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GATE ESE PSU's 2019-20

GATEACADEMY

109 ENGG.APTITUDE_GATEACADEMY

TOTAL PAGE ENGG.APTITUDE-195 PGAE

LATEST GATEACADEMY CLASSROOM HANDWRITTING

CONTENT COVERED:

1. Theory Notes
2. Explanation
3. Derivation
4. Example
5. Shortcut & Formula Summary
6. Previous year Paper Q. Sol.

Noted-: Single Source Follow, Revise

Multiple Time Best key of Success

Chapter - 01 Number System

1. Number of 0's at the end

Conceptual

Q1. Find Maximum no. of 3's present in 10!

Sol $10! = 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$9 = 3^2$, $6 = 3 \times 2$, $3 = 3$

no. of 3's = 4

Apart from Solving it Manually we Can also Solve it as.

$$3's = \frac{10}{3} + \frac{10}{3^2} + \cancel{\frac{10}{3^3}} + \cancel{\frac{10}{3^4}}$$

$N < D$

$$= 3 + 1$$

No. of 3's = 4

Condition to be followed:

→ The number from which division start must be prime. 3 in this Case.

→ Consider only the Integral part when Dividing Numerator by Dlnominator.

→ Divide Numerator by Denominator as long as $N. \geq D.$

Que2. Find Maximum no. of 2's, 3's 5's & 7's present in 25! 50! 75! 100! 150! & 200!

Sol ① 25!

a. no. of 2's $= \frac{25}{2} + \frac{25}{2^2} + \frac{25}{2^3} + \frac{25}{2^4} + \cancel{\frac{25}{2^5}}$

$= 12 + 6 + 3 + 1$

$= 22$

b. no. of 3's = $\frac{25}{3} + \frac{25}{3^2} + \cancel{\frac{25}{3^3}}$

= 8 + 2

= 10 //

c. no. of 5's = $\frac{25}{5} + \frac{25}{5^2}$

= 5 + 1

= 6 //.

d. no. of 7's = $\frac{25}{7} + \cancel{\frac{25}{7^2}}$

= 3 //

ii) 50!

no. of 2's = 25 + 12 + 6 + 3 + 1

= 47

no. of 3's = 16 + 5 + 1

= 22

~~no of 4's~~ = ~~12 + 3 = 15~~

no of 5's = 10 + 2 = 12

no. of 7 = 7 + 1 = 8

iii) 75!

no. of 2's = 37 + 18 + 9 + 4 + 2 + 1

= 76

no of 3's = 25 + 8 + 2 + 0 = 35

no. of 4's = 18 + 4 + 1
= 23

no. of 5's = 15 + 3
= 18

no. of 7's = 10 + 1
= 11

iii) 100!

no. of 2's = 50 + 25 + 12 + 6 + 3 + 1
= 97

no. of 3's = 33 + 11 + 3 + 1
= 48

no. of 4's = 25 + 8 + 2
= 35

no. of 5's = 20 + 4 + 0
= 24 (CAT Exam)

no. of 7's = 14 + 2
= 16

Conceptual Que2 Find Maximum number of 2, 4, 8, 16 present in 25! 50! & 100!

Sol
= 25!

no. of 2's = $\frac{25}{2} + \frac{25}{2^2} + \frac{25}{2^3} + \frac{25}{2^4} +$

= 12 + 6 + 3 + 1

= 22

no. of 4's $\Rightarrow$ $4 = 2^2$ $\Rightarrow$ $\frac{\text{no. of 2's}}{2} = \frac{22}{2} = 11$

no. of 8's :- $8 = 2^3$ $\quad \frac{\text{No. of 2's}}{3} = \frac{22}{3} = 7$

no. of 16 :- $16 = 2^4$ $\quad \frac{22}{4} = 5$

ii) 50!

no. of 2's = 47

no. of 4's = $\frac{47}{2} = 23$

no. of 8's = $\frac{47}{3} = 15$

no. of 16 = $\frac{47}{4} = 11$

iii) 100!

no. of 2's = 97

no. of 4's = 97/2 = 48

no. of 8's = 97/3 = 32

no. of 16's = 97/4 = 24

Que find max. no. of 2's, 3's, 5, 7's 9's, 16's, 9's & 27's in 150! & 250!

Sol i) 150!

no. of 2's = $\frac{150}{2} + \frac{150}{4} + \frac{150}{8} + \frac{150}{16} + \frac{150}{32} + \frac{150}{64} + \frac{150}{128}$ $\quad 75 + 37 + 18 + 9 + 4 + 2 + 1$

$= 146$

no of 3's = $50 + 16 + 5 + 1 = 72$

no of 5's = $30 + 6 + 1 = 37$

no. of 7's = 21 + 3 = 24

no. of 9's = $\frac{72}{2}$ + 0 = 36

no. of 16's = $\frac{146}{4}$ = 36

no. of 27's = $\frac{72}{3}$ = 24 (Vizag steel question)

no. of no. of 4's = $\frac{146}{2}$ = 73

no. of 8's = $\frac{146}{3}$ = 48

ii) 250!

no. of 2's = 125 + 62 = 187 + 31 + 15 + 7 + 3 + 1 = 244

no. of 3's = 83 + 27 + 9 + 3 + 1 = 123

no. of 5's = 50 + 10 + 2 = 62

Conceptual Que 3 find Max. no. of 6's 21's & 15's in 25! 50! & 100!

25!

Sol i) No. of 2's = 12 + 6 + 3 + 1 = 22

ii) No of 3's = 8 + 2 + 1 = 10

iii) no. of 6's ⇒ $6 = 2 \times 3$, $\min(22, 10)$ = 10 {min.}

iv) no. of 21's ⇒ min(10, 3) = 3

v) no. of 7's ⇒ 3

vi) no. of 15 ⇒ min(6, 10) = 6

vii) no. of 5 ⇒ 5 + 1 = 6

ii) 100!

a) no. of 2's = 97

b) no. of 3's = 33 + 11 + 3 + 1 = 48

c) no. of 5's = 20 + 4 + 0 = 24

d) no. of 7's = 14 + 2 = 16

e) no. of 6's = min(97, 48) = 48

f) no. of 15's = min(48, 24) = 24

g) no. 21's = 16

h) no. of 12's = min(48, 48) = 48 X

i) no. of 18's = min(48, 48) = 48 X

iii) 50!

a) no. of 2's = 47

b) no. of 3's = 22

c) 4's = 15

d) 5's = 12

e) 6's = 22

f) 7's = 8

g) 15's → min(3, 5) = 12

h) 21's = min(7, 3) = 8

i) 12's = 10

j) 18's = 1

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1. Previous year paper 4-5 times practice before final exam.

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~~100!~~ 50!

h) no. of 12's in 2^{97}

$12 \rightarrow 2^2 \times 3$

$50! = 2^{47} \times 3^{22}$

$= (2^2)^{11} \times 3^{22}$

$\min(22, 22)$

no. of 12's = 22

i) no. of 18's

$18 \rightarrow 2 \times 3^2$

$50! \rightarrow 2^{47} \times 3^{22}$

$2^{47} \times (3^2)^{11}$

$\min(47, 11) = 11$ //

100!

h) no. of 12's =

$12 \rightarrow 2^2 \times 3$

$100! = 2^{97} \times 3^{48}$

$= (2^2)^{48} \times 3^{48}$

$= 48$

i) no. of 18's

$18 \rightarrow 2 \times 3^2$

$2^{97} \times (3^2)^{24}$

$= \min(97, 24)$

$= 24$

j) no. of 21's

$21 \rightarrow 7, 3$

$3^{22} \times 7^8$

$= 8$ //

~~Test~~

Note:- In any factorial number, the number of zeros at the end is equal to the no. of 5's present.

↳ min (no. of 2's, no. of 5's)

eg. find the no. of 0's at the end of the following.

i) 80!

ii) 100!

iii) 123!

Sol 80!

no. of 5 → 16 + 3

= 19

100! → 20 + 4 = 24

123! → 24 + 4 = 28

Que. find no. of 0's at the end of following

i) 77!

Sol 77! → 15 + 3 = 18

ii) a) 27 b) 27^{27} c) $27^{27}!$

Sol:- no. of zero = 0 Sol:- 0 0's

e) $27^{27}!$

Sol no. of zeros = 0

d) 27! 5 + 1 = 6 0's

e) $27!^{27}$ no. of zero = 6^{27} X

Thus we can deduce that if m boys and n girls then total number of arrangement such that no two boys must sit together

$$m\,B \mid n\,G$$

$$n! \cdot \left({}^{n+1}C_m \cdot m! \right)$$

(n+1 → pseudo gap)

e.g If we have 5G & 3B then total number of arrangement no two boys must sit together

Sol $\times G_1 \times G_2 \times G_3 \times G_4 \times G_5 \times$

$$5! \left({}^{6}C_3 \cdot 3! \right)$$

Q9. GANESH PURI

Such that no two vowel sit together

$\times G \times N \times S \times H \times P \times R \times$

$$6! \left({}^{7}C_4 \cdot 4! \right)$$

Test 01 How many seven letter words can be formed from Letters of the word ARTICLE Such that vowel must occupy even places

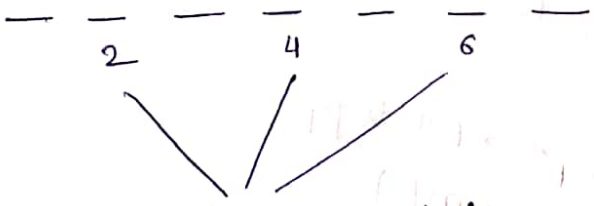
Test 02 How many six letter words can be formed from the Letters of word GARDEN. Such the vowel must come in Alphabetical order

Test 03 AAAAA BBB CCC D EE F

Total no. of ways in which all letter can be arranged

Such that no two C must come together.

Sol 1



$$({}^{3}C_{3} \cdot 3!)({}^{4}C_{4} \cdot 4!) = 3!\,4!$$
$$= 144$$

Sol 3 A A A A A B B B B C C C D E E F

(A A A A A B B B B D E E F)

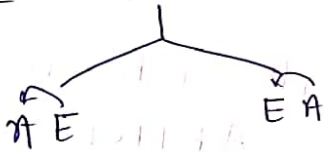
$$\frac{13!}{5!\,4!\,2!} \cdot \frac{{}^{14}C_{3} \times 3!}{3!}$$

A B E C

Sol 2 G A R D E N

Vowel must come in alphabetical order

$$6! = 720$$



$$\frac{720}{2} = 360$$

eg. 1 2 3 4

Case in which $1 > 2$ $\rightarrow \frac{4!}{2}$

$1 > 2 \& 3 \rightarrow \frac{4!}{3}$

iii) $1 > 2 > 3 = \frac{4!}{3!}$

Ja it has more than one such case

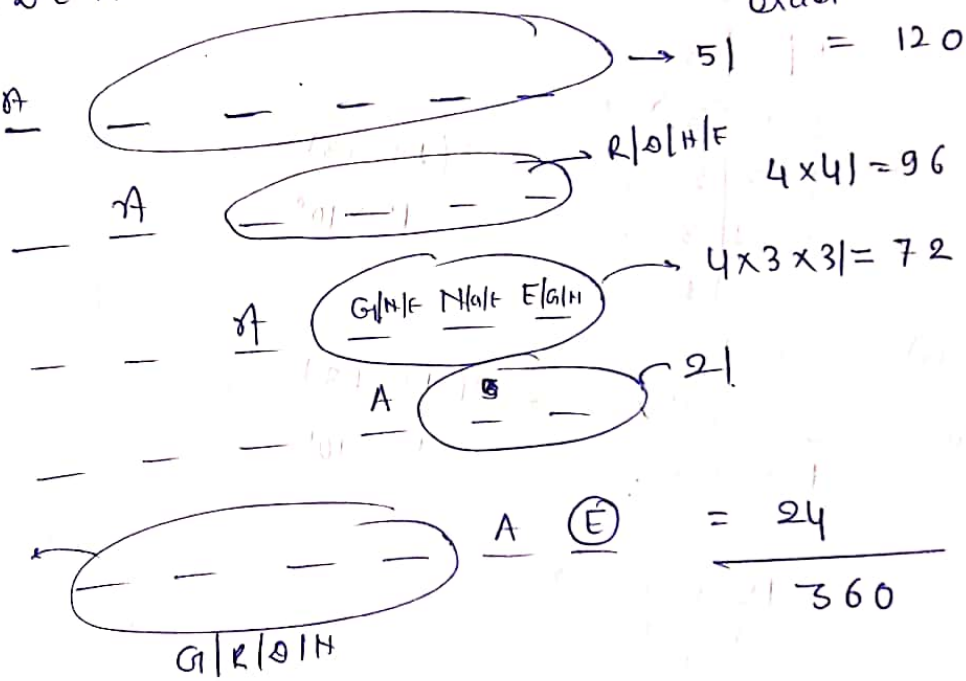
1	2	3	4
4	1	2	3

Hence use factorial

GARDEN

$A > E > D = \frac{6!}{3!} = \frac{720}{6} = 120$

Que. GARDEN vowel must come in Alphabetical order



Que. i) Given that all the Alphabet are distinct and their Value Ranges from 1 to 9

ii) If $A \times B \times C = D \times E \times F = B \times G \times E$

find G = ?

A	D
B G	E
C	F

Que 2

```
A  B  C
   O
E  F  G
   H
   I
```

If all alphabet represent distinct value from 1 to 9
also given that $A+B+C = C+O+E = E+F+G = G+H+I = 13$
find value of all the alphabets.

*Conceptual Que. Find the sum of all the four digit numbers that can be formed using the digit 1, 2, 3, 4 exactly once.

Sol

1 | 2 | 3

1	2	3	
1	3	2	$\rightarrow 2(1+2+3) = 12\times10^0$
2	1	3	
2	3	1	
3	1	2	$2(1+2+3) = 12\times10^2$
3	2	1	$\rightarrow 2(1+2+3) = 12\times10^1$
1	3	3	2

$\Rightarrow$

$$\begin{array}{r} 1200 \\ 120 \\ 12 \\ \hline 1332 \end{array}$$

That means $1|2|3 \longrightarrow \frac{3!}{3}(1+2+3)\times(10^2*10^1*10)$

$= 1332$

for $1|2|3|4 \longrightarrow \frac{4!}{4}(1+2+3+4)(10^3*10^2+10^1+10^0)$

$= 6(10)(1111) = 66660$

$$1|2|3|\cdots n = \left[\frac{n!}{n}(1+2+3+\cdots n)(10^{n-1}+10^{n-2}+\cdots 10^3+10^2+10^1+10^0)\right]$$

↳ Sum of all n digit numbers formed by (1, 2, 3 ... n)

where,

$\frac{n!}{n}$ → Number of time each digit arriving in Vertical column

$\frac{n!}{n}(1+2+3+\cdots n)$ → denotes the digit Sum

$(10^{n-1}+10^{n-2}+\cdots 10^2+10^1+10^0)$ → Place Values of all digits

Que. find the Sum of all 5 digit numbers that can be formed using the digits — (exactly once)

I) 1, 2, 3, 4, 5

Sol $\frac{5!}{5}(5+4+3+2+1)(10^4+10^3+10^2+10^1+10^0)$

$= \frac{5!}{5}(15)(11111)$

II) 1, 1, 2, 3, 4

Sol $\frac{5!}{5\times 2!}(1+1+2+3+4)(11111)$

III) 1, 1, 2, 2, 2

Sol $\frac{5!}{5\times 3!\times 2!}(2+2+2+1+1)(11111)$

IV) 0|1|2|3|4

Sol $\frac{5!}{5}(0+1+2+3+4)(11111) - \frac{4!}{4}(1+2+3+4)\times(1111)$

↳ for Very first place zero

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5) 0 | 1 | 2 | 2 | 3

Sol) $\frac{5!}{5 \times 2!}(0+1+2+2+3)(11111) - \frac{4!}{2! \times 4}(1+2+2+3)(1111)$

Challenge Que. Find the Sum of all the 5 digit numbers that using the digits

i) 0 0 1 2 3

ii) 0 0 1 1 2

Conceptual Que. If all the letters of the word AGAIN are arranged as per English dictionary then find the

1) 10^{th}

2) 25^{th}

3) 49^{th} word

4) 50^{th}

5) 54^{th}

6) 57^{th} word of the Seria

Sol

A	$\_\ \_\ \_\ \_ \rightarrow \overline{A}\,|\,\overline{G}\,|\,\overline{I}\,|\,\overline{N}$	$4! = 24$	$1^{st} - 24^{th}$
G	$\_\ \_\ \_\ \_ \rightarrow \overline{A}\,|\,\overline{A}\,|\,\overline{I}\,|\,\overline{N}$	$\frac{4!}{2!(A)} = 12$	$25^{th} - 36^{th}$
I	$\_\ \_\ \_\ \_ \rightarrow \overline{A}\,|\,\overline{A}\,|\,\overline{G}\,|\,\overline{N}$	$\frac{4!}{2!(A)} = 12$	$37^{th} - 48^{th}$
N	$\overline{A}\,|\,\overline{A}\,|\,\overline{G}\,|\,\overline{I}$	$\frac{4!}{2!(A)} = 12$	$49^{th} - 60^{th}$

57th word :

(N) | _ _ _ _ 49th - 60th
A | A | G | I

(A) | _ _ _ → 6 | A G I
A | G | I = 6

A G I → 49th → N A A G I
A I G 50th → N A A I G
G I A
G A I
I A G
I G A

(G) | _ _ _ → 3 | 2!
A | A | I

A A I
A I A
I A A

57th → N A G I A A Ans.

48th word

(I) | _ _ _ _ → 12 37th - 48th
A | A | G | N

(A) | _ _ _ → 6
A | G | N

A G N
A N G
G A N
G N A
N A G
N G A

48th = I A G N A

note:

AG A I N →

A A I G N →

(24) (12) (12) (12)

50th ⇒ 24 + 12 + 12 = 48 i.e start with N

(N) Remain A A I G
(24) (12) (12)

N A A I G

Que. OFFER

Sol 50th

EFFOR

(12) (24) (12) (1)

REE OF //

Que. MOTHER find 100th & 200th also find Rank of MOTHER

Que. ZEPHYR find Rank

Conceptual

Que. How many Committees of five members each can be formed from 8 official and 4 non official members such that—

i) No Condition

ii) 3 official & 2 Non official Members

iii) Atleast 3 official Members

iv) Atmost 3 official Member

v) A particular official Member must always be Selected.

vi) A particular official Member must always be Rejected.

vii) A particular non official Members must always be Selected.

viii) A particular non official Member must always be Rejected

Sol:- i) $^{12}C_5$

ii) $^{8}C_3 \times {}^{4}C_2$

iii)

Sol $4C_2 \cdot {}^8C_3 + {}^8C_4 \cdot {}^4C_1 + {}^8C_5 \cdot {}^4C_0$

OR Total − Unwanted

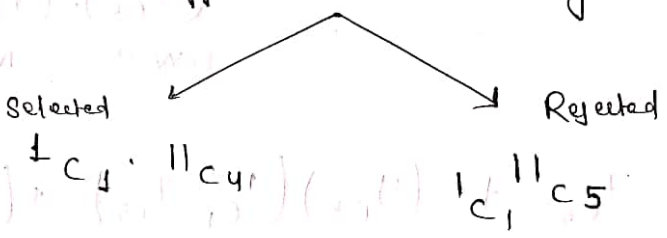
$$^{12}C_5 - \left[{}^8C_2 \cdot {}^4C_3 + {}^8C_1 \cdot {}^4C_1 + {}^8C_0 \right]$$

iv) Atmost 3 official Member

Sol $^8C_3 \cdot {}^4C_2 + {}^8C_2 \cdot {}^4C_3 + {}^8C_1 \cdot {}^4C_4 + {}^8C_0 \cdot {}^4C_5$

=

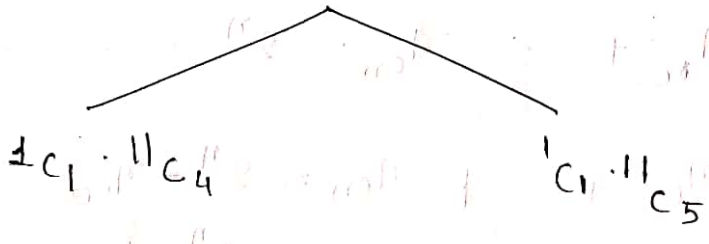
v) Particular official Member always selected



$^1C_1 \cdot {}^{11}C_4$ $\quad$ $^1C_1 {}^{11}C_5$

$= {}^{11}C_4$

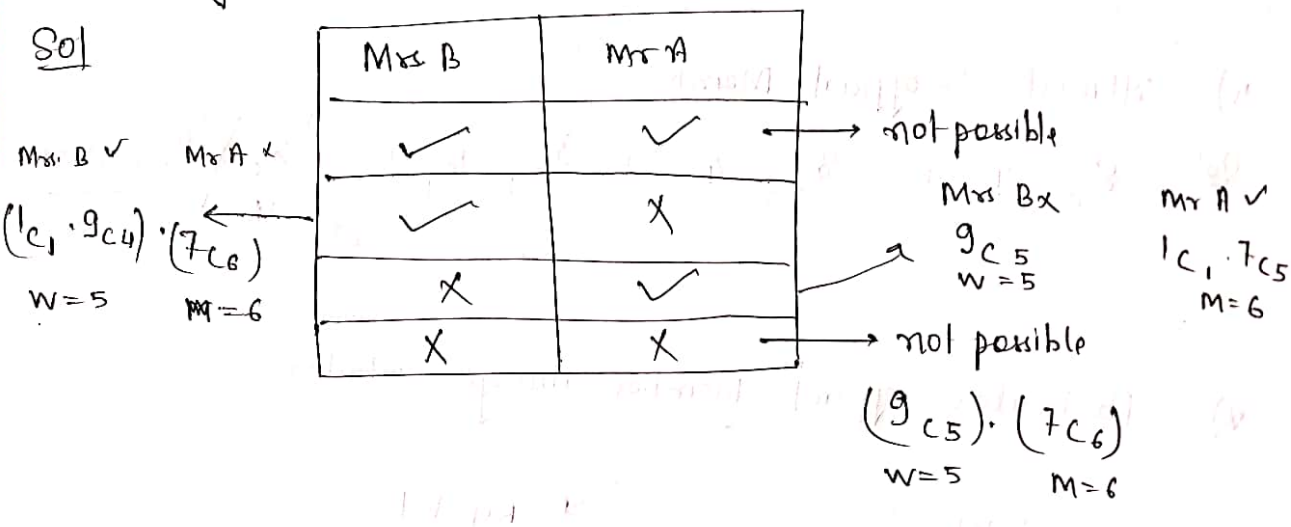
vi) Particular Non official



$^1C_1 \cdot {}^{11}C_4$ $\quad$ $^1C_1 \cdot {}^{11}C_5$

Test 01 Out of 8 Men and 10 women a Committee Consist of 6 Men and 5 Women is to be formed. How many Such Committee Can be formed when one particular Man 'A' refuses to be a Member of Committee in which his Boss B's wife is there

Sol



$$(^1C_1 \cdot {}^9C_4) \cdot {}^7C_6 + (^9C_5)(^1C_1 \cdot {}^7C_5) + (^9C_5)(^7C_6)$$

//.

Note:- Binomial theorem

$$^nC_0 + {}^nC_1 + {}^nC_2 + \cdots {}^nC_n = 2^n$$

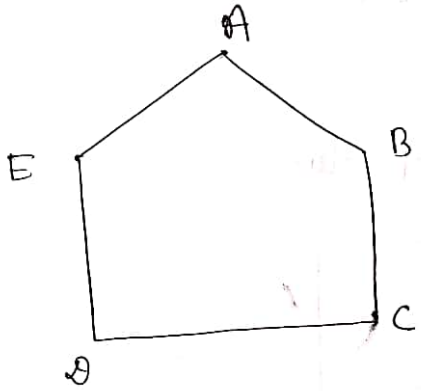
$$^nC_1 + {}^nC_2 + \cdots + {}^nC_n = 2^n - {}^nC_0$$

$$= 2^n - 1$$

eg. Question paper

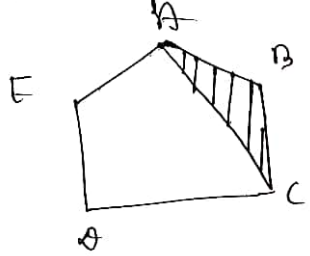
1.	1
	2
	3
2	1
	2

note

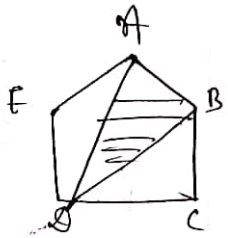


$\Delta \rightarrow \quad {}^5C_3 = {}^5C_2 = 10$

3 Consecutive point or 2 Side



A B C
B C D
C D E
D E A
E A B



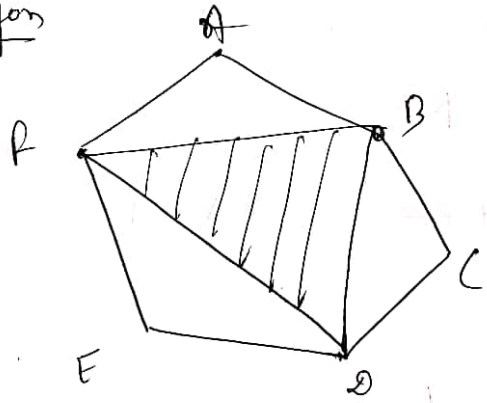
Δ using 2 Consecutive point or 1-Side

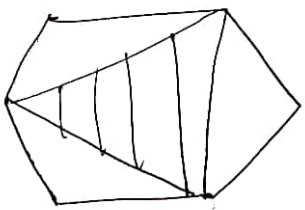
A B D
B C E
C D A
D E B
E A C

(5)

To make a Δ which doesnot ~~Vary~~ uses any side of a polygon, min' hexagon is requ.

Hexagon





no-of Δ that can be formed not using any side of polygon

$= \frac{n(n-4)(n-5)}{6}$

for hexagon $= \frac{6(2)(4)}{6}$

$= 2$ //.

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Q 5

Sol

20

✓	X
5	-
6	4
7	8
8	12
9	16

25 Q

+4 −1

55 | 63 | 68 | 70

60

✓	X
15	0
16	4
17	8

62

✓	X
16	1
17	5
18	9

68

✓	X
17	0
18	4
19	8

55

✓	X
14	1
15	5
16	9

Ans.

P-45

Q. 17-20

Tara

$\underset{4}{b} + 3x + y = 12 \Rightarrow$ 70

$3x + y = 8$ — (1)

$3 \times 3 + 2f = 12$ ✓

$\Rightarrow$ $3 \cdot 2 + 2 \rightarrow$ X

$3 \cdot 3$ X

Work and Time

P/q	%
1/1	100%
1/2	50%
1/3	33.33%
1/4	25%
1/5	20%
1/6	16.67%
1/7	14.2857 %
1/8	12.50%
1/9	11.11%
1/10	10%
1/11	9.09%
1/12	8.33%
1/13	7.7%

$\frac{1}{7}$ = 14.2857 %

$\frac{2}{7}$ = 28.5714 %

$\frac{3}{7}$ = 42.8571 %

$\frac{4}{7}$ = 57.14285 %

$\frac{5}{7}$ = 71.4285 %

$\frac{6}{7}$ = 85.7142 %

$\frac{7}{7}$ = 100%

$\frac{1}{14}$ 7.14 %.

$\frac{1}{15}$ 6.67 %.

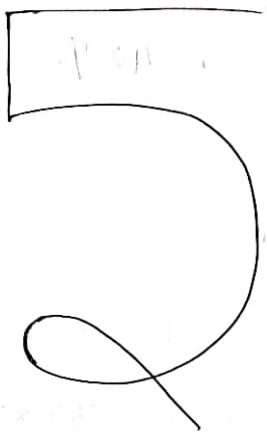
$\frac{1}{16}$ 6.25 %.

$\frac{1}{17}$ .88 %.

$\frac{1}{18}$ .55 %.

$\frac{1}{19}$ .22 %.

$\frac{1}{20}$ .00 %.



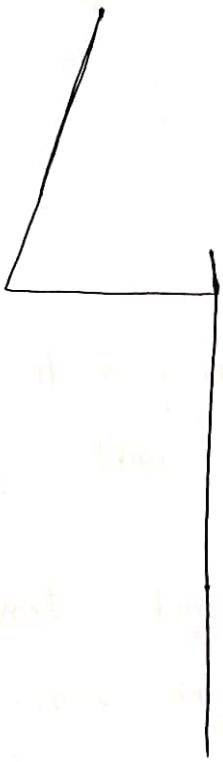
$\frac{1}{21}$ .74 %.

$\frac{1}{22}$ .54 %.

$\frac{1}{23}$ .34 %.

$\frac{1}{24}$ .14 %. $\left\{\frac{1}{24} = 4.16\%\right.$

$\frac{1}{25}$ .00 %.



$\frac{1}{26}$

$\frac{1}{27}$

$\frac{1}{28}$

$\frac{1}{29}$

$\frac{1}{30}$

3 . 84 %

-14

. 70 %

-14

. 56 %

-14

. 42 %

3.33 %

27 ⟷ 37

37 × 1 = 37
37 × 2 = 74
37 × 3 = 111
37 × 4 = 148
37 × 5 = 185
37 × 6 = 222
37 × 7 = 259
37 × 8 = 296
37 × 9 = 333
37 × 10 = 370

37 × 3 = 111
37 × 6 = 222
37 × 9 = 333
⋮
37 × 27 = 999

WANT ECE BEST QUALITY-2019-20

LATEST HANDWRITING NOTES

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3. Test series practice more n more (Try to latest test series 2-3 fully solve then join online test series.)

Noted-: Single Source Follow, Revise

Multiple Time Best key of Success

Concept. Que 01

If 'A' can finish a piece of work in 12 days then find the amount of work done by 'A' in 1 day, 2 day, 3days, 6days & 11 days

Sol

12 days ⟶ 1 work

1 day ⟶ $\frac{1}{12}$ work 8.33%

2 days ⟶ $\frac{1}{12} \times 2$ work 16.67%

3 days ⟶ $\frac{3}{12}$ work 25%

6 days ⟶ $\frac{1}{12} \times 6$ wo 50%

11 days ⟶ $\frac{11}{12}$ wo = 91.67%

Conceptual Que 02

If 'A' and 'B' can finish a piece of work in 12 and 15 days respectively. Then find no. of days required to finish the work —

a) When A & B work together

b) When A & B work together but alternately —

i) When A starts

ii) When B starts

Sol

	Days	one day	%
A →	12	1/12	8.33%
B →	15	1/15	6.67%
A+B →	20/3	$(\frac{1}{12}+\frac{1}{15}) = 3/20$	one day work 15%

⇒ 6.67 days

OR

1 day ⟶ 15% WD Combined

6 day ⟶ 90% ⟶ 6 day

left 10%

15% ⟶ 1

1% ⟶ $\frac{1}{15}$

10% $\frac{10}{15}$ day $= \frac{2}{3}$ ⟶ $\frac{2}{3}$ da

Combined ⇒ $6\frac{2}{3}$ days //

OR

	days
A →	X
B →	Y
A+B →	$\left(\frac{XY}{X+Y}\right)$ days

$\frac{12\times15}{12+15} = \frac{12\times15}{27_9} = \frac{20}{3}$

= 6.67 days //

b) A & B work together but —

i) when A starts

A	B
1/12	1/15

for two day A+B : $\frac{1}{12} + \frac{1}{15} = \frac{3}{20} = 15\%$

Day	1st	2nd	3rd	4th	5th
	A+B	A+B	A+B	A+B	A+B
	A	B	A	B	A	B - -

A + B

1 pattern (2 days) ⟶ 15 %

6 × 2 ⟶ 90 %

12 days ⟶ 90 %

Remain 10 %

now A will arrive A = 1/12 = 8.33 %

Day 13th 10 % − 8.33 %

= 1.67 %

Day 14th :- B arrive B = 1/15 = 6.67 %

$\frac{1.67\%}{6.67\%} \Rightarrow \frac{1/60}{1/15} = \frac{1}{4} = 0.25$

Total days $13 + 0.25$

$= 13.25$ days //.

ii) B start first

Sol B A B A

$15\% \times 6 = 90\%$

12 days = 90%

13th day B 6.67%

$10 - 6.67 = 3.33\%$

14th day A 8.33

$\frac{3.33\%}{8.33\%} \Rightarrow \frac{1/30}{1/2} = \frac{12}{30} = 2/5$

$\therefore 13\frac{2}{5}$ days //.

Concep Que 3 If A, B & C can complete a piece of work in 10, 20 and 25 days respectively then find the no. of days required for the following patterns.

	1st	2nd	3rd	4th	5th	
1	A	B	C	A	B	- -
2	A+B	A+C	A+B	A+C	A+B	- -
3	A	B+C	A	B+C	A	- - -
4	A+B	B+C	C+A	A+B	B+C	- -
5	A+B+C	A+B+C	A+B+C	-	- -	

Sol:- A = 10 days = 1/10 one day work 10%

B = 20 = 5%

C = 25 = 4%

i) A+B+C one day = 10% + 5% + 4%

= 19%

(3 days pattern)

5 × 19% ⟶ 95%

15 days ⟶ 95%

Rem. 5%

16th day $\frac{5\%}{10\%} = 1/2$

Hence 15 1/2 days. //.

ii) A+B = 15%

A+C = 14%

~~One day~~ 29% ⟶ 2 days

2 day

29% × 3 ⟶ 2 × 3 = 6 day

Rem. 13%

7th day $\frac{13}{15} = 0.866$

$6\frac{13}{15}$ //.

$$\frac{\eta_1}{\eta_2} = \frac{\eta_2 - \eta_m}{\eta_m - \eta_1}$$

$$= \frac{1 - 5/6}{5/6 - 0} = 1:5 \text{ //}$$

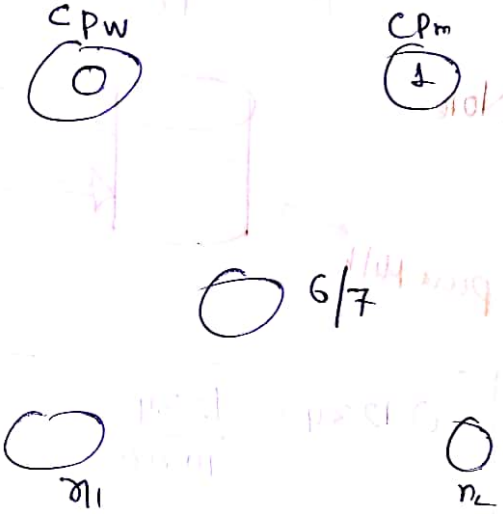
Q7. Profit $= 16\frac{2}{3}\%$

$SP = CP$

$$CP = SP \times \frac{100}{100 + \frac{50}{3}}$$

$$\rightarrow 1 \times \frac{30}{350}$$

$$\frac{30}{35} = 6/7$$

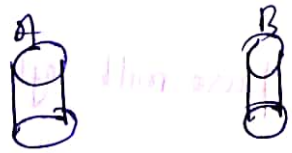


$$\frac{\eta_1}{\eta_2} = \frac{1 - \frac{6}{7}}{\frac{6}{7} - 0}$$

$$\rightarrow \frac{1}{6}$$

1 : 6 //.

Q11.



4 : 3
M W

$M_A = \frac{4}{7}$

2 : 3
M W

$M_B = \frac{2}{5}$

$$\eta_w = \frac{1}{1+1} = \frac{1}{2}$$

Ration 1:1

$$\frac{\eta_1}{\eta_2} = \frac{\frac{2}{5} - \frac{1}{2}}{\frac{1}{2} - \frac{4}{7}}$$

$$\frac{-4 + 5}{10} \times \frac{14}{1} = 1.4$$

Q.9.

Sol

$\frac{8}{13}$ $\frac{5}{7}$

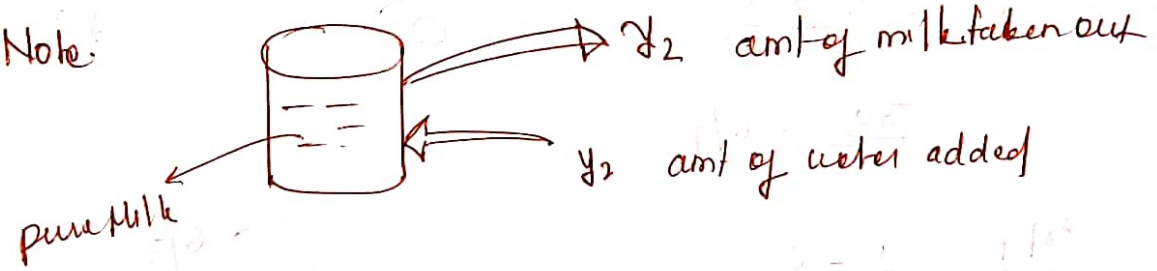
$\frac{69\times13+3}{13\times100}$ 9/15

$$-\frac{\frac{69\times13+3}{13\times100}+\frac{5}{7}}{+\frac{69\times13+3}{13\times100}}$$

x_1 x_2

$$\frac{\frac{5}{7}-\frac{9}{15}}{\frac{9}{15}-\frac{8}{13}}=\frac{2}{7}$$

Note.



$0.1234=\frac{1234}{1000}$	$0.1\overline{234}=\frac{1234-1}{9990}$
$0.\overline{1234}=\frac{1234}{9999}$	$0.12\overline{34}=\frac{1234-12}{9900}$

So after n times how much pure milk left

$y =$

After an operation the amount of pure liquid left $= x\left(1-\frac{y}{x}\right)^n$

where, x = amt of pure liquid present at the beginning or Volume of Cask

or y = amt of pure liquid (solution) replenish with water.

Q16.

$$y = 40\left(1 - \frac{4}{40}\right)^{3} \quad \text{(3) further 2 time}$$

$$= 40\left(\frac{36}{40}\right)^{3}$$

$$= \frac{40}{40^3} \times 36^3$$

$$= 29.16\ \ell \ //$$

TIME SPEED DISTANCE

Distance = Speed × Time

$$D = ST$$

Q1. A train runs at a speed of 25 km/h i) find its speed in m/s

ii) If it covers a distance of 500m in 50 sec find speed in km/hr.

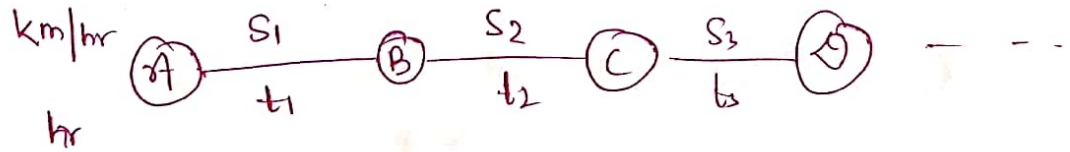
Sol i) $25 \text{ km/h} \longrightarrow \frac{25 \times 1000}{3600} = \frac{125}{18} \text{ m/s}$

ii) $\frac{500}{50} = 10 \text{ m/s} = \frac{10 \times 3600}{1000} = 36 \text{ km/hr}$

note: $1 \text{ km/hr} = \frac{5}{18} \text{ m/sec}$

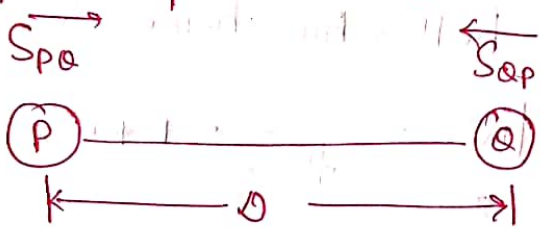
$1 \text{ m/sec} = \frac{18}{5} \text{ km/hr}$

Average speed = $\frac{\text{Total distance travelled}}{\text{Total time taken}}$



Avg. speed = $\frac{S_1t_1 + S_2t_2 + S_3t_3 \text{ --- } S_nt_n}{t_1 + t_2 + t_3 \text{ --- } t_n}$

Let us Suppose A travels P to Q at speed of S_{PQ} whereas from Q to P at speed of S_{QP}. Then the average speed of A through out the Journey is equal to —



$$\text{Avg Speed} = \frac{D_T}{T_1} = \frac{D+D}{\frac{D}{S_{PQ}} + \frac{D}{S_{QP}}} = \frac{2 S_{PQ} S_{QP}}{(S_{PQ}+S_{QP})}$$

CQ2. If 'A' travels from Delhi to Noida at a speed of 30 km/hr where as from Noida to Delhi at a speed of 70 km/hr Then find his Avg. Speed throughout the Journey.

Sol $$\text{Avg } S = \frac{D_T}{T_T} = \frac{2D(70\times30)}{(70+30)D} = \frac{2100}{100} \times 2 = 42 \text{ km/hr}$$

Q2 ii) A bird Covers a distance of 100 km at a speed of 100 km/hr. Bird Cover 2nd 100 km at speed of 200 km/hr. 3rd 100 km at speed of 300 km/hr 4th 100 km at speed of 400 km/hr. find its Avg speed during entire Journey.

$$\text{Avg speed} = \frac{400}{\frac{100}{100} + \frac{100}{200} + \frac{100}{300} + \frac{100}{400}} = 12 \times \frac{400}{12+6+4+3}$$

$$= 192 \text{ km/hr} \quad 4 \times 12 \times 4$$

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Noted-: Single Source Follow, Revise

Multiple Time Best key of Success

Que. If Arun rides a scooter at speed of 20km/hr from his home to his office. He reaches his office 5min late where as if he drive at a speed of 30 km/hr he reaches office 5m early. find The distance betn his home & office.

Sol

20 km/hr ——— $t+5$

30 km/hr ——— $t-5$

$$D = 20 \times \frac{(t+5)}{60} = 30 \left(\frac{t-5}{60}\right)$$

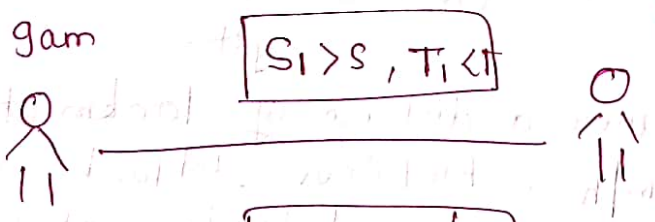
$$20t + 100 = 30t - 150$$

$$10t = 250$$

$$t = 25 \text{ min}$$

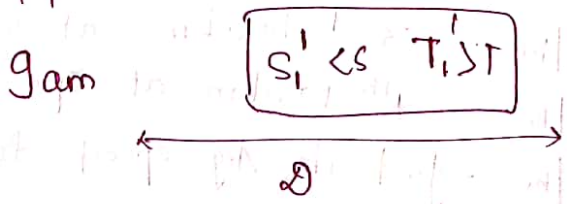
$$D = \frac{20}{\frac{km}{hr}} \times \frac{30}{min} = \frac{600}{60} = 10 \text{ km} \quad //$$

Time Difference



8:50 am ⇒ 9 − 8:50 = 10m

$$\frac{D}{S} - \frac{D}{S_1} = \frac{10}{60}$$



9:15 am ⇒ 9:15 − 9 = 15m/n

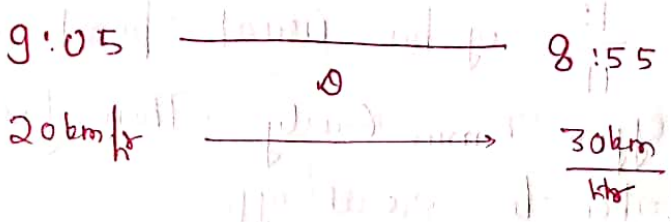
$$\frac{D}{S_1'} - \frac{D}{S} = \frac{15}{60}$$

9 am

9:30 am ⇒ 9 − 8:30 = 30m

$$= \frac{D}{S} - \frac{D}{S_2} = \frac{30}{60}$$

Ex.



$9:05 - 8:55 = 10 \text{ min}$

$$\frac{D}{20} - \frac{D}{30} = \frac{10}{60}$$

$$D = \frac{6 \times 10}{6} = 10 \text{ km} \quad //.$$

OR

Previous Que

Sol

20 km/hr	30 km/hr
5 min late	5 min early
9:05	8:55

$$T_{diff} = 10 \text{ min} = \frac{D}{20} - \frac{D}{30}$$

$$D = 10 \text{ km}$$

Que. Walking at $5/7^{th}$ of his usual speed A reaches office 16 min late. find usual time taken to reach office.

Sol

$$16 \text{ min} = 9:16 - 9:06$$

$$16 = \frac{7D}{5S} - \frac{D}{S}$$

$$16 = \frac{D}{S}\left(\frac{7-5}{5}\right)$$

$$\frac{D}{S} = \frac{16 \times 5}{2} = 40 \text{ min}.$$

ii) Walking at $\frac{12}{11}$ of his usual speed a Man reaches his office 5 min Early. Then find his usual time taken to reach office

Sol

$$5 = \frac{D}{\frac{12}{11}S} + \frac{D}{S}$$

(8:55 am, 9 am)

$$\Rightarrow \frac{D}{S}\left(1 - \frac{11}{12}\right)$$

$$60 \text{ min} = \frac{D}{S} \checkmark$$

OR

By $D = ST$

$$\text{Const} = \frac{ST}{D}$$

Inverse to Make $D = \text{Const}$

$$= \left(\frac{12}{11}S\right)\left(\frac{11}{12}T\right)$$

$$\Rightarrow \frac{11}{12}T = \frac{12-1}{12}$$

$$\frac{1}{12}T = 5 \text{ min}$$

$$T = 60 \text{ min} \checkmark$$

Que. A train Running between 2 town arrives at its destination 10 min late when travelling at a speed of 60 km/hr where as it reaches its destination 16 min late when travelling at 40 km/hr. find distance between two towns

Sol

9:am 9:10 = 10 min

~~10 min~~ = 9:10 − 9

$= \frac{D}{60} - \frac{D}{60}$

16 min − 10 m = 9:16 9:10

$\frac{6 \text{ m}}{60} = \frac{D}{40} - \frac{D}{60}$

$D = \frac{6 \times 40^{2} \times 60}{20 \times 60}$

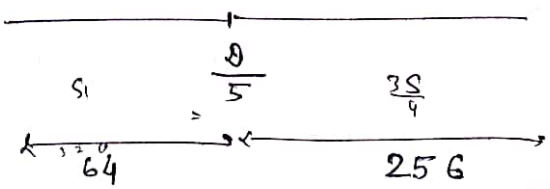
$= 12 \text{ km}$ //

~~OR~~

~~$D = ST$~~

Que. A train has 320 km to run. After going $1/5^{th}$ of distance. The engine breaks down and it can only run remaining part of Journey at $\frac{3}{4}^{th}$ of original speed. If it arrive 2 hr 40 min late then what is the original speed of train

Sol



Ans 2h 40 min 11:40 am → 9 am

$$\Rightarrow 2\frac{40}{60} = \frac{8}{3} = \left(\frac{64}{x} + \frac{256}{\frac{3}{4}x}\right) - \frac{320}{x}$$

$$\frac{8}{3} = \frac{64}{x} + \frac{256 \times 4}{3x} - \frac{320}{x}$$

$$= \frac{64 \times 3 + 256 \times 4 - 320 \times 3}{3x}$$

$$\frac{8}{3} = \frac{192 + 1024 - 960}{3x}$$

$$\Rightarrow x = \frac{1216 - 960}{8} = \frac{256}{8} = 32 \text{ km/hr}$$

Relative Speed

km/h

$x \longrightarrow$ (diff.) $(x \sim y)$ km/hr

$y \longrightarrow$

$x \longrightarrow (x+y)$ km/h

$y \longleftarrow$