

GATE

ALL BRANCHES



General Aptitude

QUANTITATIVE APTITUDE

Lecture No.- 07



By- Amulya Ratan Sir

Recap of Previous Lecture



Topic

Number System



Topics to be Covered



Topic-1

More on Numbers *u*

Topic-2

Counting Theory



[MCQ]



#Q. A mixture contains milk and water in the ratio 5:1. On adding 5 liters of water, the ratio of milk to water becomes 5:2. the quantity of milk in the mixture earlier was:

Assignment

- A 16 litres
- B 25 litres**
- C 32.5 litres
- D 22.75 litres

Handwritten solution:

Let the initial quantity of milk be x and water be y .

Initial ratio: $\frac{x}{y} = \frac{5}{1}$

After adding 5 liters of water, the ratio becomes $\frac{x}{y+5} = \frac{5}{2}$.

Solving for x :

$$\frac{x}{y} = \frac{5}{1} \Rightarrow x = 5y$$
$$\frac{x}{y+5} = \frac{5}{2} \Rightarrow 2x = 5(y+5) \Rightarrow 2x = 5y + 25$$

Substituting $x = 5y$ into the second equation:

$$2(5y) = 5y + 25 \Rightarrow 10y = 5y + 25 \Rightarrow 5y = 25 \Rightarrow y = 5$$

Therefore, the initial quantity of milk is $x = 5y = 5 \times 5 = 25$ litres.

Handwritten notes and calculations:

- $\frac{5}{1} \times 30$ (with a checkmark)
- $\frac{7}{42} = \frac{1}{6}$ (labeled "Milk")
- $\frac{2}{7} = \frac{12}{42}$ (labeled "Water")
- $\frac{30}{42}$ (labeled "Milk")
- $\frac{5}{42}$ (labeled "Water")
- $\frac{42}{42} = 1$ (labeled "Mixture")
- $\frac{30}{42} = \frac{5}{7}$ (labeled "Milk")
- $\frac{5}{42} = \frac{1}{8.4}$ (labeled "Water")
- $\frac{5}{7} : \frac{1}{8.4} = 30 : 5$ (labeled "Mixture")

[MCQ]



#Q. In what ratio must a grocer mix two varieties of pulses costing ₹15 and ₹20 per kg respectively so as to get a mixture worth ₹16.50 per kg?

Assignment

A 3:8

B 5:3

C 7:3

D 4:5

Handwritten solution:

$$\begin{array}{ccccc} & A & & B & \\ & 15 & & 20 & \\ & \swarrow & & \swarrow & \\ A:B & = 3.5 : 1.5 & & 16.5 & \\ & \swarrow & & \swarrow & \\ & = 35 : 15 & & & \\ & \swarrow & & \swarrow & \\ & 3.5 & & 1.5 & \\ & \swarrow & & \swarrow & \\ & 7 : 3 & & & \end{array}$$

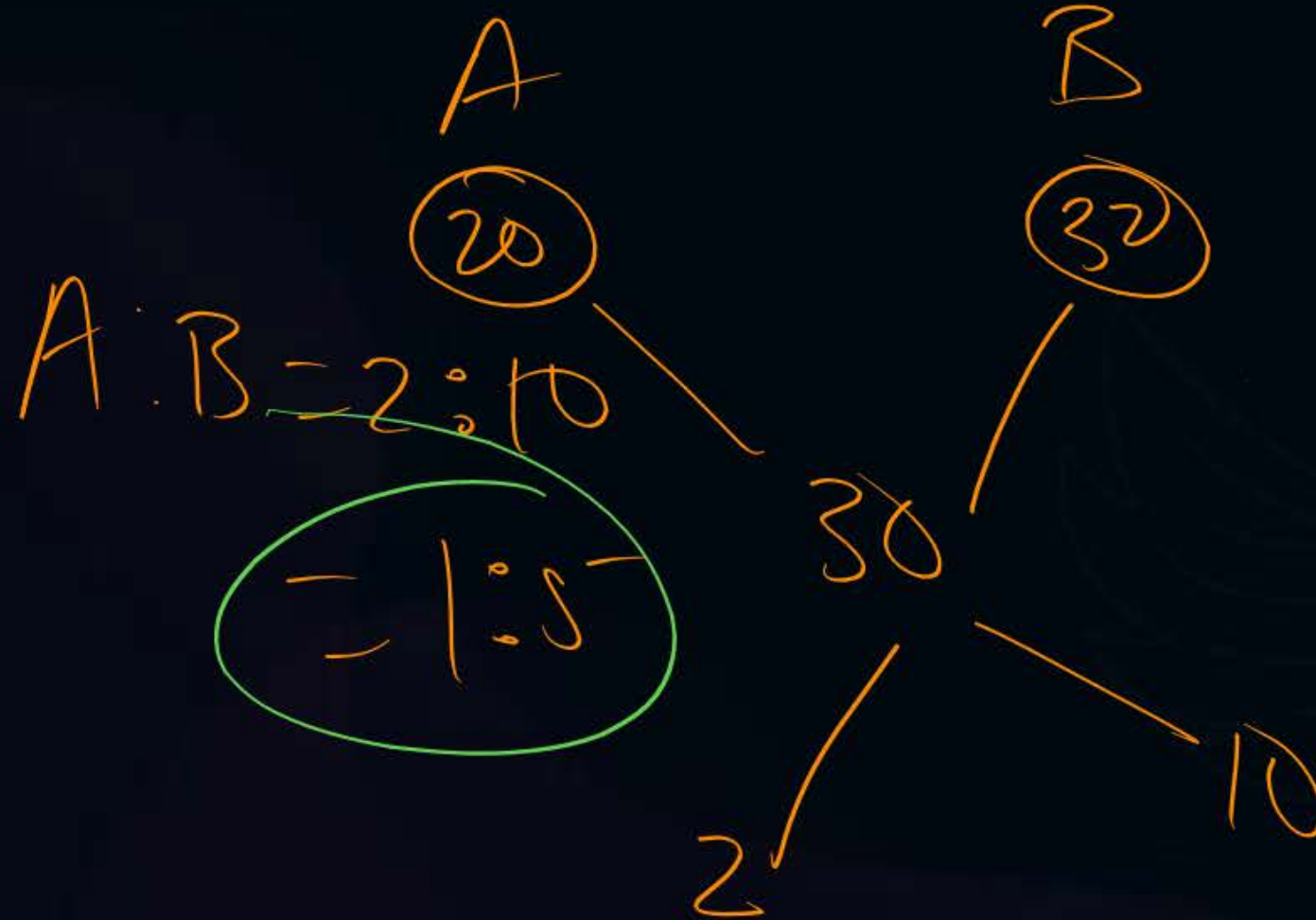
[MCQ]



#Q. In what ratio must Ankit mix two varieties of sugar worth ₹20 per kg and ₹32 per kg so that by selling the mixture at ₹36 per kg he may gain 20%?

Assignment

- ☒ **A** 1:5
- ☐ **B** 3:5
- ☐ **C** 2:3
- ☐ **D** 3:2



$$\begin{aligned} S.P. &= 36 \\ P.V. &= 20\% \\ \frac{36}{C.P.} &= 1.2 \\ \frac{36}{1.2} &= C.P. \end{aligned}$$

[MCQ]



#Q. What would the unit digit in the answer of given expression:

$$1! + 2! + 3! + \dots + \underline{2025!}$$

Assignment

13

3

1!	→	1
2!	→	2
3!	→	6
4!	→	24
5!	→	120

$$\begin{array}{r} 120 \\ \times 6 \\ \hline 720 \\ \times 7 \\ \hline 5040 \end{array}$$

[MCQ]



#Q. What would the remainder when the answer of given expression is divided by 3?

$$1! + 2! + 3! + \dots + 2025! = \underline{\underline{\text{Ans}}}$$

~~3?~~

(A) 0

(B) 1

(C) 2

(D) Can't be determined

3) Ans (

R = ?

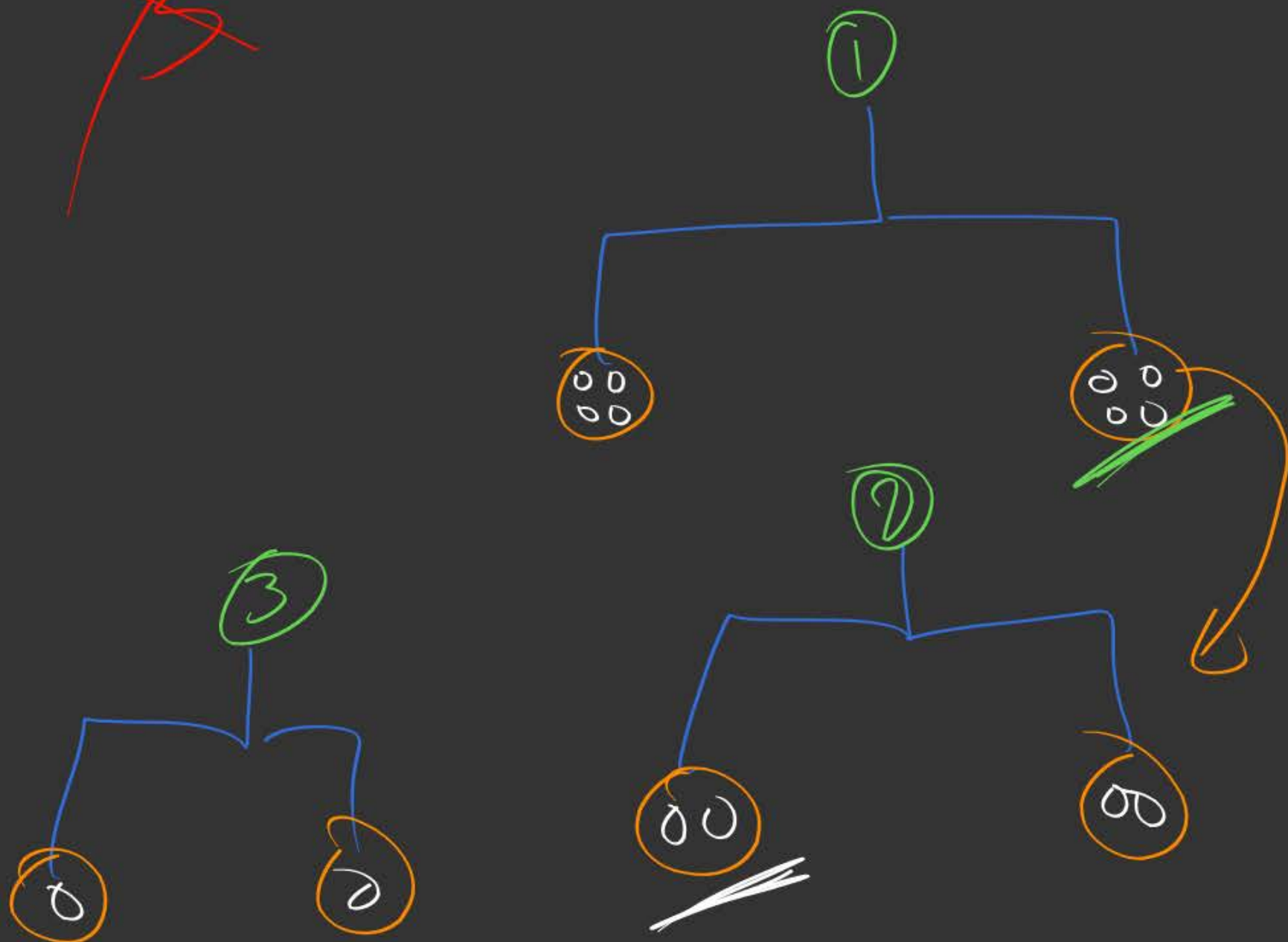
[MCQ]



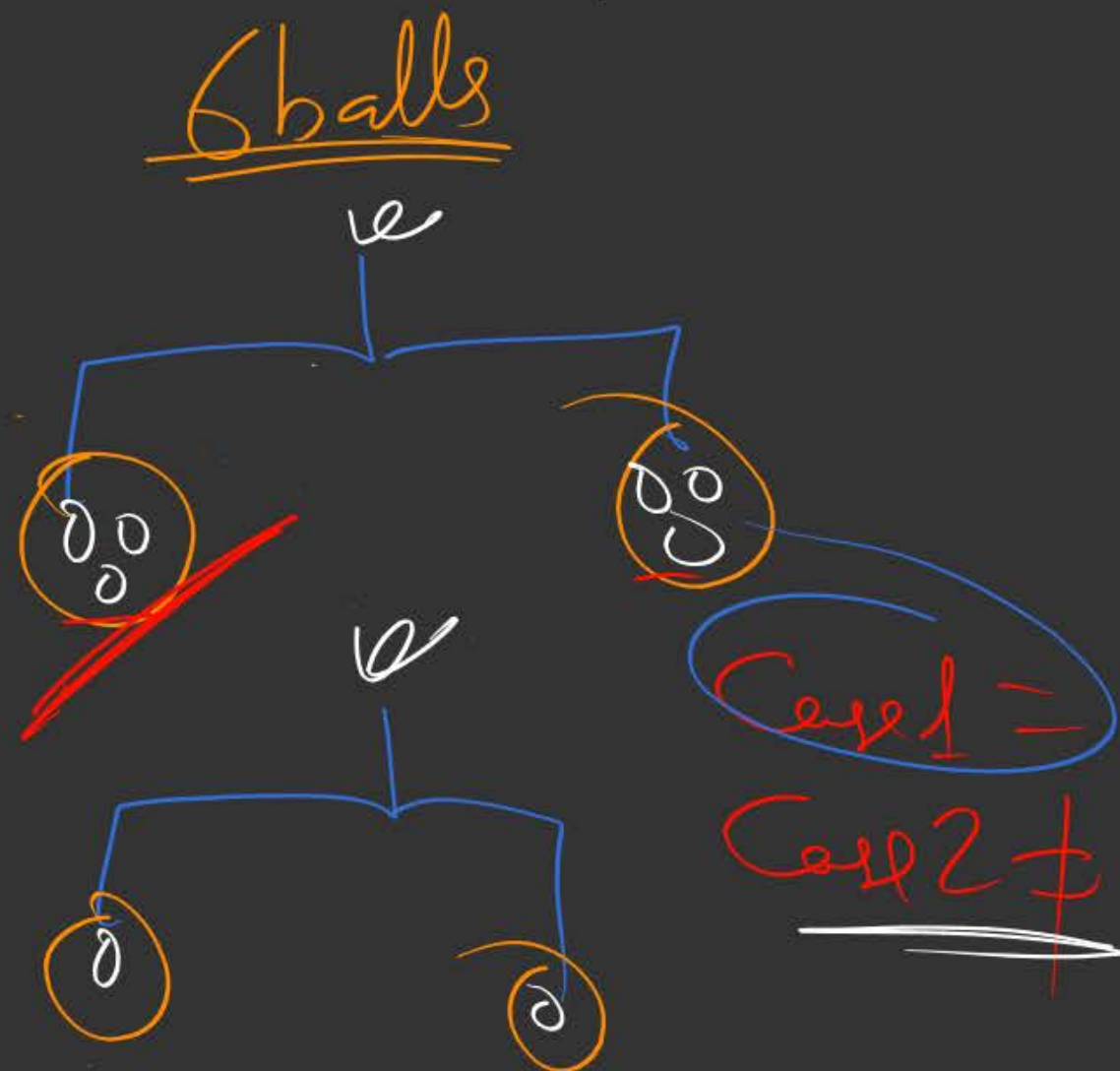
#Q. There are 8 balls of which one is defective. Given that the defective ball is of less weight and remaining are of equal weights. What are the minimum number of chances a common balance is to be used to find the defective one?

2 chance

~~3~~



2 chance
8 balls



[MCQ]



#Q. A bag consist of 48 ¹red colour balls, 16 ²green colour balls, 12 ³yellow colour balls, 11 ⁴black colour balls and 11 ⁵white colour balls. How many minimum number of balls are to be taken out from the bag randomly so that we get at least two balls of same colour?

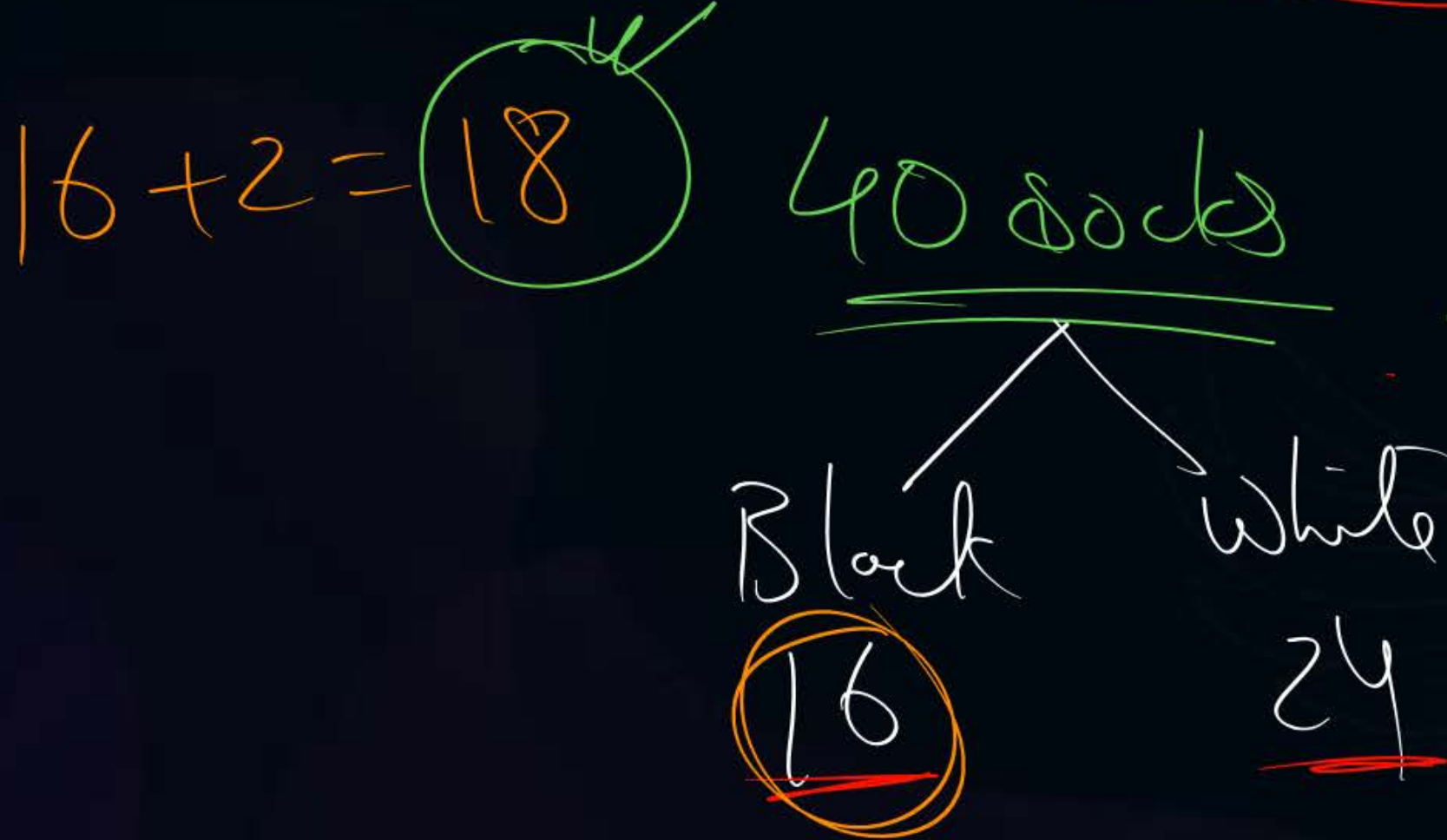
blindfolded

6 balls

[MCQ]



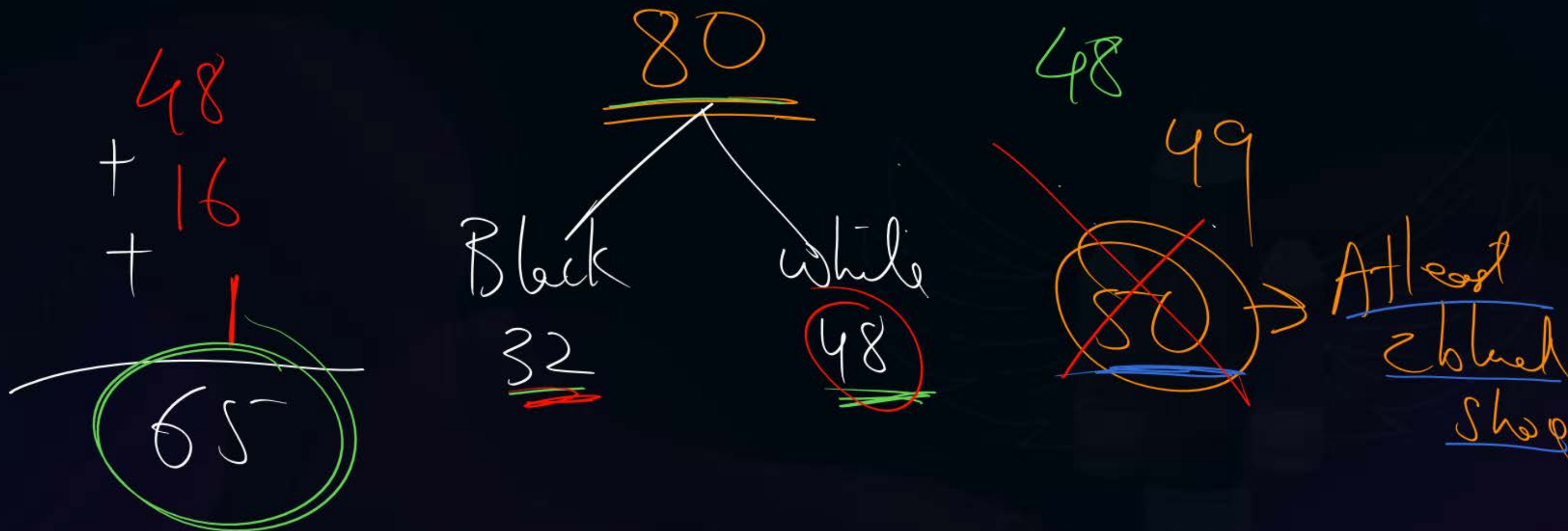
#Q. A shelf consist of 40 socks. 40% of these are black and remaining are white. How many minimum number of socks are to taken out from the shelf randomly (blindly), so that we get atleast two white socks?



[MCQ]



#Q. A box consist of 40 pairs of shoes of equal size. 40% of these are black and remaining are white. How many minimum number of shoes are to taken out from the box randomly, so that we get at least a pair of black shoes?



[MCQ]



#Q. How many zeroes would be at the end in the answer of 50!?

$$25 = \underline{5} \times \underline{5}$$

$$50 = \textcircled{25} \times 2$$

12 zeroes

$$50 \times 49 \times 48 \times 47 \dots 2 \times 1$$

OR

$$1 \times 2 \times 3 \times \textcircled{4 \times 5} \times 6 \times 7 \times 8 \dots 50$$

$$\begin{aligned} 1-10 &\Rightarrow \textcircled{2} \\ 11-20 &\Rightarrow 2 \\ 21-30 &\Rightarrow 3 \end{aligned}$$

$$\begin{aligned} 31-40 &\Rightarrow 2 \\ 41-50 &\Rightarrow 3 \end{aligned}$$

$$\underline{\underline{12}}$$

A

12

B

15

C

23

D

24

$$\frac{50}{5} \rightarrow 10$$

$$\frac{10}{5} \rightarrow 2$$

$$\frac{2}{5} \rightarrow 0$$

$$\underline{\underline{12}}$$

[MCQ]



#Q. If 50! can be denoted maximum 7^x , then the value of x is?

A

9

B

8

C

7

D

None of these

$$\frac{50}{7} \rightarrow 7$$

$$\frac{7}{7} \rightarrow 1$$

$$\frac{1}{7} \rightarrow 0$$

8

$$50 \rightarrow 7^8$$

$$1 - 10 \rightarrow 1$$

$$11 - 20 \rightarrow 1$$

$$21 - 30 \rightarrow 2$$

$$31 - 40 \rightarrow 1$$

$$41 - 50 \rightarrow 1$$

8

[MCQ]



#Q. Find the number of zeroes in following multiplication:

$$\underline{5 \times 10 \times 15 \times 20 \times 25 \dots \times 50} \quad ?$$

$$5 \rightarrow 10 + 2 = 12$$

$$\frac{10}{5} \rightarrow 2$$
$$\frac{2}{5} = 0$$

$$= 5 \times 1 \times 5 \times 2 \times 5 \times 3 \times 5 \times 4 \dots 5 \times 10$$

$$= 5^{10} \times 10!$$

$$2 \rightarrow 8$$

A

48

B

12

C

24

D

8

$$\frac{10}{2} \rightarrow 5$$
$$\frac{5}{2} \rightarrow 2$$
$$\frac{1}{2} \rightarrow 0$$
$$\frac{2}{2} \rightarrow 1$$

$$70! \Rightarrow \underbrace{4}_{\substack{\vee \\ 2 \times 2}} \times \underline{\underline{33}}$$

$$\frac{70}{2} \rightarrow 35 \vee$$

$$\frac{35}{2} \rightarrow 17$$

$$\frac{17}{2} \rightarrow 8$$

$$\frac{8}{2} \rightarrow 4$$

$$\frac{4}{2} \rightarrow 2$$

$$\frac{2}{2} \rightarrow 1$$

$$\frac{1}{2} \rightarrow 0$$

$$2 \overline{) 67} \quad \underline{\underline{33}}$$

$$67$$

$$70! \rightarrow \underline{12} \quad \text{32}$$

$$\frac{2 \times 2 \times 3}{\text{33}} \quad \text{32}$$

$$\frac{70}{3} \Rightarrow 23$$

$$\frac{23}{3} \rightarrow 7$$

$$\frac{7}{3} \rightarrow 2$$

$$\frac{2}{3} \rightarrow \underline{0}$$

[MCQ]

204 ✓

#Q. How many squares are there in a chessboard?

Size
1x1
2x2
3x3
4x4

4x4 = 16
3x3 = 9
2x2 = 4
1x1 = 1

30

Size

1x1

2x2

3x3

4x4

5x5

6x6

7x7

8x8

8x8 = 64

7x7 = 49

6x6 = 36

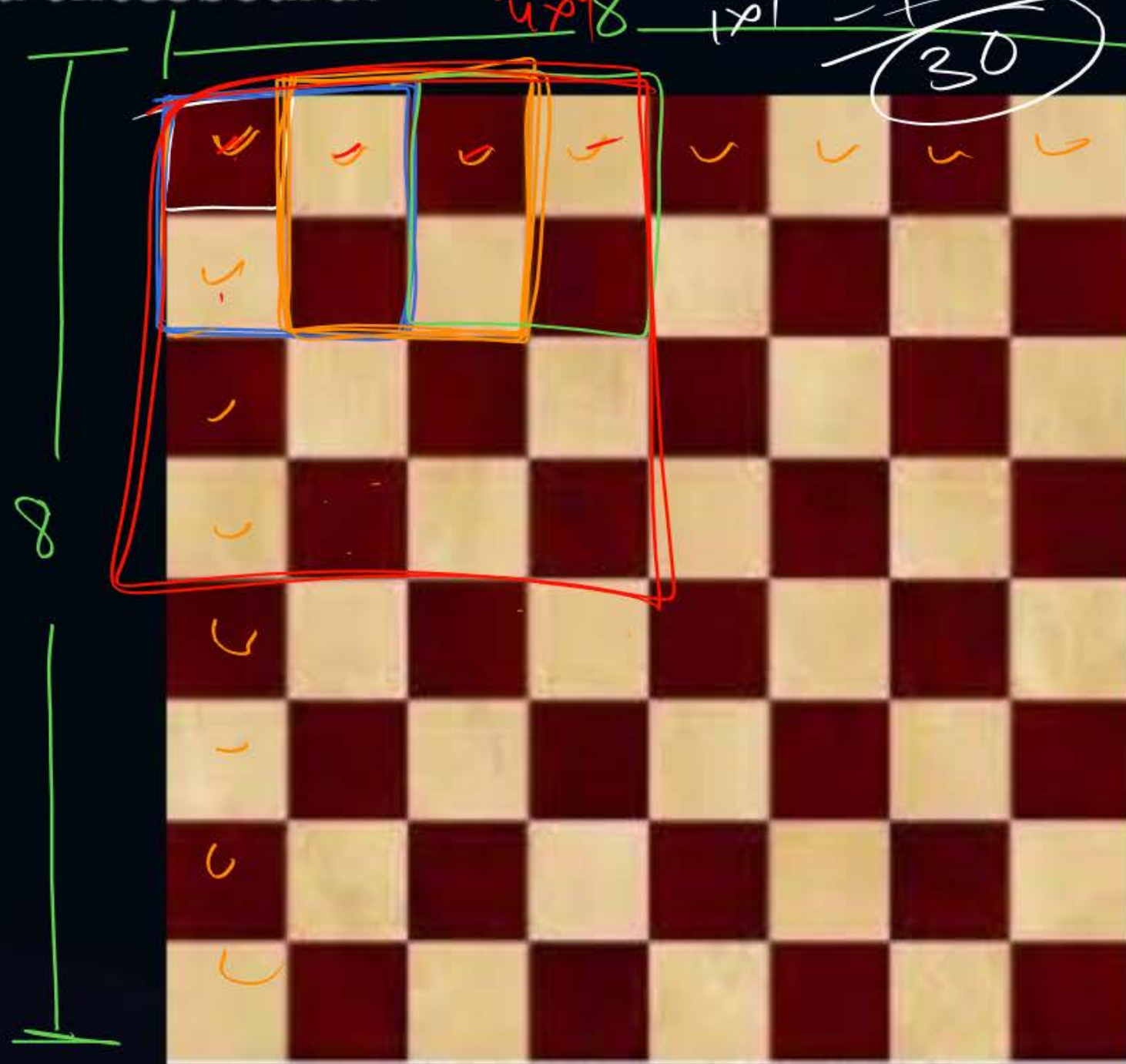
5x5 = 25

4x4 = 16

3x3 = 9

2x2 = 4

1x1 = 1



[MCQ]



$$\begin{array}{r} 64 \\ \times 8 \\ \hline \end{array}$$

#Q. What would be the unit digit in the answer of:

$$\begin{array}{r} 2362^{911} + 1418^{216} \\ \hline \end{array}$$

$8 + 6$

$8^1 \rightarrow 8$	$R=1$	$2^1 \rightarrow 2$	$R=1$
$8^2 \rightarrow 4$	$R=2$	$2^2 \rightarrow 4$	$R=2$
$8^3 \rightarrow 2$	$R=3$	$2^3 \rightarrow 8$	$R=3$
$8^4 \rightarrow 6$	$R=0$	$2^4 \rightarrow 6$	$R=0$
$8^5 \rightarrow 8$		$2^5 \rightarrow 2$	
		$2^6 \rightarrow 4$	

$$= 14$$

[MCQ]



#Q. What would be the unit digit in the answer of:

$$2913 \text{ } \underline{1902} + 1647 \text{ } \underline{460} ?$$

$$9 + 1 = 10$$

$$\begin{array}{l} 3^1 \rightarrow 3 \quad R=1 \\ 3^2 \rightarrow 9 \quad R=2 \\ 3^3 \rightarrow 7 \quad R=3 \\ 3^4 \rightarrow 1 \quad R=0 \\ 3^5 \rightarrow 3 \end{array}$$

$$\begin{array}{l} 7^1 \rightarrow 7 \\ 7^2 \rightarrow 9 \\ 7^3 \rightarrow 3 \\ 7^4 \rightarrow 1 \quad R=0 \\ 7^5 \rightarrow 7 \end{array}$$

- ☒ A 0
- ☐ B 2
- ☐ C 3
- ☐ D 5

[MCQ]



#Q. What would be the unit digit in the answer of:

$$932\textcolor{red}{6}^{397} + 1475^{363}$$

0

1

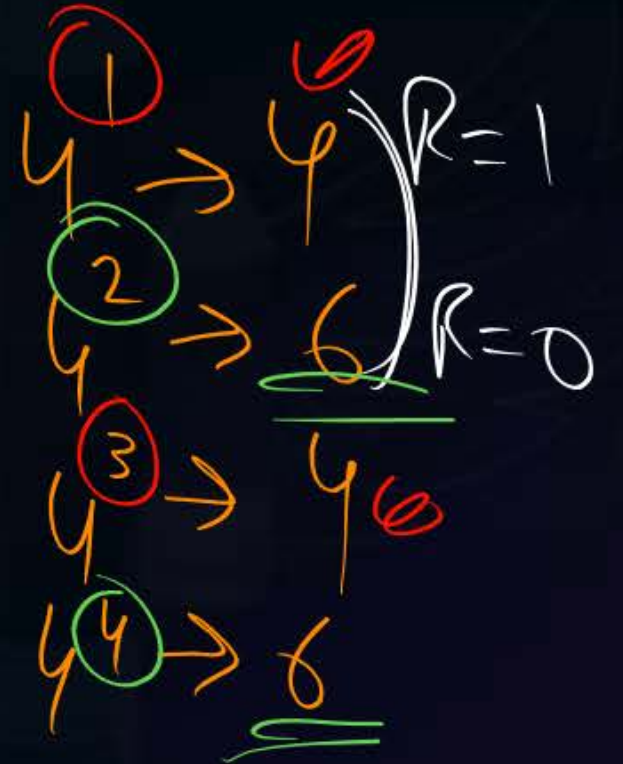
5

6

→ Same

$$6 + 5$$

$$= 11$$



[MCQ]



#Q. What is the greatest number of 4 digits that when divided by any of the numbers 6, 9, 12, 17 leaves a remainder of 1?

$6, 9, 12, 17 \Rightarrow \text{LCM} = 612$

- A 9997
- B 9793
- C 9895
- D 9487

$612 \times 15 = 9180$
 $612 \times 16 = 9792$
 $9792 + 1 = 9793$

$612 \times 1 = 612$
 $612 \times 2 = 1224$
 $612 \times 3 = 1836$

$2 \mid 6, 9, 12, 17$
 $3 \mid 3, 9, 6, 17$
 $1, 3, 2, 17$

Divisibility Rules:



30 ✓ ✓
31
46983

• 2: → Unit digit should be 0 or Multiple of 2

• 3: → Sum of digits should be divisible by 3
4 → 2
②
last two digit of a given no.

• 4: 64 → 2
⑥
Should be 00 or Multiple of 4

Divisibility Rules:



Handwritten notes showing divisibility rules for 7 and 5. For 7, a number 721 is shown with arrows indicating a process: $7 \rightarrow 1, 2 \rightarrow 1, 1 \rightarrow 3, 3 \rightarrow 2, 2 \rightarrow 1$. For 5, the number 625 is shown with an arrow pointing to 5, and the number 49382 is shown in a red box.

- 5: last digit should be 0 or multiple of 5

- 6: $\Rightarrow 2 \times 3$

Handwritten note showing the rule for 25: $25 \Rightarrow 5$ (circled 2).

last two digit 00
OR multiple of 25

- 7:

~~48637~~9

48637 ~ 18

484 ~ 6

= 478

47 ~ 16

= 3①3 ~ 2 = 1

= 48619

4861 ~ 18

= 4843

Twin Prime & Co-Prime Numbers:

9
 $3, 5$ ✓
 $5, 7$
 $17, 19$
 $11, 13$

7

~~9~~ $\Rightarrow 1, 3, 9$

~~32~~ $\Rightarrow 1, 2, 4, 8, 16, 32$

- ① Any two consecutive Number
- ② Any two distinct Prime Number

Divisibility Rules:

• 8: \rightarrow 000 OR Multiple of 8

• 9: \rightarrow Sum of digits should be divisible by 9

• 10: \rightarrow last digit 0

100 \rightarrow 10²

Divisibility Rules:




Handwritten example for divisibility by 11:

$$\begin{array}{ccccccc} & 1 & 8 & + & 3 & + & 1 & 1 & = & 12 \\ & 4 & 8 & 9 & 3 & 1 & 1 & & & \\ \downarrow & & \downarrow & & \downarrow & & \downarrow & & & \\ 4 & + & 9 & + & 1 & = & 14 & & & \end{array}$$

The difference between the sums is $12 - 14 = -2$, which is not divisible by 11. A green 'X' is drawn over the number 489311.

- 11: Difference between sum of odd place digits and even place digit should be 0 or divisible by 11.
- 12: = 4×3 be 0 or divisible by 11.
- 14: = 2×7

Divisibility Rules:

- 15: $\rightarrow 3 \times 5$
- 16: $\rightarrow 2^4$  OR divisible by 16
- 18: $\rightarrow 2 \times 9$

Divisibility Rules:

- 20: $\rightarrow 4 \times 5$

- 40: $\rightarrow 8 \times 5$

- 80: $\rightarrow 5 \times 16$

[MCQ]



#Q. Which largest number of 5 digits is divisible by 99 ?

Assignment

- A** 99999
- B** 99981
- C** 99909
- D** 99990

[MCQ]



#Q. Find the least perfect cube divisible by 2, 3, 4 and 6.

Assignment

A

216

B

1728

C

512

D

360

[MCQ]



#Q. How many natural numbers up to 100 are divisible by both 2 and 3?

Assignment

A

13

B

14

C

17

D

16

[MCQ]



#Q. Find the largest four digit number that is exactly divisible by 88.

Assignment

- A** 9844
- B** 9768
- C** 8894
- D** 9944

Numbers



Counting Theory?





2 mins Summary



Topic

~~Counting Theory~~

Numbers



THANK - YOU