TCS NQT / DIGITAL / NINJA

APTITUDE SOLVED QUESTIONS

PART 2

🔑 TOPICS COVERED: (Part 2 Focus)

- Number System
- Linear and Quadratic Equations
- Probability
- Time, Speed and Distance
- Permutations and Combinations

With Detailed Solutions & Shortcut Tricks

START SOLVING QUESTIONS!

DATE
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Number System

Divisibility rules:-

For 2 : last digit should be even.

For 3 :- Sum of digits should 3, 6, 9

For 4 :- last two digits should divisible by 4, or end with "00".

For 5 :- last digit should be 0 or 5.

For 6 :- Divisible by bom "2" and "3"

For 7 :- multiply last digit by 2 and then subtract the result from the rest digits if the final result is divisible by 7, the no. is divisible by 7.

For 8 : last three digits should divisible by 8 or end with "000".

For 9 :- sum of digits should be 9

For 10 :- should be end with "0".

For 11 :- Sum of odd position digits - Sum of even position digits, should be 0 or multiple of 11.

For 12 :- divisible by both 4 and 3.

Que: If the no. 24P51 is divisible by 9, then value of the digit marked as P would be ?

(a) 3 (b) 1 (c) 2 (d) 4

Sum ⇒ 2+4+3+P+5+1 ⇒ 15+P

Hence → 15+3 = 18 divisible by 9

Ans = 3.

Que:- If 41895A8 is divisible by 11, find the value of A.

4+8+5+8 - (1+9+A) = 11

25 - 10 - A = 11

A = 25 - 10 - 11

A = 15 - 11

A = 4. Ans

Que: Find A and B if the number A85631458 is divisible by 88?

88 → 8 and 11

45B should divisible by 8

$$8 \overline{)45B\,(5}$$

$$\underline{40}$$

$$5B$$

$$\underline{1}$$

$$0$$

B should be 6 because only 56 is a multiple of 8.

Now, A8561456 should divisible by 11

$$(A+5+1+4+6) - (8+6+1+5) = 11 \text{ or } 0$$

$$A + 18 - 20 = 11 \text{ or } 0.$$

$$A - 2 = 11 \text{ or } 0$$

$$A = 11 + 2 = 13 \quad \text{Ans. or}$$

$$A = 0 + 2 = 2 \quad \text{Ans.}$$

HCF and LCM.

Qus: The LCM and HCF of 3/5, 4/7, 2/9 are

$HCF\left(\frac{3}{5}, \frac{4}{7}, \frac{2}{9}\right)$ $LCM\left(\frac{3}{5}, \frac{4}{7}, \frac{2}{9}\right)$.

⇒ HCF of Numerator / LCM of Denominator

⇒ LCM of Numerator / HCF of denominator

⇒ $\frac{HCF(3,4,2)}{LCM(5,7,9)} = \frac{1}{315}$ ⇒ $\frac{LCM(3,4,2)}{HCF(5,7,9)} = \frac{12}{1}$

$HCF = \frac{1}{315}$, $LCM = 12$ Ans

Qus. 5 bells are heard at intervals of 3, 6, 8, 10 and 12 minutes respectively. If all the bells toll together exactly at 2:00 PM, they will again be heard together at?

LCM(3, 6, 8, 10, 12) ⇒ 120 minutes ⇒ 2 hours

Ans all the bells are heard together at 4:00 PM

Qus: Find the greatest number that will divide 12, 36 and 54 exactly.

HCF(12, 36, 54) → 6.

Que: Find the latest number that is exactly divisible by 6, 8, and 12.

LCM (6, 8, 12)

Ans:- 24.

Que: Find the greatest number that will divide 43, 91 and 183 so as to leave the same remainder in each case.

~~HCF (43, 91, 183)~~ →

a, b, c → same remainder

HCF of (a-b, b-c, c-a)

HCF of (48, 92, 140) → 4. Ans.

Que: Find the least number when divided by 36, 24 and 16 leaves 11 as remainder in each case.

LCM (~~36, 24~~, a, b, c) + remainder

LCM (36, 24, 16) + 11

4	36, 24, 16
3	9, 6, 4
2	3, 2, 4
	3, 1, 2

⇒ 4 × 3 × 2 × 3 × 1 × 2 ⇒ 144

Ans ⇒ 144 + 11 = 155.

Q: Find the greatest number that will divide 27, 38 and 47 leaving remainders of 3, 2 and 5 respectively.

HCF(a-x, b-y, c-z)

HCF(27-3, 38-2, 47-5)

HCF(24, 36, 42) → 6

Ans ⇒ 6

Que: Find the least number which when divided by 12 leaves a remainder of 10, when divided by 24 leaves a remainder of 22 and when divided by 32 leaves a remainder of 30.

No. km.

12 - 10 = 2

24 - 22 = 2 Hence K = 2

32 - 30 = 2

LCM(12, 24, 32) - K

96 - 2 = 94 Ans.

Remainder Theorem

Ex: 1) $4^{32}/9$ → $\frac{4}{9} = R(4)$, $\frac{4^2}{9} \to R(2)$, $\frac{4^3}{9} \Rightarrow R(1)$

$\frac{4^4}{9} \to R(4)$, $\frac{4^5}{9} \to R(2)$, $\frac{4^6}{9} \to R(1)$

Repetition at every 3 intervals.

Then:

$\frac{4^{32} \times 4}{9} = R(1) \times \frac{4}{9} \to \frac{4}{9} \to R(4)$ Ans.

2) $5^{32}/7$ $\frac{5}{7} \to R(5)$, $\frac{5^2}{7} \to R(4)$, $\frac{5^3}{7} \to R(6)$

$\frac{5^4}{7} \to R(2)$, $\frac{5^5}{7} \to R(3)$, $\frac{5^6}{7} \to R(1)$, $\frac{5^7}{7} \to R(5)$

no. of intervals → 6

32 is divisible by 6 means at last

~~cycle~~ Reminder of cycle

R(1) Ans.

Que: And the remainder when 3^{35} is divisible by 5?

$\frac{3^{35}}{5}$ ⇒ $\frac{3}{5} \to R(3)$, $\frac{3^2}{5} \to R(4)$, $\frac{3^3}{5} \to R(2)$, $\frac{3^4}{5} \to R(1)$

Interval = 4

$\frac{35}{4}$ = R(3) ~~32~~ = Ans is R(2).

Que: Find the remainder when 7^{203} is divided by 4?

$\frac{7^{203}}{4}$ Now, $\frac{7}{4} \to R(3)$, $\frac{7^2}{4} \to R(1)$

$\frac{203}{2} \to R(1)$ means Ans is $R(3)$

Que: Find the remainder when 13^{41} is divided by 7?

$\frac{13^{41}}{7}$ Now, $\frac{13}{7} \to R(6)$, $\frac{13^2}{7} \to R(1)$

$\frac{41}{2} \to$ Ans is $\to R(6)$.

BODMAS. - Simplification of Complex Equation

Que: $4 - 3.6 \div 4 + 0.2 \times 0.5 = ?$

$4 - \frac{3.6}{4} + 0.2 \times 0.5$

$4 - 0.9 + 0.10$

$4 \cdot 0 - 0.8$

3.2 Ans

Que: $108 \div 36$ of $\frac{1}{3} + \frac{2}{5} \times 3\frac{3}{4}$

$108 \div 36 \times \frac{1}{3} + \frac{2}{5} \times \frac{15}{4}$

$\frac{108}{36} + \frac{3}{2} \Rightarrow 3 + \frac{3}{2}$

$= 11.7$ Ans

$3 + \frac{1}{2} = \frac{21}{2} \quad 10\frac{1}{2}$

Que: $(7+7+7 \div 7) / (5+5+5 \div 5) =$

$(7+7+1) / (5+5+1)$

$15/11$ Ans

Que: $[(272-72)(124+176)] / (17 \times 15 - 15) =$

$[(240)(300)] / (255-15)$

$[(240)(300)] / (240)$

$= 300$ Ans.

Que: $1 + 1 \div [1 + 1 \div (1 + 1/2)]$

$1 + 1 \div [1 + 1 \div (4/2)]$

$2 \div [2 \div 4/3]$

$1 + 1 \div [1 + \frac{1}{4}]$

$1 + 1 \div [7/4]$

$1 + \frac{4}{7} = \frac{11}{7}$ Ans $\quad 1\frac{4}{7}$

Que: The value of $1 \div [1 + 1 \div [1 + 1 \div (1 + 1 \div 2)]]$ is

$1 \div [1 + 1 \div [1 + 1 \div (\frac{3}{2})]]$

$1 \div [1 + 1 \div [1 + \frac{2}{3}]]$

$1 \div (1 + \frac{1}{5})$

$\frac{5}{8}$ Ans.

(Powers) $a(a^{\frac{1}{n}} \; a^{\frac{1}{b}})$

Exponents and surds

17
17
119
17x
119

Qu:- The value of $(11111)^2$ is.

$1^2 = 1$

$11^2 = 121$

$111^2 = 12321$

$1111^2 = 1234321$

$11111^2 = 123454321$ Ans.

Q: $\sqrt{8+\sqrt{57+\sqrt{38+\sqrt{108+\sqrt{169}}}}} = ?$

$\sqrt{121} = 11$ (13)

$\sqrt{38+11} = \sqrt{49} = 7$

$\sqrt{57+7} = \sqrt{64} = 8.$

$\sqrt{8+8} = \sqrt{16} = 4$ Ans.

Q $\sqrt{289} - \sqrt{625} \div \sqrt{25}$ is equal to

17 - 25 ÷ 5

17 - 5 = 12 Ans

Q Find the square root of 15376

$\sqrt{15376}$ → ending with 6.

means last digit should be 4 or 6.

Now ignoring last two digit.

153 is closest to 12^2 and nearest small to 13^2

take least value 12

12^2 = 144 13^2 = 169

124^2 or 126^2

Now for 12×13

$125^2 \Rightarrow 15625 > 15376$

So, the answer is 124^2.

Find the cube root of 3869893.

1. last digit of No.
2. Ignore last 3 digit.

last digit = 3 means cube root must be of last digit 7

neglect last 3 digit → 3869

15^3 → 3375

16^3 → 4096

Ans is 157.

Simplification using Algebric Identities

$(a+b)^2 = a^2+2ab+b^2$

$(a-b)^2 = a^2-2ab+b^2$

$(a^2-b^2) = (a-b)(a+b)$

$(a+b+c)^2 = a^2+b^2+c^2+2ab+2bc+2ca$

$(a+b)^3 = a^3+b^3+3ab(a+b)$

$(a-b)^3 = a^3-b^3-3ab(a-b)$

$a^3+b^3 = (a+b)(a^2-ab+b^2)$

$a^3-b^3 = (a-b)(a^2+ab+b^2)$

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

If $a+b+c=0$, Then $a^3+b^3+c^3 = 3abc$

Que:- The value of $[(3.2)^3-0.008]/[(3.2)^2+0.64+0.04]$ is

$$= \frac{(3.2)^3-0.008}{(3.2)^2+0.64+0.04} = \frac{(3.2)^3-(0.2)^3}{(3.2)^2+3.2\times0.2+(0.2)^2}$$

$$\frac{(3.2-0.2)[(3.2)^2+3.2\times0.2+(0.2)^2]}{(3.2)^2+3.2\times0.2+(0.2)^2}$$

$= 3.2-0.2$

$= 3.0$ Ans

Q. $\frac{0.9\times0.9\times0.9+0.2\times0.2\times0.2+0.1\times0.1\times0.1-3\times0.9\times0.2\times0.1}{0.9\times0.9+0.2\times0.2+0.1\times0.1-0.9\times0.2-0.2\times0.1-0.1\times0.9}$

$$= \frac{(0.9)^3+(0.2)^3+(0.1)^3-3(0.9)(0.2)(0.1)}{(0.9)^2+(0.2)^2+(0.1)^2-(0.9)(0.2)-(0.2)(0.1)-(0.1)(0.9)}$$

$$= (0.9+0.2+0.1)\frac{[(0.9)^2+(0.2)^2+(0.1)^2-(0.9)(0.2)-(0.2)(0.1)-(0.1)(0.9)]}{(0.9)^2+(0.2)^2+(0.1)^2-(0.9)(0.2)-(0.2)(0.1)-(0.1)(0.9)}$$

$= 0.9+0.2+0.1 = 1.4$ Ans

Q. $(113)^2+115^2+117^2-113\times115-115\times117-117\times113$ is equal to

$a^2+b^2+c^2-ab-bc-ca$

No direct formula :-

mul and divide by 2

$\frac{1}{2}[2a^2+2b^2+2c^2-2ab-2bc-2ca]$

$\frac{1}{2}[a^2+a^2+b^2+b^2+c^2+c^2-2ab-2bc-2ca]$

$\frac{1}{2}[a^2+b^2-2ab+a^2+b^2-2ca+b^2+c^2-2bc]$

$\frac{1}{2}[(a-b)^2+(a-c)^2+(b-c)^2]$

$\frac{1}{2}[(113-115)^2+(113-117)^2+(115-117)^2]$

$= \frac{1}{2}[4+16+4] = \frac{24}{2} = 12$ Ans

Q $[137 \times 137 + 137 \times 133 + 133 \times 133] / [137 \times 137 \times 137 - 133 \times 133 \times 133]$
$= ?$

$\Rightarrow \dfrac{[(137)^2 + 137 \times 133 + (133)^2]}{(137^3 - 133^3)}$

$\Rightarrow \dfrac{[(137)^2 + 137 \times 133 + (133)^2]}{(137-133)[(137)^2 + 137 \times 133 + (133)^2]}$

$= \dfrac{1}{4}$ Ans

Q Solve: $[(999 + 588)^2 - (999 - 588)^2] / (999 \times 588)$

$\dfrac{(999)^2 + (588)^2 + 2(999)(588) - (999)^2 - (588)^2 + 2(999)(588)}{(999 \times 588)}$

$+ 4 \dfrac{(999)(588)}{(999 \times 588)} = 4$. Ans

Decimal simplification

Q If $547.527 / 0.0082 = x$, then find the value of $547527 / 82$ is.

$x = \dfrac{547527 \times 10000}{0.0082 \times 1000}$

$x = \dfrac{547527}{82} \times 100$

$\dfrac{547527}{82} = \dfrac{x}{100}$ Ans

Q $(0.9 \times 0.9 \times 0.9 + 0.1 \times 0.1 \times 0.1)$ is approximately equal to.

$\Rightarrow [(0.9)^3 + (0.1)^3]$

$= [(0.9) + (0.1)][(0.9)^2 - (0.9)(0.1) + (0.1)^2]$

$= [1.0][0.81 - 0.09 + 0.01]$

$= 0.81 - 0.08$

$= 0.72 + 0.01$

$= 0.73$ Ans

Q $(0.5 \times 5 + 0.25 + 0.5 \times 4 + 0.5 \times 0.75)$

$= 2.5 + 0.125 + 2 + 0.375$

$= 4.5 + 0.500$

$= 5$ Ans.

Q $\frac{4.41 \times 0.16}{2.1 \times 1.6 \times 0.21}$ is simplified to

$\frac{4141 \times 0016}{2121 \times 1616 \times 0021} \times \frac{10000}{10000}$

$\frac{441 \times 16}{21 \times 16 \times 21} = \frac{441}{441} = 1$ Ans

Q $(0.05 \times 5 - 0.005 \times 5)$ is equal to

$5(0.05 - 0.005)$

$5(\frac{5 - 5}{100} \quad 0.045)$

0.225

Decimal & fraction Simplification

Q $\left\{\frac{(0.1)^2 - (0.01)^2}{0.0001} + 1\right\}$ is equal to

$\frac{0.01 - 0.0001}{0.0001} + 1$

$= \frac{0.0100}{0.0001} = 100$ Ans

Q $\frac{3.25 \times 3.20 - 3.20 \times 3.05}{0.064}$ is equal to

$\frac{3.20\,(3.25 - 3.05)}{0.064} \Rightarrow \frac{3.20\,(0.20)}{0.064}$

$\frac{0.640}{0.064} \quad \frac{0.0064}{0.0640} = \frac{1}{10}$ Ans

$= 10$ Ans

$y = x$

Q $\frac{2.5 \times 3 + 7.5 \div 2.5 - 0.5 \text{ of } 3}{4x + 12 \div 1.5 - 6 \text{ of } 2x} = ?$

$\frac{7.5 + 3 - 1.5}{4x + 8 - 16} \Rightarrow \frac{9}{19}$ Ans

Q The simplified value of $\frac{(0.0529 - 0.002) \times 0.4 + 0.56 \times 0.07}{0.04 \times 0.25}$

$\Rightarrow \frac{(0.0529 - 0.0020) \times 0.4 + 0.56 \times 0.07}{0.04 \times 0.25}$

$\Rightarrow \frac{(0.0519) \times 0.4 + 0.56 \times 0.07}{0.04 \times 0.25}$

$(0.0519) \times 0.4 + 0.4 \times 1.4 \times 0.07$

$\frac{0.4\,(0.0519 + 1.4 \times 0.07)}{0.04 \times 0.25}$

$\frac{0.4\,(0.0519 + 0.098)}{0.04 \times 0.25}$

$\frac{0.4 \times 0.1499}{0.04 \times 0.25}$

$= \frac{4 \times 1499}{4 \times 25} \times \frac{10000}{100000}$

$= \frac{1499}{250} = 5.996$

Decimal to fraction

Convert the following into vulgur fraction.

(A) $0.25 \rightarrow \frac{25}{100} \frac{1}{4}$ (B) $4.004 \rightarrow \frac{4004}{1000} \frac{1001}{250} = \frac{1001}{250}$

(C) $0.0056 \rightarrow \frac{56}{10000} = \frac{14}{2500} \frac{7}{1250}$

Q Convert $87.434343\ldots$ into a vulgar fraction/ rational number.

$x = 87.434343\ldots$

$100x = 8743.434343\ldots$

$100x - x = 8743.4343\ldots - 87.434343\ldots$

$99x = 8743 - 87$

$99x = 8656$

$x = \frac{8656}{99}$

Q $1.023232323\ldots$ as a vulgar fraction

$\frac{10.232323 \times 10}{10} \Rightarrow \frac{(1023 - 10)}{99} \times \frac{1}{10}$

$\frac{1013}{990}$ Ans

62
-13
49

Linear & Quadratic Equation.

linear Equation.

Solve for x:

A) $6x - 27 + 3x = 4 + 9 - x$

$10x = 13 + 27$

$10x = 40$

$x = 4$ Ans

B) $3(x + 10y + 4) + 8 = 5(x + 6y)$

$3x + 30y + 12 + 8 = 5x + 30y$

$5x - 3x = 20$

$2x = 20$

$x = 10$ Ans

C) $19(x + y) + 17 = 19(-x + y) - 21$

$19x + 19y + 17 = -19x + 19y - 21$

$38x = -38$

$x = -1$ Ans

D) $x + \frac{x}{2} + \frac{x}{3} + 5 = 27$

$\frac{11x}{6} + 5 = 27$

$\frac{11x}{6} = 22$

$x = \frac{22 \times 6}{11} = 12$ Ans

90
-42
48

Q Solve the following

(A) $5x + y = 13$; $x + 5y = 17$

$(5x + y = 13) \times 5 \Rightarrow 25x + 5y = 65$

$(x + 5y = 17) \quad\quad - x \mp 5y = -17$

$24x = 48$

$x = 2$

$y = 3$ Ans

(B) $4x - y = 13$; $2x + 3y = 31$

$4x - y = 13 \Rightarrow 4x - y = 13$

$(2x + 3y = 31) \times 2 \quad\quad -4x + 6y = 62$

$7y = 49$

$y = 7 \rightarrow x = 5$ Ans

Q If 6 pens and 7 pencils together costs 90 rs. while 5 pens and 6 pencils cost Rs 76, what will be the cost of each pen.

$6x + 7y = 90$; $5x + 6y = 76$

$(6x + 7y = 90) \times 5 \Rightarrow 30x + 35y = 450$

$(5x + 6y = 76) \times 6 \quad\quad -30x + 36y = 456$

$y = 6$

$x = 8$

Concept of unique solution

$a_1x + b_1y + c_1 = 0$
$a_2x + b_2y + c_2 = 0$ $\rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

Concept of Infinite and no soln.

Infinite soln:-

$a_1x + b_1y + c_1 = 0$
$a_2x + b_2y + c_2 = 0$ $\rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

No. soln:-

$a_1x + b_1y + c_1 = 0$
$a_2x + b_2y + c_2 = 0$ $\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Quadratic eqn:-

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

Factorization method.

Ex:- $x^2 + 10x + 24 = 0$
$a.c = 1 \times 24 = 24 <$ 6, 4 $\Big\}+ = b = 10$

$x^2 + 6x + 4x + 24 = 0$
$x(x+6) + 4(x+6) = 0 \Rightarrow$ Roots $(-4, -6)$
$(x+4)(x+6) = 0$

$x^2 + 5x + 6 = 0$
$a.c = 1 \times 6 = 6 <$ 2, 3 $\Big\}+ 5$

~~$x^2 + 6x - x + 6 = 0$~~ $x^2 + 3x + 2x + 6 = 0$
~~$x(x+6) - 1(x-6) = 0$~~ $x(x+3) + 2(x+3) = 0$
~~$(x-1)($~~ $(x+2)(x+3) = 0$
$x = -2, -3.$

~~$x2$~~ $2x^2 + 3x - 9 = 0$ $-6 <$ 6, $-3\Big\}+$
$2 \times -9 = -18$

$2x^2 + 6x - 3x - 9 = 0$
$2x(x+3) - 3(x+3) = 0$
$(2x - 3)(x+3) = 0$
$x = 3, -3, \frac{3}{2}$ Ans

Quadratic formula:-

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

right angled

Q The three sides of triangle are $x, x+1$, and 5. If the longest side is 5. Then x is

$H = 5$
$H^2 = P^2 + B^2$
$5^2 = x^2 + (x+1)^2$
$5^2 = x^2 + x^2 + 1 + 2x$
$0 = 2x^2 + 2x - 24$

$x^2 + x - 12 = 0$
$1 \times -12 = -12 <$ -3, $+4\Big\}$

$x^2 + 4x - 3x - 12 = 0$
$x(x+4) - 3(x+4) = 0$

$x = 3, -4$ [-4 (neglected)]

Q Rohan's momer is 26 years older than him. The product of their ages (in years) 3 years from now will be 360. We would like to find Rohan's present age.

Rohan = x → $x+3$ ⇒ $x+3$

Rohan's momer = $26+x$ $26+x+3$ $29+x$

$(x+3)(29+x) = 360$

$29x + x^2 + 29\times3 + 3x = 360$

$x^2 + 32x + 87 = 360$

$x^2 + 32x$.

Nature of roots

$ax^2+bx+c=0$

$b^2-4ac>0$.

(i) Two distinct real roots = $b^2-4ac>0$

(ii) Two equal real roots = $b^2-4ac=0$

(iii) No real roots = $b^2-4ac<0$.

Q find the nature of the roots.

(i) $2x^2-3x+5=0$

$\Rightarrow b^2-4ac = (3)^2-4\times2\times5 = 9-40$

$= -31$

Hence $b^2-4ac<0 \Rightarrow$ no real roots

(ii) $3x^2-4\sqrt{3}x+4=0$

$\Rightarrow b^2-4ac = (4\sqrt{3})^2-4\times3\times4$

$= 48-48 = 0$

Two equal real roots

$\frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{4\sqrt{3} \pm \sqrt{0}}{6} = \frac{4\sqrt{3}}{6}$

$= \frac{2}{\sqrt{3}}, \frac{2}{\sqrt{3}}$

Sol) $2x^2 - 6x + 3 = 0$

$b^2 - 4ac = 36 - 4 \times 2 \times 3 =$

$= 36 - 24$

$= 12 > 0.$

Two distinct real roots.

$\frac{-b \pm \sqrt{b^2-4ac}}{2a} \Rightarrow \frac{6 \pm \sqrt{12}}{4}$

$\Rightarrow \frac{3}{2} + \frac{\sqrt{12}}{4}, \frac{3}{2} - \frac{\sqrt{12}}{4}$

$^5C_3 = \frac{5 \times 4 \times 3}{3 \times 2 \times 1}$

Probability

Q A committee of 3 members is to be selected out of 3 men and 2 women. What is the probability that the commitee has at least one women?

P(atleast 1 women)

favorable outcomes :- 2men + 1women or 2women + 1men

$\Rightarrow \frac{^2C_1 \times {}^3C_2}{^5C_3} + \frac{^2C_2 \times {}^3C_1}{^5C_3}$ (min, max.) $= \frac{2 \times 3 + 1 \times 3}{10} = \frac{9}{10}$

$= \frac{3}{5} \frac{9}{10}$ Ans

Q If A speaks the truth 80% of the time B speaks the truth 60% of the times, what is the probability that they both will speak truth?

P(A & B) ⇒ Truth

$A = 80\% = \frac{80}{100} = \frac{8}{10} = \frac{4}{5}$

$B = 60\% = \frac{60}{100} = \frac{6}{10} = \frac{3}{5}$

$P(A \& B = \text{Truth}) = \frac{4}{5} \times \frac{3}{5} = \frac{12}{25} = 0.48$

Coins

Q When two coins are tossed, find the probability of getting at least one head.

outcomes → {HH, HT, TH, TT}

P(atleast one Head) = $\frac{3}{4}$

Q When three coins are tossed find the Probability of getting.

Total outcomes = $2^3 = 8$

= {HHH, HHT, HTH, THH, THT, TTH, TTT, HTT}

(i) AT least 2 heads.

= $\frac{4}{8} = \frac{1}{2}$

(ii) AT most 2 Heads.

= $\frac{7}{8}$

(iii) No Heads

= $\frac{1}{8}$

(iv) AT least 1 head

= $\frac{7}{8}$

(v) AT least 1 head and 1 tail.

= $\frac{7}{8} \times \frac{7}{8} = \frac{49}{64}$ $\frac{6}{8}$

Dice

Q When 2 Dice are rolled, how many ways are possible to get a sum as 3 or 5 or 7?

2 Dice rolls : Total outcomes = 36

For sum 3 = {(1,2), (2,1)}

For sum 5 = {(1,4), (2,3), (3,2), (4,1)}

For sum 7 = {(1,6), (2,5), (3,4), (4,3), (5,2), (6,1)}

P(3 or 5 or 7) = $\frac{12}{36} = \frac{2}{6} = \frac{1}{3}$

There are 12 possible outcomes or ways

Q When 3 dice are rolled, what is the probability of geting the sum as 8?

For 2 Dice

Sum of 8 = {(6,2) (2,6) (3,5), (4,4), (5,3), (6,2)}

= P(sum of 8) = $\frac{5}{36}$

For 3 Dice

Sum of 8 = (1,1,6) (1,2,5) (1,3,4) (2,3,3) (2,4,2)

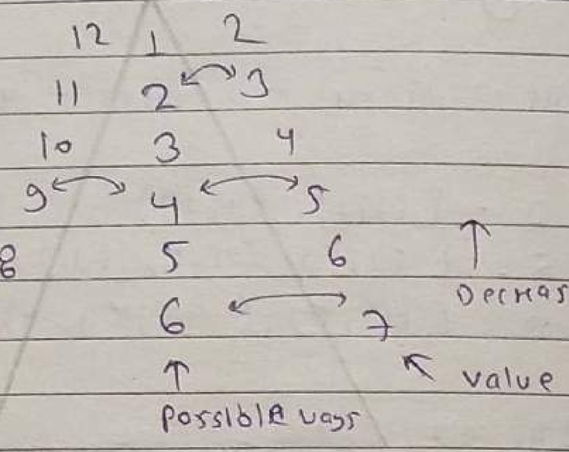
= $\frac{3!}{2!}$ $\frac{3!}{1!}$ $\frac{3!}{1!}$ $\frac{3!}{2!}$ $\frac{3!}{2!}$

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

= $\frac{3+6+6+3+3}{216} = \frac{21}{216}$

For 2 dice rolled

Trick :- Pyramid trick



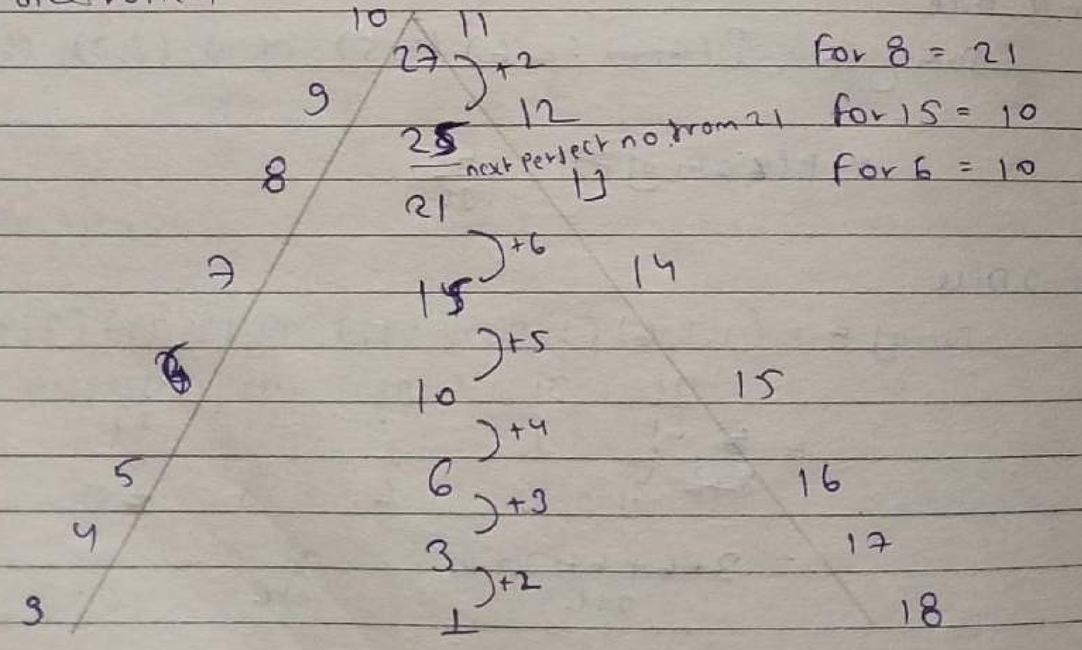
For 1 → 2

For 5 → 4, For 12 → 1

For 7 → 6

For 9 → 4

For 3 dice rolled



For 8 = 21

For 15 = 10

For 6 = 10

Bag & Ball

Q A bag contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?

2 Red, 3 Green, 2 Blue

P(2 balls, no blue) =

one from red & one from Green + Both Red + Both green.

$$\Rightarrow \frac{{}^2C_1 \times {}^3C_1 + {}^2C_2 + {}^3C_2}{{}^7C_2}$$

$$\Rightarrow \frac{2 \times 3 + 1 + 3}{\frac{7 \times 6}{2 \times 1}} = \frac{10}{21} \text{ Ans.}$$

Qes. Two bags are there, in the first bag there are 5 red & 3 blue where as in the second bag there are 6 red and 2 blue. Find the probability of drawing 2 Red and 1 blue colored balls?

P(2R & 1B)

Either Bag1 or Bag2

$$= \frac{1}{2}\left[\frac{{}^5C_2 \times {}^3C_1}{{}^8C_3}\right] + \frac{1}{2}\left[\frac{{}^5C_2 \times {}^3C_1}{{}^8C_3}\right]$$

$$= \frac{1}{2}\left[\frac{30}{56}\right] + \frac{1}{2}\left[\frac{30}{56}\right]$$

$$= \frac{30}{56} \times \frac{2}{2} = \frac{60}{112}$$

Cards

Spade (♠), club (♣), Diamond (♦), Heart (♥)

Total = 52 cards

Red (26 cards) — Black (26 cards)

Clubs (13)	Spades (13)	Diamond (13)	Hearts (13)
Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King.	Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King	Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King	Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King.

Q. A card is drawn from a deck of cards. Find the probability of getting.

(i) A spade card. $= \frac{13C_1}{52C_1} = \frac{13}{52} = \frac{1}{4}$

(ii) 2 Red cards $= \frac{26C_2}{52C_2} = \frac{26 \times 25}{52 \times 51} = \frac{25}{102}$

(iii) A king $= \frac{4}{52} = \frac{1}{13}$

(iv) 3rd ace cards $= \frac{0}{52} = 0$

(v) 2 - face cards $= \frac{12C_2}{52C_2} = \frac{12 \times 11}{52 \times 51} = \frac{11}{221}$

(vi) A - Red face card $= \frac{6C_1}{52C_1} = \frac{6}{52} =$

(vii) Queen of hearts $= \frac{1}{52}$

(viii) Neither the heart nor the king.

no. of hearts = 13

no. of kings = 4 including 1 heart

Total = 16

$\Rightarrow \frac{52 - 16}{52} = \frac{36}{52}$

(ix) Neither an Ace nor a King.

no. of Ace = 4
no. of Kings = 4.

Total To be selected = 52 - 8 = 44

$$P(\text{(N(Ace) Nor (King))}) = \frac{44}{52} = \frac{11}{13}$$

(x) ~~Proba~~: 2 cards but not black cards.

$$\Rightarrow \frac{^{26}C_2}{^{52}C_2} = \frac{26 \times 25}{52 \times 51} = \frac{25}{102}$$

Time, Speed & Distance

Distance :- Km $\times 1000$ = 1000 m

time : 1 hr = 60 min = 3600 sec

1 min = 60 sec

Speed : $\frac{Km}{hr} = \frac{1000\ m}{3600\ sec} = \frac{5}{18}\frac{m}{sec}$

Ex: Walking at $(5/7)^{th}$ of your usual speed, you will reach the market 16 minutes late. What is the usual time taken by you to reach the market?

Think!

distance same so.

usual = unusual.

speed$_1$ x time$_1$ = speed$_2$ x time$_2$

$\frac{5}{7}s \times (t + \frac{16}{60}) = s \times t$

$\frac{5}{7}(t + \frac{16}{60}) = t$

$\frac{5}{7}t + \frac{5}{7} \times \frac{16}{60} t$

$t - \frac{5t}{7} = \frac{5}{7} \times \frac{16}{60}$

$\frac{2t}{7} = \frac{5 \times 16}{7}$ $\quad t = 40$ minutes

~~$t = 5 \times 8 = 40$ sec~~ 5×80

~~$t = 1900$ sec~~

~~$t = 1900$~~ 1860 + 40 → ~~31 minutes + 40 sec~~

$\frac{5}{7}s \rightarrow t + 16$ min

equal

$\frac{5}{7}s \rightarrow \frac{7}{5}t$

$t + 16 = \frac{7}{5}t$

$5t - 7t = -5 \times 16$

$2t = 80$

$t = 40$ min.

Que:- Rohit drives from his home at a speed of 30 Km/hr and reaches his bank 20 minuts late. Then the next day he increases his speed by 15Km/hr but still he is late by 8 minuts. How far is his bank from his home?

$t_1 = t + 20\,min$, $t_2 = t + 8\,min.$

subtract both eqn

$t_1 - t_2 = t + 20 - t - 8$

$t_1 - t_2 = 12\,mins$ $\left(t = \frac{D}{S}\right)$

$\frac{D}{30} - \frac{D}{45} = 12$

$\frac{3D - 2D}{90} = 12$

$\frac{D}{90} = \frac{12}{60}$

$D = \frac{12}{60} \times 90$

$D = 18\,Km$

Q A farmer travelled a distance of 61 Km in 9 hours. He travelled partly on foot @ 4 Km/hr and partly on bicycle @ 9 Km/hr. The distance travelled on foot is:-

$d_f = x$, $d_b = 61 - x$

$t_f + t_b = 9\,hr$ $\quad t = \frac{Distance}{Speed}$

$\frac{x}{4} + \frac{(61-x)}{9} = 9$

$\frac{9x + 244 - 4x}{36} = 9$

$5x + 244 = 324$

$5x = 324 - 244$

$5x = 80$

$x = 16\,Km$

Que: Shilpa travelling at the speed of 1000 Kmph reaches her destination in 80 min. If she travels at the speed of 125 Kmph, in how many minuts will she reach her destination?

$100 \times 80 \times 60 = 125 \times t$

$t = \frac{100 \times 80 \times 60}{125 \times 60} = \frac{480000}{125}\,hr.$

$t = \frac{480000}{125 \times 60}\,min$ $\quad t = \frac{8000}{125} \frac{100 \times 16}{125}$

$t = 64\,min$

Que:- Excluding stoppages, the speed of a bus is 54 Km/h and including stoppages, it is 45 Km Ph. For how many minutes does the bus stop per hour.

54 Km/hr = 1 hr (Nostoppage)

45 Km/hr = 1 hr (stoppages)

Distance covered by stoppages = 54 - 45.

= 9 Km.

$T = \frac{D}{S} = \frac{9}{54} = \frac{1}{6}$ hr.

$T = \frac{1}{6} \times 60$ min = 10 min.

Ave Average speed.

Que:- If you travel ~~70~~ 210 Km from Town A to Town B at a speed of 30 Kmph and from there to town C at a speed of 70 Kmph for another 140 Km, then what is your average speed during the entire journey?

$\text{Avg speed} = \frac{\text{Total Distance}}{\text{Total time}}$

$T_1 = \frac{\text{Distance}}{\text{Speed}} = \frac{210}{30} = 7$ hr

$T_2 = \frac{\text{Distance}}{\text{Speed}} = \frac{140}{70} = 2$ hr

$\text{Avg speed} = \frac{210+140}{7+2} = \frac{350}{9} = 38.88$ Kmph

Que:- Arjun covers a distance by cycle at 18 Km/h. He returns to the starting point in a bus at a speed of 45 Km/h. Find the average speed for the journey.

Distance same ⇒ ~~Ave~~ Avg speed = $\frac{2 \times S_1 \times S_2}{S_1 + S_2}$

time same ⇒ Avg speed = $\frac{2 \times S_1 \times S_2}{S_1 + S_2}$ $\frac{S_1 + S_2}{2}$

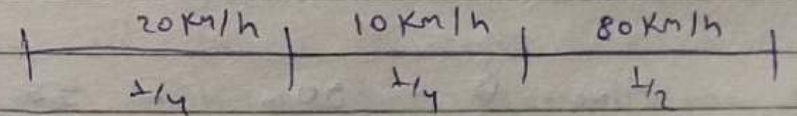
Here, Distance is same:

$\text{Avg speed} = \frac{2 \times 18 \times 45}{45 + 18} = \frac{1620}{63} \frac{18 \times 30}{7}$

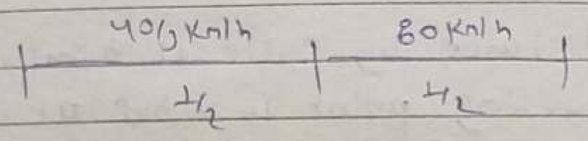
$= \frac{20}{7} = 2.5$ $= \frac{2 \times 18 \times 45}{63} 5$

$= \frac{180}{7} = 25.071$ Km/hr

Que Krishna covers one-fourth of the total distance at 20 Km/hr, one-fourth at 10 Km/hr and rest of his journey at 80 Km/h. Find Krishna's average speed for the whole distance?



$\text{Avg speed} = \frac{2 \times 20 \times 10}{20+10} = \frac{400}{30} = \frac{40}{3}$



$$\text{Avg speed} = \frac{2 \times \frac{40}{3} \times 80}{\frac{40}{3} + 80} = \frac{\frac{2 \times 40 \times 80}{3}}{\frac{40 + 240}{3}}$$

$$= \frac{640}{280} = \frac{160}{7} = 22.85 \text{ Kmlh}$$

Relative speed.

Que:- A train 90m long is travelling at a speed of 40Kmlh. A man is running at a speed of 5Kmph in a direction opposite to the motion of the train. What would be the time taken by the train to cross the man?

train	man
L = 90m	S = ~~Km~~ 5Kmlhr.
S = 40Km/hr	

$$\text{time} = \frac{D}{S} = \frac{90m}{40+5} = \frac{90}{45 \times 1000} = \frac{1}{500}$$

$$= \frac{90 \text{ m}}{45 \times 5 \text{ m}/5} = \frac{180}{25} \text{ s} = \frac{36}{5} =$$

$$\frac{18}{2} = \boxed{7.2 \text{ sec}}.$$

Que: A train passes a stationary pole in 8 sec. The train also passes a 200m long bridge in 28 seconds. What is the length and the speed of the train?

Pole	Bridge
Dist = x m	Dist = x + 200m
t = 8 sec	t = 28 sec.
St	St

Speed is equal.

$$S_t = S_t$$

$$\frac{x}{8} = \frac{x+200}{28}$$

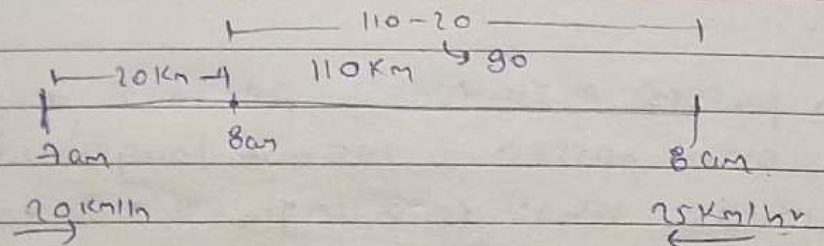
$$28x = 8x + 1600$$

$$20x = 1600$$

$$x = \frac{160}{2} = 80 \text{ m}.$$

$$\text{Speed of train} = \frac{x}{8} = \frac{80}{8} = 10 \text{m/s}$$

Que: Two station ~~or~~ A and B are 110 Km apart on a ~~station~~ straight line. One train starts from A at 7 am and travels towards B at a speed of 20 Kmph. Another train starts from B at 8 am and travels towards A at speed of 25 Kmph. At what time will they meet?



$\text{Speed} = \frac{D}{T}$

$D = 5 \times t$

$D = 20 \times 1$

$= 20 \text{ Km}$

$D = 90 \text{ Km}$

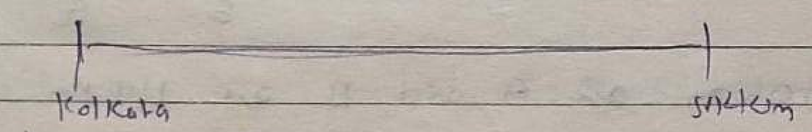
$RS = 20 + 25 = 45 \text{ Km/hr}$

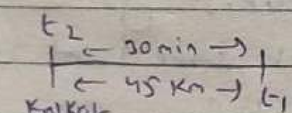
~~Speed = D~~

$T = \frac{D}{S} = \frac{90}{45} = 2 \text{ hrs.}$

Ans = 10 a.m.

Que: Two trains A and B leave Kolkata for Sikkim at 8:00 pm and 8:30 pm respectively and run at 90 km/h and 120 km/h respectively. At what distance from Kolkata, will the two trains meet?





$S = 90 \text{ Kmph}$

$t = 30 \text{ min} = \frac{1}{2} \text{ hr}$

$D = 90 \times \frac{1}{2} = 45 \text{ Km}$

$D = 45 \text{ Km}$

$RS = 120 - 90 = 30 \text{ Km/h}$

$T = \frac{D}{S} = \frac{45}{30} = \frac{9}{6} = \frac{3}{2} \text{ hr} = 1.5 \text{ hr}$

So, The Distance is

$D = \text{Speed} \times \text{time} = 120 \times \frac{1}{2} = 180 \text{ Km}$

Que: A train overtakes two boys, who are running at 8 Km/hr and 16 Km/hr in the same direction as the train. The train completely passes them in 36 seconds and 40 seconds. respectively. What is the length of the train?

length of the train = x, speed of train = y

Boy (1)	Boy (2)
$D = x$	$D = x$
$t = 36 \text{ sec}$	$t = 40 \text{ sec}$
$RS = y - 8$	$RS = y - 16$
$x = 36 \times (y-8) \times \frac{5}{18}$	$x = 40 \times (y-16) \times \frac{5}{18}$

$36 \times (y-8) \times \frac{5}{18} = 40 \times (y-16) \times \frac{5}{18}$

$36y - 36 \times 8 = 40y - 40 \times 16$

$40y - 16y = 40 \times 16 - 16 \times 8$

$4y = 640 - 288$

$4y = 352$

$y = 88$

Den, length of the train is.

$= 16 \times (y - 8) \times \frac{5}{18}$

$= 16 \times (88 - 8) \times \frac{5}{18}$

$= \frac{16}{4^2} \times 80 \times \frac{5}{18_2}$

$= 800$ m Ans

Effective speed.

Upstream: Against the flow [speed$_{obj}$ - speed$_{stream}$]
Downstream: Along the flow. [speed$_{obj}$ + speed$_{stream}$]

Q A boat can travel at a speed of 13 Kmph in still water. If the speed of the stream is 4 Kmph, find the time taken by the boat to travel 68 Km downstream

Effective speed = Speed (boat) + Speed (stream).

ESpeed = 13 + 4 = 17

Time Taken = $\frac{\text{Distance}}{\text{Speed}} = \frac{68}{17} = 4$ hours.

Q A motorboat travels 40 Km Downstream in 5 hours and 30 Km upstream in 6 hours. Find the speed of the stream (in Kmph).

DS	US
D = 40 Km	D = 30 Km
T = 5h	T = 6h
ES = 8 Km/h	ES = 5 Km/h

Effective speed in DS and US

$ES = S_0 + S_S$ $\quad ES = S_0 - S_S$

$8 = S_0 + S_S$ $\quad 5 = S_0 - S_S$

$S_0 + S_S = 8$

$-S_0 \pm S_S = -5$

$2S_S = 3$

$S_S = \frac{3}{2} = 1.5$ Km/h

Ans: A man can row a boat at a speed of 6 Kmph in still water. If it takes him twice as long to row up as to row down the river, the rate of current in the stream would be

$T_U = 2T_D$

means $\Rightarrow \frac{D}{S_U} = 2 \times \frac{D}{S_D}$

$S_D = 2S_U$

$$S_0 + S_s = 2(S_0 - S_s)$$

$$6 + S_s = 2\times 6 - 2S_s$$

$$3S_s = 6$$

$$\boxed{S_s = 2}$$

Q: A boat sails 15 Km of a river towards upstream in 5hours. How long will it take to cover the same Distance downstream, if the speed of current is one-fourth the speed of the boat in still ~~river~~ water:

Up	Down
$D = 15$ Km	$D = 15$ Km
$t = 5$ hr	$S_D = S_B + S_s$
$S(S_U) = 3$ Km/h	$S_D = 4 + 1 = 5$

$$S_s = \frac{1}{4}S_B$$

$$S_U = S_B - S_s$$

$$= S_B - \frac{1}{4}S_B$$

$$\frac{3}{4}S_B$$

$$S_B = 4$$

Time taken $= \frac{15}{5} = 3$ hr

Q: Ratio b/w speed of boat in still water to speed of stream is 5:2. If 224 Km is travelled by downstream in 4 hours then find the difference between speed of boat in still water and speed of stream.?

$$S_B = 5x$$

$$S_s = 2x$$

Dis.

$D = 224$ Km

$t = 4$ hr

$$S_D = \frac{224}{4} = 56 \text{ Kmph}$$

$$S_D = 56 \text{ Kmph}$$

$$S_B + S_s = 56$$

$$5x + 2x = 56$$

$$x = \frac{56}{7} = 8$$

Difference

$\rightarrow 5x - 2x = 3x$

$\Rightarrow 3\times 8 = 24$ Ans

Q: A boat goes 360 Km upstream and returns to the same point in 25 hrs. If the speed of current is 3 Km/h what is speed of boat?

$$t_D + t_U = 25$$

$$\frac{D}{S_D} + \frac{D}{S_U} = 25$$

$$\frac{360}{(x+3)} + \frac{360}{(x-3)} = 25$$

$D = 360$

$S_U = x - 3$

$S_D = x + 3$

Concept of linear race

Que: In a race of 200m, A can beat B by 31m and C by 18m. In a race of 350m C will beat B by?

A	B	C
200 m	169m	182m
	←	Cross multiply
	? ←	350m

$$x = \frac{169 \times 350}{182} = 325\ m$$

Que: In a race of 500m, the ratio of the speeds of two contestants A and B is 3:4. A has a head start of 140 m. In A will win by?

Distance should cover by A = 500 − 140
= 360m

A = 360 m
B = 500m

A	→	B
3m	→	4m
360m	→	?

$$x = \frac{360 \times 4}{3} = 480\ m$$

B cover 480m
A will win by 20 m.

Que: In a 200m race, A gives B a head start of 25m and wins by 10sec. If A gives B a head start of 45m, the race ends in a dead heat, what will be the time taken by A to complete the race?

A	B
200m	175 m
t sec	(t + 10 sec
200m	155 m
t sec	t sec

B → 20m in 10 sec
So, 155m = $\frac{155 \times 10}{20}$ sec

t = 77.5 sec

Concept of Circular race

Two persons start running simultaneously around a circular track of length 300m from the same point at speeds of 15 Km/hr and 25 Km/hr. When will they meet for the first time anywhere on the track if they are moving in opposite directions?

$$T = \frac{D}{S}$$

S = 15 + 25 = 40 Km/hr ⇒ $\frac{40 \times 5}{18}$ m/sec = $\frac{100}{9}$ m/s

$$T = \frac{200\,m}{\frac{100}{9}} = \frac{100 \times 9}{100} = 27\ sec$$

Que:- Three friends A, B and C run around a circular of length 120 m at speed of 5 m/sec, 3 m/sec and 15 m/sec, starting simultaneously from the same point and in the same direction. How often will the three of them meet?

Time for A & B → D = 120 m $T = \frac{120}{2} = 60$ sec
R.S = 3 - 5 = 2 m/s

Time for B & C → D = 120 m $T = \frac{120}{8}$ sec
R.S = 15 - 3 = 8 m/s

Time for C & A → D = 120 m $T = \frac{120}{10}$ sec
RS - 15 - 5 = 10 m/s

(60 sec, 15 sec, 12 sec)
LCM → 60 sec

Permutation and Combination

Concept of Principle of counting :-

or → + and → ×.

Q. A shopping mall has 3 distinct glass doors and 2 distinct metal doors for entry and has 5 distinct glass doors and a wooden door for exit.

Entry: G_1 G_2 G_3 M_1 M_2
Exit: G_1 G_2 G_3 G_4 G_5 W_1

(A) In how many ways can you enter the mall?
→ 5 ways.

(B) In how many way can you leave the mall?
→ 6 ways

(C) In how many way the entry and the exit can happen?
→ 5 × 6 = 30 ways

Q If there are 3 trains from A to B, 5 trains from B to C, 6 trains from C to D and 2 trains from D to A. In how many ways can a person travel from A to D (via ~~fro~~ B to C) and return back to A again?

A - B = 3 trains
A - C = 5 trains
C - D = 6 trains
D - A = 2 trains

A - D.
A-B & B-C & C-D & D-A
3 × 5 × 6 × 2 = 180 ways

Q. Each of 2 friends has 20 stamps and 10 post cards. We all call all an Exchange fair if they exchange a card for a card (or) stamp for a stamp. How many ways are there to carry out one fair exchange between these two friends?

A
20 S & 10 P

B
20 S & 10 P

Card to card (or) stamp to stamp

$(10 \times 10) + (20 \times 20) = 500$ ways.

Q The total no of ways of answering 5 objective type questions each question having 4 choices is?

obj1 obj2 obj3 obj4 obj5

$(1+1+1+1) \times (1+1+1+1) \times (1+1+1+1) \times (1+1+1+1) \times (1+1+1+1)$

$4 \times 4 \times 4 \times 4 \times 4$

1024 Ans

Concept of Combination.

$${}^nC_r = \frac{n!}{r!(n-r)!}$$ = n = total elements
= r = favourable elements.

${}^nC_n = 1$
${}^nC_1 = n$
${}^nC_{(n-1)} = n$

$$\boxed{{}^nC_r = {}^nC_{n-r}}$$

Q A committee of 5 persons is to be formed from 6 men and 4 women. In how many ways this can be done when at least 2 women are included?

6M & 4W

2W & 3M or 3W & 2M or 4W & 1M

~~2×3 + 3×2 + 4×1~~
~~6 + 6 + 4 = 16~~

${}^4C_2 \times {}^6C_3 + {}^4C_3 \times {}^6C_2 + {}^4C_4 \times {}^6C_1$

$\frac{4 \times 3}{1 \times 2} \times \frac{6 \times 5 \times 4}{1 \times 2 \times 3} + \frac{4 \times 3 \times 2}{1 \times 2 \times 3} \times \frac{6 \times 5}{1 \times 2} + 1 \times 6$

$6 \times 20 + 4 \times 15 + 6$

$120 + 60 + 6$

186 Ans.

Q. A Conference is attended by 25 participants. If each participant shakes hand with every other participant what will be the resultant number of handshakes?

$= {}^{25}C_2 = \frac{25 \times 24}{1 \times 2} = 300$ Ans.

Q A Department contains 17 male and 15 female employee. In how many ways can a male and a female employee be choosen to represent the department?

${}^{17}C_1 \times {}^{15}C_1$

$= 17 \times 15 = 255$

Q out of 11 points there are 4 collinear points how many triangles can be formed by using the points as vertex?

$\Rightarrow {}^{11}C_3 - {}^{4}C_3$

$\Rightarrow \frac{11 \times 10^{5} \times 9^{3}}{1 \times 2 \times 3_1} - \frac{4 \times 3 \times 2}{1 \times 2 \times 3}$

$\Rightarrow 165 - 4$

$\Rightarrow 161$ Ans

Q How many parallelograms are formed by a set of 6 parallel lines (horizontal) intersecting another set of 4 parallel lines (vertical)?

$\Rightarrow {}^{6}C_2 \& {}^{4}C_2$

$\Rightarrow \frac{\overset{3}{6} \times 5}{1 \times 2_1} \times \frac{\overset{2}{4} \times 3}{1 \times 2_1}$

$\Rightarrow 15 \times 6 = 90$ Ans

Concept of Permutation.

${}^{n}P_r = \frac{n!}{(n-r)!}$ $\Rightarrow {}^{10}P_2 \Rightarrow 10 \times 9 = 90$

${}^{5}P_4 \Rightarrow 5 \times 4 \times 3 \times 2 = 120$

${}^{n}P_0 = n!$

${}^{n}P_1 = n.$

${}^{n}P_{n-1} = n! = {}^{n}P_n.$

Q How many 3 letter words can be formed by using different alphabets?

${}^{26}P_3 = 26 \times 25 \times 24 = 15,600$

Q. A out of 6 consonants and 5 vowels, how words of 3 consonants and 2 vowels can be formed.

6 cons & 5 vowels
3 cons & 2 vowels.

Selection :- $^6C_3 \times {}^5C_2$

Arrangement : $({}^6C_3 \times {}^5C_2) \times {}^5P_5$

$= \left(\frac{6 \times 5 \times 4}{1 \times 2 \times 3} \times \frac{5 \times 4}{1 \times 2}\right) \times 5!$

$= 20 \times 10 \times 120$

$= 2400$

Q How many ways 5 letter words can be formed using the letters of the word "GREAT".

(i) if repetition of alphabets are allowed

$5 \times 5 \times 5 \times 5 \times 5 \rightarrow 5^5 \rightarrow 3125$

(ii) if repetion of alphabets are not allowed

$5 \times 4 \times 3 \times 2 \times 1 = 120$

(iii) Such that all the vowels are together.

| EA | G | R | T |

$4! \times 2! = 24 \times 2 = 48$ ans

(iv) Such that all the vowels are not together.

Total Arrangements - vowel together.

$= 120 - 48 = 72$

(v) Such that all the constants are together

| GRT | E | A |

$\Rightarrow 3! \times 3! \Rightarrow 36$

(vi) Such that all the consonants are not together.

Total arrangement - consonant together

$120 - 36 \Rightarrow 84$

(vii) Such that all the vowels are together and all the Consonants are together

| EA | GRT |

$2! \times 2! \times 3!$

$\rightarrow 2 \times 2 \times 6 = 24$

Alphabet and number related Problems:-

Q: In how many ways can be the letters of the word "STRANGE" be arranged so that the vowel may appear in odd places?

S T R A N G E (a, e, i, o, u)

_ _ _ _ _ _ _

~~5!~~

$5! \times {}^4P_2$

$120 \times 4 \times 3 \rightarrow 1440$

Q How many 5 digits no. can be formed on having the numbers 5, 1, 6, 7 and 4? (repetition not allowed)

_ _ _ _ _

~~5!~~

$5 \times 4 \times 3 \times 2 \times 1 = 120$

Q How many 4 digit numbers can be formed on having the numbers 0, 1, 2, 3 and 4? (repetition not allowed)

$4 \times 4 \times 3 \times 2 = 96$

Q How many 7 digits telephone numbers can be formed with 6 and 5 at the right and left extreme ends resp.

_ _ _ _ _ _ _

1: 5 ... 6

2: 6 ... 5

$8 \times 7 \times 6 \times 5 \times 4 = 6720$

Q. How many 6 digit even numbers can be formed from digits 1, 2, 3, 4, 5, 6, 7 so that the digit should not repeat and the second last digits is even?

even = 2, 4, 6.

_ _ _ _ _ _

~~8 7 6~~

$5 \times 4 \times 3 \times 2 \times 2 \times 3 = 720$ ways

Q Find the number of 5 digit numbers that are formed by using digits 1, 2, 5, 6, and 7 (without repetition)

$\Rightarrow 5! = 120$

(i) divisible by 2: even = 2, 6.

_ _ _ _ _

$5 \times 3 \times 2 \times 1 \times 2 = 240 = 48$

(ii) divisible by 4: _ _ _ [_ _] → 12, 16, 52, 56, 72, 76.

$3 \times 2 \times 1 \times 6 = 36$ ways

(iii) Divisible by 5 (0 or 5)

Q

$$\_\_ \quad \_\_ \quad \_\_ \quad \_\_ \quad \_\_ \quad (5)$$

$$4 \times 3 \times 2 \times 1 \times 1 \rightarrow (\text{fixed})$$

$$= 24 \text{ ways}$$

Q What is the sum of all 4-digit numbers that can be formed using the digits 1, 2, 3, 4 where repetition of digits is not allowed?

Sum of ~~digit~~ numbers that are formed

$$= (\text{sum of digits}) \times (n-1)! \times 1111$$

$$= 10 \times 3! \times 1111$$

$$= 66660.$$