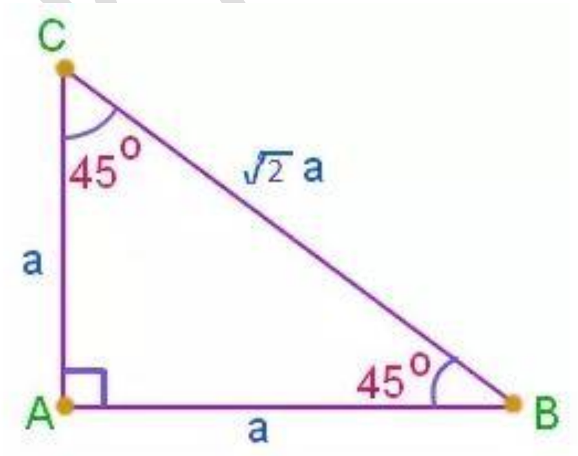
2.) ISOSCELES TRIANGLE:

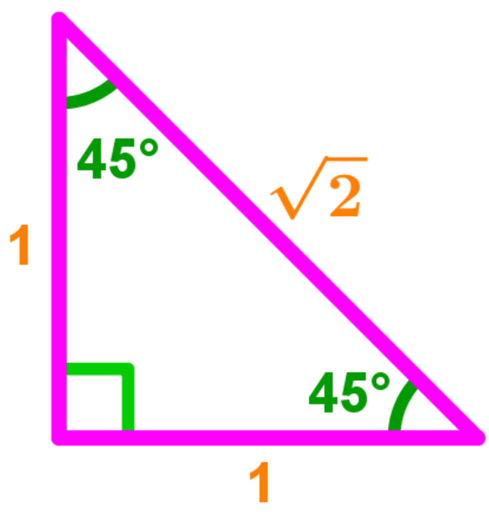


H= $\sqrt{b^2 - \frac{c^2}{4}}$

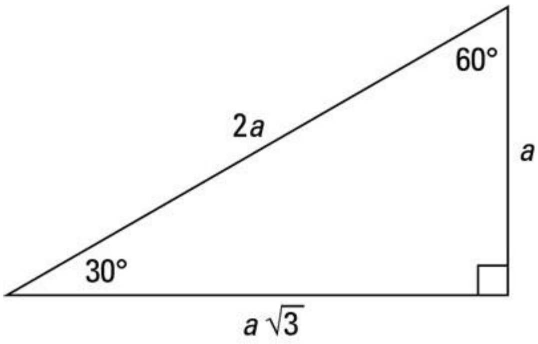
A= $\frac{c}{4}\sqrt{4b^2 - c^2}$

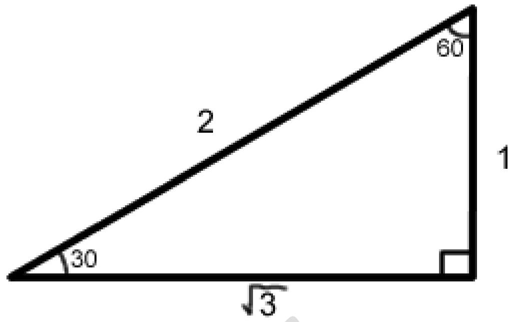
3.ISOSCELES RIGHT TRIANGLE:



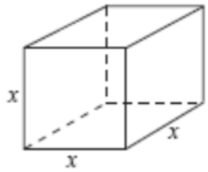
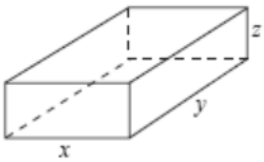
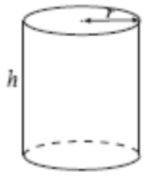
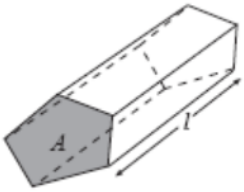


4.





3 D GEOMETRY

Cube		Volume = x^3 Surface area = $6x^2$
Cuboid		Volume = xyz Surface area = $2xy + 2xz + 2yz$
Cylinder		Volume = $\pi r^2 h$ Area of curved surface = $2\pi rh$ Area of each end = πr^2 Total surface area = $2\pi rh + 2\pi r^2$
Prism		A prism has a uniform cross-section Volume = area of cross section × length = $A\,l$

CUBE

1s= 6 x $(n-2)^2$
2s= 12 x (n-2)
3s= 8
0s = $(n-2)^3$
Where n is the length of the side of cube.

CHESSBOARD

1. **Rectangles =** $^{\text{Horizontal lines}}C_2 * {}^{\text{Vertical Lines}}C_2 = \sum n^3 = \left[\frac{n(n+1)}{2}\right]^2$

   Rectangles without squares = No of rectangles- No of squares.

2. **Squares =** $\sum n^2 = \left[\frac{n(n+1)(2n+1)}{6}\right]$

3. **Different types of rectangles =** $\sum n = \frac{n(n+1)}{2}$

   Where n x n is the size of chessboard.

4. **Shortest path from A to B:** $\frac{(R+C)!}{R!*C!}$ where R are no of rows, C are no of Columns

Ex:

B

A

Every small square are equal and have size 1 unit & not allowed to enter inside.

Find no of shortest path from A to B = $\frac{(5+3)!}{5!*3!}$

DATA INTERPRETATION

% CHANGE = $\frac{(finalvalue - Initialvalue)}{Initialvalue} * 100$

%increase = Growth rate
% decrease= Decline rate

SI AND CI

SI= $\frac{P * R * T}{100}$

CI= AMOUNT –P

AMOUNT= $P(1+\frac{R}{100})^n$

(CI-SI) $_{2y}$ = $p(\frac{R}{100})^2$

(CI-SI) $_{3y}$ = $p(\frac{R}{100})^3 + 3p(\frac{R}{100})^2$

PERMUTATIONS AND COMBINATIONS

Permutation: $^{n}P_{r} = \frac{n!}{(n-r)!}$

Combination: $^{n}C_{r} = \frac{n!}{(n-r)! * r!}$

Geometry P & C:

No of Diagonals of any n-sided polygon = $\left[\frac{n(n-1)}{2} - n\right]$