




GENERAL APTITUDE

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Calendar

- In Non Leap year –
 - 365 days
 - 1 year = 52 weeks + 1 odd day(extra day)
 - 28th February
- In Leap year –
 - 366 days
 - 1 year = 52 weeks + 2 odd days
 - 29th February 
- A **century leap year** is a **year** that is exactly divisible by 400
 - **years** 1600 and 2000 were **century leap years**; (400,800,1200,1600,2000 – century leap years till date)
 - **years** 1700, 1800, and 1900 were not **century leap years**.
- To find the day of a week on a given date we use the concept of “**odd days**”.
- 01/01/0001 A.D(Anno Domini) was a Monday and 1st day of week so 1st January 0001 was a Monday.



Calendar

- In a century,
 - 24 leap year
 - 76 non leap years

100 years

Leap year / non leap year

$$\begin{array}{rcl} 24 \times 2 & + & 76 \times 1 \\ = \frac{48}{7} & & = \frac{76}{7} \\ \downarrow & & \downarrow \\ 6 & + & 6 \end{array}$$

remainder

$$= 12 \div 7 = 5 \leftarrow \text{remainder}$$

5 extra(odd) days in a century (100 years)

100 years = 5 odd days \leftarrow remainder

200 years = $10 \div 7 = 3$ odd days

300 years = $15 \div 7 = 1$ odd days

400 years = 0 odd days (as century leap year)



Calendar

Years	No. of odd
Ordinary year	1
Leap year	2
100 years	5
200 years	3
300 years	1
400 years	0

BEAM



Calendar

Day of week	No. of odd
Sunday	0
Monday	1
Tuesday	2
Wednesday	3
Thursday	4
Friday	5
Saturday	6

BEAM



Calendar

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Month		Remainder
January	$31 \div 7$	3
February	$28 \div 7$ or $29 \div 7$	0(non leap) or 1(leap)
March	$31 \div 7$	3
April	$30 \div 7$	2
May	$31 \div 7$	3
June	$30 \div 7$	2
July	$31 \div 7$	3
August	$31 \div 7$	3
September	$30 \div 7$	2
October	$31 \div 7$	3
November	$30 \div 7$	2
December	$31 \div 7$	3

M



Calendar

Q. What was the day of the week on 15th August, 1947?

Soln:

Completed till 1946

$$\begin{array}{l} 1946 \\ \swarrow \quad \searrow \\ \frac{1900}{400} = 300 \quad \frac{46}{4} = 11(\text{quotient}) \\ \downarrow \quad \quad \quad \downarrow \\ 1 \text{ odd day} \quad 46 + 11 = 57 \quad \frac{57}{7} = 1(\text{remainder}) \end{array}$$

In 1946, odd days are,

$$\begin{array}{ccc} 1900 & 46 & \\ 1 & + & 1 = 2 \text{ odd days} \end{array}$$

1946 month date

$$\text{Total odd days} = 2 + 2 + 1 = 5 \text{ odd days}$$

As per table for days of a week , 5 \longleftrightarrow Friday

As month is August, go till July as per table,

$$\begin{array}{cccccc} J & F & M & A & M & J & J \\ 3 & + & 0 & + & 3 & + & 2 & + & 3 & + & 2 & + & 3 = 16 \end{array}$$

$$\text{Now, } \frac{16}{7} = 2 (\text{remainder})$$

$$\begin{array}{l} \text{For date ,} \\ \frac{15}{7} = 1 (\text{remainder}) \end{array}$$



Calendar

For Months -

J	F	M	A	M	J	J	A	S	O	N	D
0	3	3	6	1	4	6	2	5	0	3	5

For years -

1600 – 1699	6
1700 – 1799	4
1800 – 1899	2
1900 – 1999	0
2000 – 2099	6



Calendar

Q. What was the day of the week on 26th January, 1947?

Soln:

1. Last 2 digits of the year → 47
 2. Divide by 4 ($47 \div 4$) = 11 (quotient)
 3. Take the date → 26
 4. Take the no. of month → 0 (from table)
 5. Take the no. of year → 0 (from table)
- $$\begin{array}{r} \text{---} \\ 84 \end{array} \text{ (add)}$$
6. Divide by 7 → $\frac{84}{7} = 0$ (remainder)

Check table for day of the week

0 ↔ Sunday



Calendar

Q. What was the day of the week on 29th February, 2012?

Soln:

1. Last 2 digits of the year → 12
2. Divide by 4 ($12 \div 4$) = 03(quotient)
3. Take the date → 29
4. Take the no. of month → 03 (from table)
5. Take the no. of year → 06 (from table)

53 (add)

6. Divide by 7 → $\frac{53}{7} = 4$ (remainder)

subtract 1 from remainder

In this case for all dates of **January & February** in a leap year , $4 - 1 = 3$

Check table for day of the week

3 \longleftrightarrow Wednesday



Calendar

It was Sunday on Jan 1, 2006. What was the day of the week Jan 1, 2010?

A. Sunday

B. Saturday

C. Friday

D. Wednesday

Ans: C

On 31st December, 2005 it was Saturday.

Number of odd days from the year 2006 to the year 2009 = $(1 + 1 + 2 + 1) = 5$ days.

On 31st December 2009, it was Thursday.

on 1st Jan, 2010 it is Friday.



Calendar

Q. If we have preserved the calendar of 2017. Find the next immediate year in which we can reuse.

A. 2027

B. 2023

C. 2025

D. 2029

Soln:

$x/4$ (x = given year)

$$\frac{2017}{4} = 1 \text{ (remainder)}$$

For any year divide by 4, the possibility of remainder is 0,1,2,3

If remainder = 0 $\rightarrow x + 28$

If remainder = 1 $\rightarrow x + 6$

If remainder = 2/3 $\rightarrow x + 11$

So, $\frac{2017}{4} = 1 \text{ (remainder)}$

$$2017 + 6 = 2023$$

Ans: B



Calendar

Q. Which of the following days can never be the last day of a century?

A. Sunday B. Monday C. Tuesday D. Wednesday

- **Soln:**
- The last day of century can be only
- 1 odd day(Monday)
- 3 odd days (Wednesday)
- 5 odd days (Friday)
- 7 or 0 odd days (Sunday)
- So, century can never end in **Tuesday** , **Thursday** or **Saturday**.
- **Ans: C**



Calendar(Assignment)

- Q. The day on 5th April of a year will be the same day on 5th of which month of the same year?
- A. 5th July B. 5th August C. 5th June D. 5th October
- **Ans A**
- April & July for all years have the same calendar. So, a day on any date of April will be the same day on the corresponding date in July.
- The same day will fall on 5th July of the same year.



Calendar(Assignment)

Q. What was the day of the week on your birthdate?

Q. 13th October 2019 is a Sunday. Find the day on 13th October 1989?

A. Sunday B. Monday C. Friday D. Wednesday

Ans: C

Q. 1st March 2006 falls on a Wednesday .What day does 1st March 2010 fall on?

A. Tuesday B. Monday C. Friday D. Wednesday

Ans: B

Q. Today is Monday. Which day will be after 64 days?

A. Tuesday B. Monday C. Friday D. Wednesday

Ans: A

Q. Today is Monday. After 30 days it will be?

A. Tuesday B. Monday C. Friday D. Wednesday

B. Ans: D



Calendar(Assignment)

Q. 15th August 1947 was a Friday. Find the day on 15th August 1977?

• Soln:

$$\begin{array}{r} 1977 \\ - 1947 \\ \hline 30 \text{ years} \end{array}$$

Leap years between 1947 to 1977

1948	1964	} 8 years
1952	1968	
1956	1972	
1960	1976	

$$30 + 8 = 38$$

total years leap

$$\frac{38}{7} = 3 \text{ (remainder)}$$

As 15th August 1947 was a Friday ,

So, Friday + 3 days = **Monday**



Calendar(Assignment)

Q. 4th January 2016 falls on Monday. What day of the week does 4th January 2017 lies?

A. Wednesday

B. Thursday

C. Tuesday

D. Monday

Soln:

Normal year = 1 odd day

Leap year = 2 odd days

Jan 4, 2016 → Monday

+ 2 (as leap year)

Jan 4, 2017 → Wednesday

Ans: A



Calendar(Assignment)

Q. Wednesday falls on 5th of a month .So which day will fall 5 days after 22nd of the same month?

A. Tuesday

B. Friday

C. Thursday

D. Wednesday

Ans: B

5th = Wednesday

+7

12th = Wednesday

+7

19th = Wednesday

22nd = Saturday

+5

27th = Thursday

5 days after 22nd will be **Friday**



Calendar(Assignment)

Q. What dates of May 2002 did Monday fall on?

Soln:

Lets take date = 1st May 2002

1. Last 2 digits of the year → 02
2. Divide by 4 ($02 \div 4$) = 00(quotient)
3. Take the date → 01
4. Take the no. of month → 01 (from table)
5. Take the no. of year → 06 (from table)
-
- 10 (add)
6. Divide by 7 → $\frac{10}{7} = 3$ (remainder)

Check table for day of the week

3 \longleftrightarrow Wednesday

1st May 2002 falls on Wednesday

1	2	3	4	5	6
W	Th	F	Sa	Su	M

↑
first Monday

Now add 7 to it to find remaining Mondays

Dates on which Monday falls are -
6, 13, 20, 27



Calendar(Assignment)

Q. On what dates of April, 2001 did Wednesday fall?

A. 1st, 8th, 15th, 22nd, 29th

B. 2nd, 9th, 16th, 23rd, 30th

C. 3rd, 10th, 17th, 24th

D. 4th, 11th, 18th, 25th

Ans: D



Calendar(Assignment)

Q. What is the day on 22 April 2222?

A. Monday

B. Tuesday

C. Saturday

D. Sunday

Ans: A



Calendar(Assignment)

Which of the following is not a leap year?

- A. 700 B. 800 C. 1200 D. 2000

Ans: A

The century divisible by 400 is a leap year.
The year 700 is not a leap year.



Calendar(Assignment)

Q. Today is Monday. Which day will be on 61st day?

Soln:

1 week = 7 days. Taking the multiple of 7

56 - Monday	or	63 - Monday
57 - Tuesday		62 - Sunday
58 - Wednesday		61 - Saturday

59 - Thursday

60 - Friday

61 - Saturday

$56 + 5 = 61$ days		$63 - 61 = 2$ days
(add 5 days)	or	(subtract 2 days)



Calendar(Assignment)

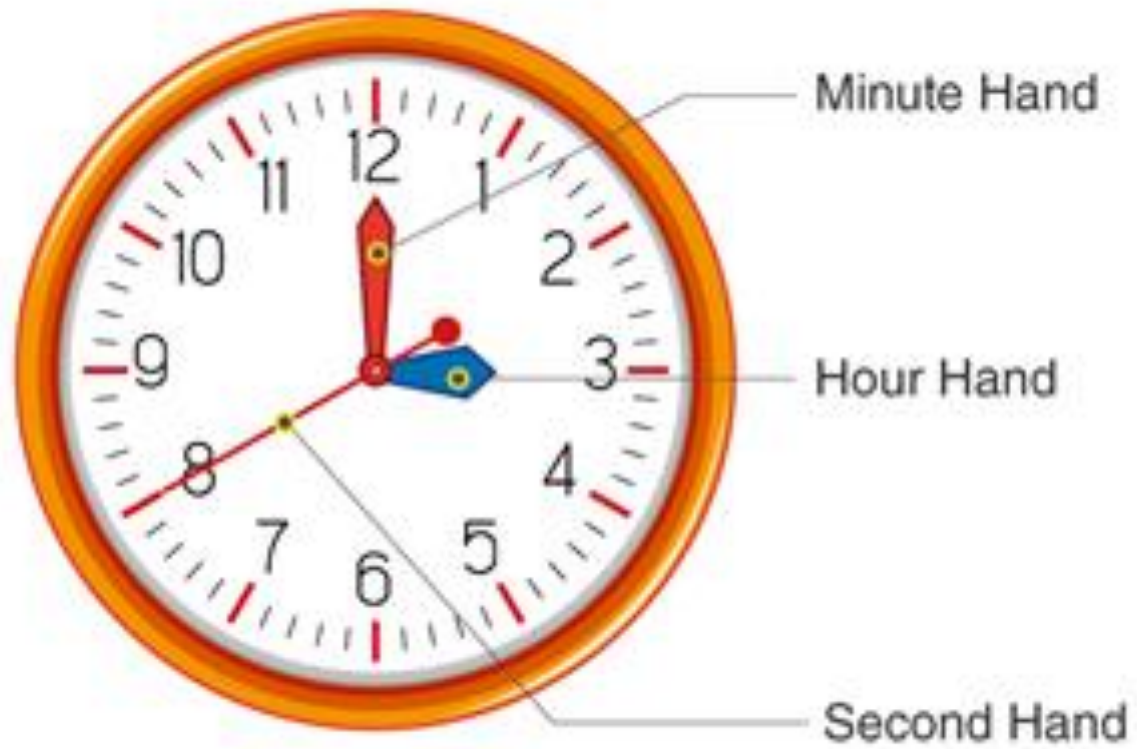
Q. January 1, 2007 was Monday. What day of the week lies on Jan. 1, 2008?

- A. Monday
- B. Tuesday
- C. Wednesday
- D. Sunday

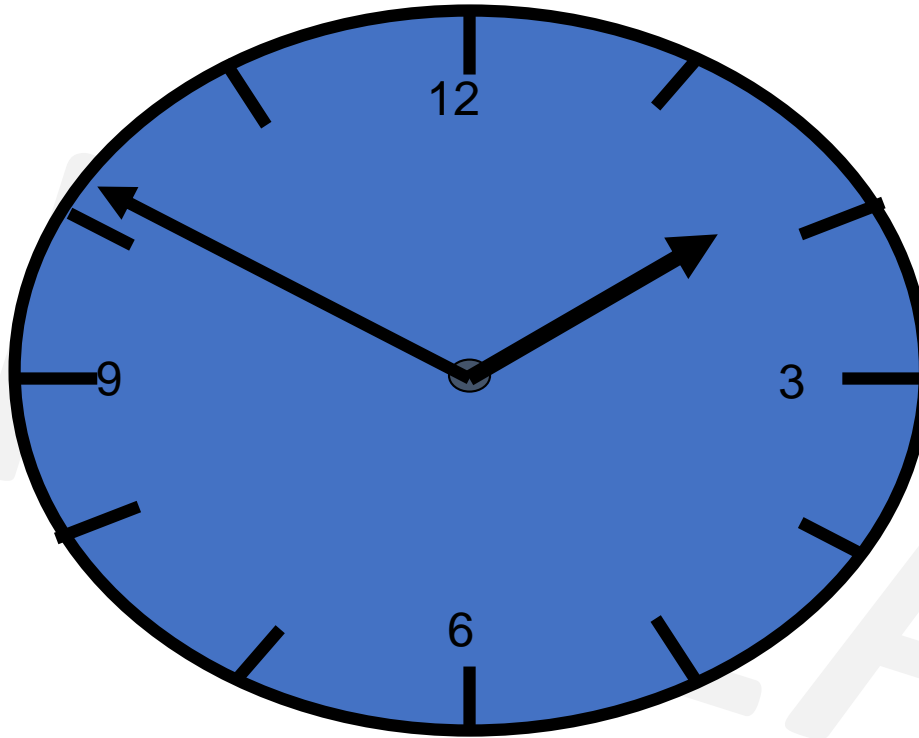
Ans: B



Clocks



Clocks



- → 360°
- → 60 minute spaces of 6° each
- → 12 Hours space of 30° each



Clocks

- The Face or dial of a watch is a circle whose circumference is divided into 60
- equal parts, called ***minute spaces***.
- A clock has two hands, the smaller one is called ***the hour hand or short hand***
- while the larger one is called the ***minute hand or long hand..***
- i) In 60 minutes, the minute hand gains 55 minutes on the hour hand.
- ii) In every hour, both the hands coincide once.
- iii) The hands are in the same straight line when they are coincident or opposite to each other.
- iv) When the two hands are at right angles, they are 15 minute spaces apart.
- v) When the hands are in opposite directions, they are 30 minute spaces apart.
- vi) Angle traced by hour hand in 12 hrs = 360° .
- vii) Angle traced by minute hand in 60 min. = 360° .



Clocks

- $12 \text{ hr} \times 30^\circ = 360^\circ$
- At night 12, day starts , both hands are at same place.
- Every hour they coincide once **but between 11-12 it coincides at 12**, so its 11 times only.
- The two hands coincide -
 - 11 times in 12 hours
 - 22 times in 24 hours
- The two hand are in opposite direction –
 - 11 times in 12 hours
 - 22 times in 24 hours
 - **Between 5-7 it happens only once at 6 o'clock.**
- The two hand make right angles –
 - 22 times in 12 hours
 - 44 times in 24 hours



Clocks

- The hands of a clock coincide 11 times in every 12 hours (Since between 11 and 1, they coincide only once, *i.e.*, at 12 o'clock).

AM

12:00

1:05

2:11

3:16

4:22

5:27

6:33

7:38

8:44

9:49

10:55

PM

12:00

1:05

2:11

3:16

4:22

5:27

6:33

7:38

8:44

9:49

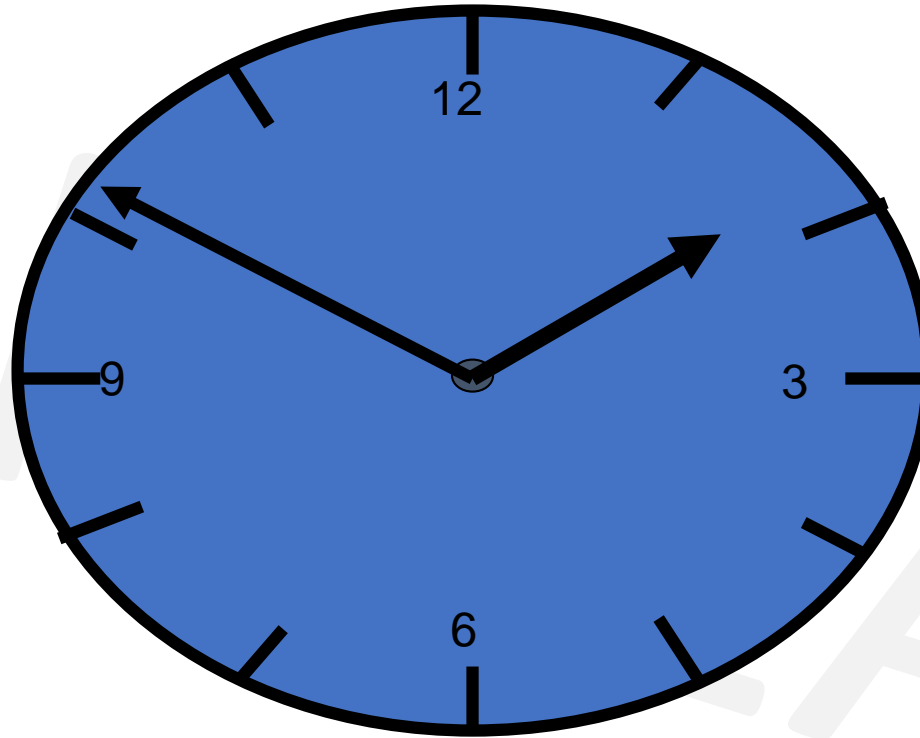
10:55

The hands overlap about every 65 minutes, not every 60 minutes.

∴ The hands coincide 22 times in a day.



Remember



- Relative speed of minute hand with respect to hour hand = $\frac{11}{12}$ ms/min



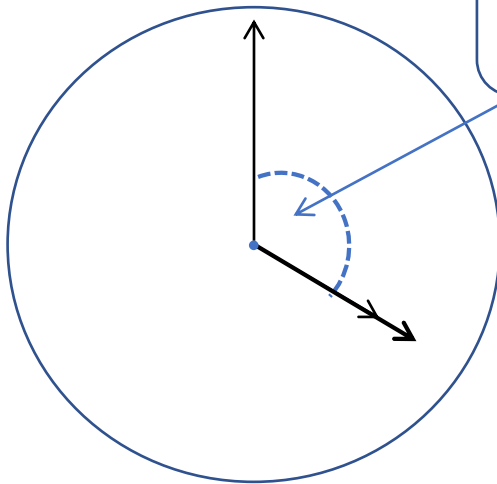
Clocks

Q. At what time between 4 and 5 o'clock will the hands of a watch be together/coincide?

- A. $10 \frac{9}{11}$ min past 4 B. $21 \frac{10}{11}$ min past 4 C. $11 \frac{10}{11}$ min past 4 D. $21 \frac{9}{11}$ min past 4

Soln:

- **Ans: D**
- Draw diagram of clock here



Distance travelled by minute hand is 20 min-spaces.
So $D = 20$

$$\begin{aligned} T &= \frac{D}{S} \\ &= \frac{20}{11/12} \\ &= \frac{20 \times 12}{11} \\ &= \frac{240}{11} \\ &= 21 \frac{9}{11} \text{ mins. past 4} \end{aligned}$$



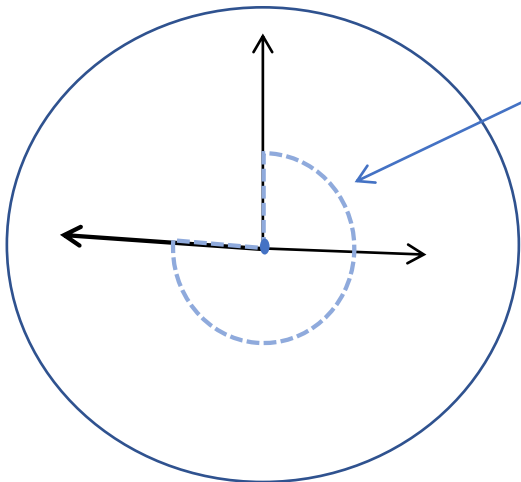
Clocks

Q. At what time between 3 & 4 o'clock will the hands of the clock be in the opposite direction.

- A. $40 \frac{9}{11}$ min past 3 B. $30 \frac{10}{11}$ min past 3
C. $49 \frac{1}{11}$ min past 3 D. $41 \frac{9}{11}$ min past 3

Ans : C

- Draw diagram of clock here



Distance travelled by minute hand is 45min-spaces.
So D =45

$$\begin{aligned} T &= D/S \\ &= \frac{45}{11/12} \\ &= \frac{45 \times 12}{11} \\ &= \frac{540}{11} \\ &= 49 \frac{1}{11} \text{ mins. past 3} \end{aligned}$$



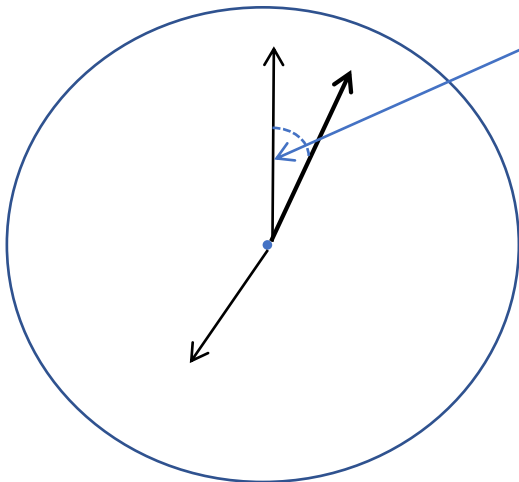
Clocks

Q. At what time between 7 and 8 o'clock will the hands of a clock be in the same straight line but, not together? ← means in opposite direction

- A. 5 min. past 7 B. $5\frac{2}{11}$ min. past 7 C. $5\frac{3}{11}$ min. past 7 D. $5\frac{5}{11}$ min. past 7

Soln:

- **Ans: D**
- Draw diagram of clock here



Distance travelled by minute hand is 5 min-spaces.
So $D = 5$

$$\begin{aligned} T &= D/S \\ &= \frac{5}{11/12} \\ &= \frac{5 \times 12}{11} \\ &= \frac{60}{11} \\ &= 5\frac{5}{11} \text{ mins. past 7} \end{aligned}$$

Clocks

Q. What is the angle between the hands of a clock at 7:23 am?

A. 90° B. 85.5° C. 83.5° D. 81.5°

Soln:

$$\begin{aligned}\text{Angle } \theta &= 30H - 11/2 M \\ &= 30 \times 7 - \frac{11}{2} \times 23 \\ &= 210 - 253/2 \\ &= 210 - 126.5 \\ &= 83.5^\circ\end{aligned}$$

Ans : C



Clocks

Find the reflex angle between 2 hands of a clock at 10:25

A. 187.5° B. 192.5° C. 197.5° D. 207.5°

Soln:

$$\begin{aligned}\theta &= |30H - 11/2 M| \quad \text{OR } |30H - 5.5 M| \\ &= 30 \times 10 - 11/2 \times 25 \\ &= 300 - 275/2 \\ &= 300 - 137.5 \\ &= 162.5^\circ\end{aligned}$$

But reflex angle is greater than 180° and less than 360°

$$360 - 162.5 = 197.5^\circ$$

• **Ans: C**

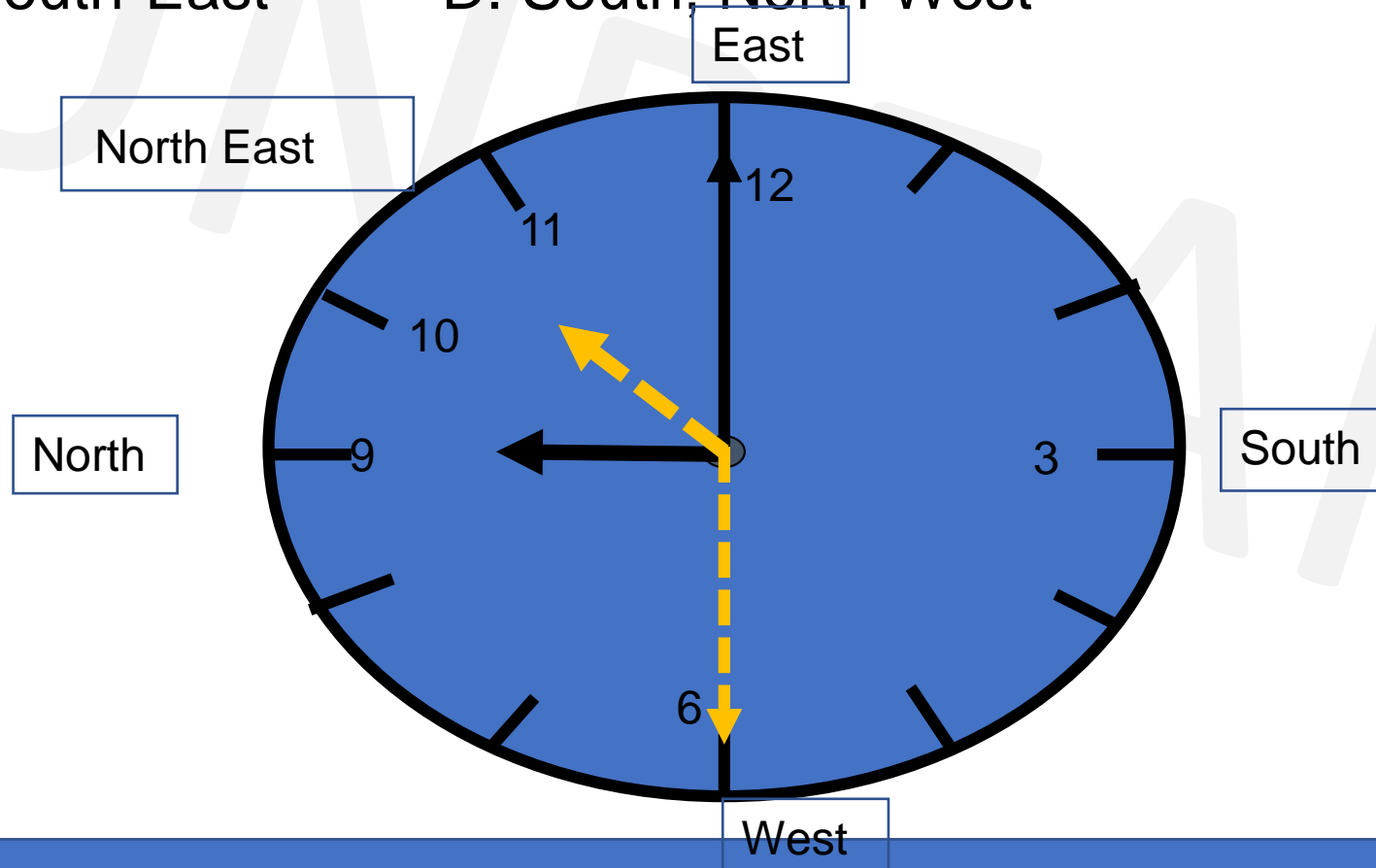


Clock(Assignment)

Q. Time piece kept in home is such that hour hand points to North at 9am..In which direction minute hand and hour hand point respectively at 10:30am?

- A. West, North-East B. East, North-West
C. North, South-East D. South, North-West

Ans: A



Clock(Assignment)

Q. How many rotations will the hour hand of a clock complete in 72 hours?

- A. 3
- B. 6
- C. 9
- D. 12

Ans: B



Clocks - Method1(Assignment)

- The minute hands of a clock meet at intervals of 70 mins. How much does the clock gain or lose in one day?
- A. $90 \frac{10}{77}$ min B. $93 \frac{39}{77}$ min C. $93 \frac{35}{143}$ min D. None of these
- **Soln:**
- In a clock that runs correctly, hands overlap every $720/11$ mins.
- In this clock hands are together after every 70 mins.
- So gain/loss in 70 mins = $720/11 - 70$ mins = $(720-770)/11 = -50/11$
- 70 min $\rightarrow 50/11$ min loss
- 24×60 min $\rightarrow x$
- So loss in one day = $(\frac{50}{11} \times 24 \times 60) / 70 = 93 \frac{39}{77}$ min
- **Ans: B**



Clocks – Method2(Assignment)

Q. The minute hands of a clock meet at intervals of 70 mins. How much does the clock gain or lose in one day?

- A. $90 \frac{10}{77}$ min B. $93 \frac{39}{77}$ min C. $93 \frac{35}{143}$ min D. None of these

• **Soln:**

- The minute hand of a clock overtakes the hour hand at intervals of M minutes of correct time.

- The clock gains or loses in a day by $= (720/11 - M)(60 \times 24/M)$ minutes.

- Here $M = 70$.

- The clock gains or losses in a day by-

- Gain/loss $= (720/11 - M)(60 \times 24/M)$

$$= (720/11 - 70)(60 \times 24/70)$$

$$= \left(\frac{720 - 770}{11} \right) \left(\frac{6 \times 24}{7} \right)$$

$$= \left(\frac{-50}{11} \right) \left(\frac{144}{7} \right) = \frac{-7200}{77}$$

$$= 93 \frac{39}{77} \text{ min}$$



Clock(Assignment)

Q. A clock is set at 4am. It loses 16 minutes in 24 hours. What will be the correct time when the clock indicates 9pm on the 4th day?

- A. 8pm B. 7pm C. 10pm D. 11pm

• **Ans C**

- Time from 4am on a day to 9pm on the 4th day = 89 hours
- 23 hrs 44 minutes of this clock = 24 hours of the correct clock as this clock loses 16 minutes in 24 hours.
- $23 \text{ hrs } 44 \text{ minutes} = 23 \frac{44}{60} = 23 \frac{11}{15} = \frac{356}{15} \text{ hrs}$
- Now, $\frac{356}{15} \text{ hrs of this clock} = 24 \text{ hours of correct clock}$
- 89 hours of this clock = ?
- $\frac{24 \times 11}{356} * 89 = 90 \text{ hours of the correct clock, i.e. the correct clock gains one hour over the incorrect clock.}$
- The correct time on the fourth day will be 10pm.
- **OR**
- time from first day 4am to 4th day 9pm = 89 hours
- 16mins loss - in 24hrs
- ? - in 89hrs
- so loss = 59.33mins == 1hr
- as loss is of 1hr ,so correct clock will indicate 10pm when this clock will show 9pm



Clocks(Assignment)

Q. An accurate clock shows 8 o'clock in the morning. Through how many degrees will the hour hand rotate when the clock shows 2 o'clock in the afternoon?

- A. 144° B. 150° C. 168° D. 180°

- Soln:
- In one hour ----- the hour hand rotates 30°
- In 6 hours ----- the hour hand rotates 180°
- OR
- Number of hours from 8am till 2pm = 6hrs
The rotation of an hour hand in one hour = 30°
Total degree of rotation = 360°

Therefore, the Angle traced by the hour hand in 6 hours is = $(360/12) \times 6 = 180^\circ$

- **Ans: D**



Clocks(Assignment)

Q. What is the angle between the hands of a clock at 7:20 ?

- A. 100° B. $192\frac{1}{2}^\circ$ C. 195° D. $197\frac{1}{2}^\circ$

Ans : A

What is the angle between the hands of a clock at 2:30 ?

- A. 144° B. 150° C. 105° D. 180°

Ans : C

What is the angle between the hands of a clock at 3:30 ?

- A. 144° B. 150° C. 105° D. 75°

Ans : D



Clocks(Assignment)

Q. The minute hand of a clock overtakes the hour hand at intervals of 65 mins of correct time. How much does the clock gain or lose in one day?

- A. $10 \frac{10}{143}$ min B. $10 \frac{21}{143}$ min C. $10 \frac{100}{143}$ min D. None of these

Ans: A



Clocks(Assignment)

Q. A clock is so placed that at 12 noon its minute hand points towards North-east. In which direction does its hour hand point at 1:30 p.m ?

A. West

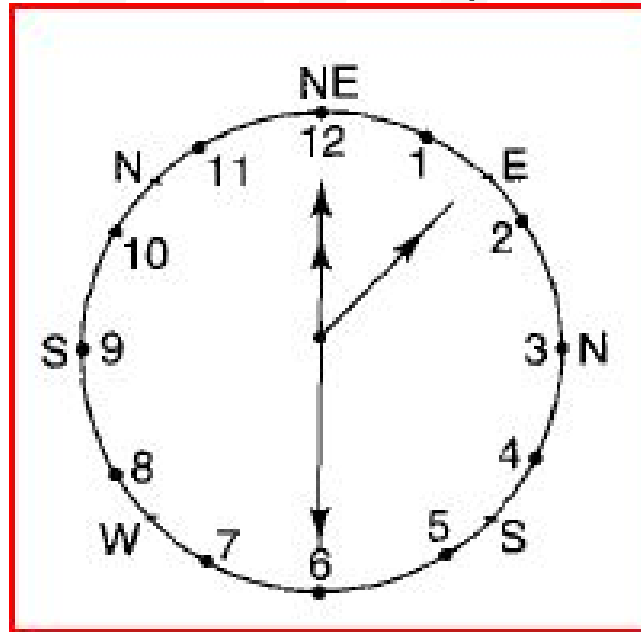
B. East

C. North

D. South

Ans: B

Diagram is shown as per the conditions in the question. Clearly at 1.30 p.m hour hand shall point - East.



Permutation & Combination

- What is permutation?
- It is the number of ways a group of things can be arranged.

E.g: Consider 3 letters A,B,C . In how many ways they can be arranged?

- A B C
- A C B
- B A C
- B C A
- C A B
- C B A

6 ways to arrange these 3 letters

- For 3 letter / 4 letter words its possible but for more number of letters we need a formula-
- $nPr = \frac{n!}{(n-r)!}$



Permutation & Combination

Q. Consider 4 letters A,B,C,D and arrange them in 3 spaces

- - - 3 spaces

No . Of letters = 4

No of spaces = 3

$$nPr = 4P_3 = \frac{4!}{(4-3)!} = \frac{4!}{1!} = 4! = 4 \times 3 \times 2 \times 1 = 24 \text{ ways it can be arranged}$$

Q. Arrange 7 letters A,B,C,D,E,F,G in 4 spaces

- - - - 4 spaces

$$nPr = 7P_4 = \frac{7!}{(7-4)!} = \frac{7!}{3!} = \frac{5040}{6} = 840$$



Permutation & Combination - Remember

$$0! = 1$$

$$1! = 1$$

$$2! = 2 \times 1 = 2$$

$$3! = 3 \times 2 \times 1 = 6$$

$$4! = 4 \times 3 \times 2 \times 1 = 24$$

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

$$6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$$

$$7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 5040$$



Permutation & Combination

Q. In how many ways can the letters of the word 'LEADER' be arranged?

A. 72 B. 144 C. 360 D. 720 E. None of these

Soln:

The word LEADER has 6 letters. So it can be arranged in $6!$ ways.

Out of these 6 letters, 2 letters are repeated (letter E repeated twice)

So we write it as - $\frac{6!}{2!}$

$6!$ → 6! ways to arrange letters in the word LEADER
 $2!$ → 2! In the denominator as letter E is repeated twice

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

$$= 360 \text{ ways}$$

Ans : C



Permutation & Combination

Q. In how many different ways can the letters of the word 'LEADING' be arranged in such a way that the vowels always come together?

- A. 360 B. 480 C. 720 D. 5040 E. None of these

Soln:

L E A D I N G \longrightarrow vowels in this word are E, A I

Remaining letters(consonants) are - L D N G

now we can arrange the vowels together in the remaining spaces as

_ L _ D _ N _ G _ in 5! ways and vowels be rearranged in those spaces in 3! ways

$$5! \times 3! = 720 \text{ ways}$$

Ans : C



Permutation & Combination

Q. In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together?

- A. 810 B. 1440 C. 2880 D. 50400 E. 5760

Soln:

C O R P O R A T I O N----- vowels in this word are O,O,A,I,O

Remaining letters(consonants) are - C R P R T N

now we can arrange the vowels together in the remaining spaces as

_C_R_P_R_T_N_ in 7! ways and vowels be rearranged in those spaces in 5! Ways

But the repeated letters are 2R in consonants and 3O in vowels

$$\frac{7!}{2!} \times \frac{5!}{3!} = 50400 \text{ ways}$$

Ans : D



Permutation & Combination

Q. Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?

- A. 210 B. 1050 C. 25200 D. 21400 E. None of these

Soln:

we need to form a 5 letter word with 3 consonants & 2 vowels = C C C V V

Ways to select, (3 consonants out of 7) AND (2 vowels out of 4)

$$= {}^7C_3 \times {}^4C_2 \times 5! \quad \leftarrow \text{each group has 5 letters and they can be arranged in } 5! \text{ ways}$$

$$= \frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{4 \times 3}{2 \times 1} \times 5!$$

$$= 35 \times 6 \times 120$$

$$= 25200 \text{ ways}$$

Ans : C



Permutation & Combination

Q. From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are there on the committee. In how many ways can it be done?

- A. 564 B. 645 C. 735 D. 756 E. None of these

Soln:

We may have (3 men and 2 women) or (4 men and 1 woman) or (5 men only).

Required number of ways = $({}^7C_3 \times {}^6C_2) + ({}^7C_4 \times {}^6C_1) + ({}^7C_5)$

$$= \left(\frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{6 \times 5}{2 \times 1} \right) + ({}^7C_3 \times {}^6C_1) + ({}^7C_2) \rightarrow [\text{using } {}^nC_r = {}^nC_{(n-r)}]$$

$$= 525 + \left(\frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{6}{1} \right) + \left(\frac{7 \times 6}{2 \times 1} \right)$$

$$= 525 + 210 + 21$$

$$= 756$$

Ans: D



Difference between permutation and combination

Combination (order does not matter)

"My fruit salad is a combination of apples, grapes and bananas" We don't care what order the fruits are in, they could also be "bananas, grapes and apples" or "grapes, apples and bananas", its the same fruit salad.



Permutation (When the order does matter)

"The combination to the safe is 472". Now we **do** care about the order. "724" won't work, nor will "247". It has to be exactly **4-7-2**.



Difference between permutation and combination

What is permutation?

Permutation: The various ways of arranging a given number of things by taking some or all at a time are all called as permutations.

Permutation includes word formation, number formation, circular permutation, etc. **In permutation, objects are to be arranged in particular order.** It is denoted by ${}^n P_r$ or $P(n, r)$.

Example: Arrange the given 3 numbers 1, 2, 3 by taking two at a time.

Now these numbers can be arranged in 6 different ways: **(12, 21, 13, 31, 23, 32).**

Here,

12 and 21, 13 and 31 or 23 and 32 do not mean the same, because here order of numbers is important.



Difference between permutation and combination

- **What is combination?**

Combination: Each of different groups or selections formed by taking some or all number of objects is called a combination.

Combination is used in different cases which include team/group/committee.

In combination, objects are selected randomly and here order of objects doesn't matter. It is denoted by ${}^n C_r$ or $C(n, r)$ or ${}^n C_r = {}^n C_{(n-r)}$.

Example: If we have to select two girls out of 3 girls X, Y, Z, then find the number of combinations possible.

Now only two girls are to be selected and arranged. Hence, this is possible in 3 different ways: **(XY, YZ, XZ,).**

Here,
You cannot make a combination as XY and YX, because these combinations mean the same.



Permutation & Combination(Assignment)

Q. In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there?

- A. 159 B. 194 C. 205 D. 209 E. None of these

Soln:

(1 boy and 3 girls) or (2 boys and 2 girls) or (3 boys and 1 girl) or (4 boys).

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

$$= ({}^6C_1 \times {}^4C_1) + ({}^6C_2 \times {}^4C_2) + ({}^6C_3 \times {}^4C_1) + ({}^6C_2) \quad \rightarrow \text{using } {}^nC_r = {}^nC_{(n-r)} \text{ (to reduce calculation)}$$

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

$$= (24 + 90 + 80 + 15)$$

$$= 209$$

Ans: D



Permutation & Combination(Assignment)

Q. How many 4-letter words with or without meaning, can be formed out of the letters of the word, 'LOGARITHMS', if repetition of letters is not allowed?

- A. 40
- B. 400
- C. 5040
- D. 2520

Ans: C



Permutation & Combination(Assignment)

Q. In how many different ways can the letters of the word 'MATHEMATICS' be arranged so that the vowels always come together?

- A. 10080
- B. 4989600
- C. 120960
- D. None of these

Ans: C



Permutation & Combination(Assignment)

Q. In how many different ways can the letters of the word 'OPTICAL' be arranged so that the vowels always come together?

- A. 120
- B. 720
- C. 4320
- D. 2160
- E. None of these

Ans: B



Permutation & Combination(Assignment)

Q. How many Permutations of the letters of the word APPLE are there?

A.600 B.120 C.240 D.60

Ans: D



Permutation & Combination(Assignment)

Q. How many different words can be formed using all the letters of the word ALLAHABAD?

A.7560

B.7890

C.7650

D. None of these

Ans: A



Permutation & Combination(Assignment)

Q. Find the value of ${}^{50}P_2$

- A. 4500
- B. 3260
- C. 2450
- D. 1470

Ans : C



Permutation & Combination(Assignment)

Q. How many words can be formed by using letters of the word 'DELHI'?

- a. 50
- b. 72
- c. 85
- d. 120

Ans : D



Permutation & Combination(Assignment)

Q. Find the number of ways the letters of the word 'RUBBER' can be arranged?

- A. 450
- B. 362
- C. 250
- D. 180

Ans: D



Permutation & Combination(Assignment)

Q. Out of 5 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?

- A. 60
- B. 200
- C. 5230
- D. 7200

Ans : D



Permutation & Combination(Assignment)

Q. In how many ways can a group of 5 men and 2 women be made out of a total of 7 men and 3 women?

- A. 63
- B. 90
- C. 126
- D. 45
- E. 135

Ans: A



IMPORTANT FORMULAE

- **I.1.**Area of a rectangle=(length x breadth)
- Therefore length = (area/breadth) and breadth=(area/length)
- **2.**Perimeter of a rectangle = 2 x (length + breadth)
- **II.**Area of a square = (side)² =1/2(diagonal)²
- **III** Area of four walls of a room = 2*(length + breadth)*(height)
- **IV** 1.Area of the triangle=1/2(base*height)
- 2. Area of a triangle = (s*(s-a)(s-b)(s-c))^(1/2), where a,b,c are the sides of a triangle & s= ½(a+b+c)
- 3.Area of the equilateral triangle =((3^{1/2})/4)*(side)²



IMPORTANT FORMULAE

- **V.1.**Area of the parellogram =(base *height)
- 2.Area of the rhombus= $\frac{1}{2}$ (product of the diagonals)
- 3.Area of the trapezium= $\frac{1}{2}$ (size of parallel sides)*distance between them.
- **VI** 1.Area of a circle = πr^2 ,where r is the radius
- 2. Circumference of a circle = $2\pi R$.
- 3. Length of an arc = $\frac{2\pi R\theta}{360}$ where θ is the central angle
- 4. Area of a sector = $(\frac{1}{2}) (\text{arc} \times R) = \frac{\pi R^2 \theta}{360}$.
- **VII.** 1. Area of a semi-circle = $(\pi) R^2$.
- 2. Circumference of a semi-circle = $(\pi) R$.
- where, **π** = 3.142



VOLUME AND SURFACE AREA – IMPORTANT FORMULAE

- **I. CUBOID**

- Let length = l, breadth = b and height = h units. Then,
- **1. Volume** = (l x b x h) cubic.units.
- **2. Surface area** = $2(lb + bh + lh)$ sq.units.
- **3. Diagonal** = $\sqrt{l^2 + b^2 + h^2}$ units

- **II. CUBE**

- Let each edge of a cube be of length a. Then,
- **1. Volume** = a^3 cubic units.
- **2. Surface area** = $6a^2$ sq. units.
- **3. Diagonal** = $\sqrt{3} a$ units.

- **III. CYLINDER**

- Let radius of base = r and Height (or length) = h. Then,
- **1. Volume** = ($\pi r^2 h$) cubic units.
- **2. Curved surface area** = ($2\pi rh$). units.
- **3. Total surface area** = $2\pi r (h+r)$ sq. units



VOLUME AND SURFACE AREA – IMPORTANT FORMULAE

- **IV. CONE**

- Let radius of base = r and Height = h . Then,
- **1. Slant height, $l = \sqrt{h^2 + r^2}$**
- **2. Volume** = $(1/3) \pi r^2 h$ cubic units.
- **3. Curved surface area** = (πrl) sq. units.
- **4. Total surface area** = $(\pi rl + \pi r^2)$ sq. units.

- **V. SPHERE**

- Let the radius of the sphere be r . Then,
- **1. Volume** = $(4/3) \pi r^3$ cubic units.
- **2. Surface area** = $(4 \pi r^2)$ sq. units.

- **VI. HEMISPHERE**

- Let the radius of a hemisphere be r . Then,
- **1. Volume** = $(2/3) \pi r^3$ cubic units.
- **2. Curved surface area** = $(2 \pi r^2)$ sq. units.
- **3. Total surface area** = $(3 \pi r^2)$ units.



Surds and Indices

○ Rules of Indices: -

- i. $a^n * a^m = a^{m+n}$
- ii. $\frac{a^m}{a^n} = a^{m-n}$
- iii. $(a^n)^m = a^{mn}$
- iv. $(ab)^n = a^n * b^n$
- v. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$
- vi. $a^0 = 1$ (where $a \neq 0$)
- vii. $a^{-n} = \frac{1}{a^n}$

○ Rules of Surds: -

- i. $\sqrt[n]{a} = a^{\frac{1}{n}}$
- ii. $\sqrt[n]{ab} = a^{\frac{1}{n}} * b^{\frac{1}{n}}$
- iii. $\sqrt[n]{\frac{a}{b}} = \frac{a^{\frac{1}{n}}}{b^{\frac{1}{n}}}$
- iv. $\left(\sqrt[n]{a}\right)^n = a$
- v. $\left(\sqrt[n]{a}\right)^m = a^{\frac{m}{n}}$



Races

Races

- A contest of speed in running, riding, driving, sailing or rowing is called a race.
- If in a race Ram is at starting point & Shyam starts from 20 mts ahead, then it is said that Ram has given Shyam a start of 20 mts or Ram gives Shyam 20 mts.
- This means that if they start from same point Ram would beat Shyam by 20 mts.



Races

Q. In a 100 mt race A gives B a start of 25 mt & still wins by 9 sec. Find the speed of A if speed of B is 6 kmph.

A. 8 kmph

B. 9 kmph

C. 10 kmph

D. 12 kmph

Soln

!-----100 m-----!
A<---25--->B<-----75m-----> A=t-9, B=t

$$S_b = 6 \text{ kmph} = 6 \times \frac{5}{18} = \frac{5}{3} \text{ m/s}$$

$$T_b = D_b / S_b = 75 / (\frac{5}{3}) = 45 \text{ sec}$$

$$T_a = T_b - 9 = 36 \text{ sec}$$

$$\begin{aligned} S_a &= D_a / T_a \\ &= 100 / 36 \text{ m/s} \\ &= 100 / 36 \times \frac{18}{5} \\ &= 10 \text{ kmph} \end{aligned}$$

Ans C



Races(Assignment)

Q. In a 100 m race, A can beat B by 25 m and B can beat C by 4 m. In the same race, A can beat C by:

A. 21 m

B. 26 m

C. 28 m

D. 29 m

• **Soln:-**

$$A : B = 100 : 75$$

$$B : C = 100 : 96$$

$$A:C=(\frac{A}{B} \times \frac{B}{C})=(\frac{100}{75} \times \frac{100}{96})=100:72$$

A beats C by $(100-72)=28$ m.

Ans: C



Circular Motion

- Use of both relative speed & LCM
- Let S_a, S_b = speeds of two persons.

S_r = Their relative speed

Distance traveled in 1 round = circumference

Case A : Both running in Same direction

Both meet again first time when \rightarrow **Time = dist/ S_r = Circumference/ $S_a - S_b$**

Case B : Both running in opposite directions(**DistA+ DistB =Circumference**)

Both meet first time when \rightarrow **Time = Circumference/ $S_a + S_b$**

Case C : Both running in same/opposite directions

Both meet again at starting point at LCM of their Lap times.



Circular Motion(Races)

Q. Two friends P & Q start from same point at the same time on a circular track 336 meters long in opposite directions at 6 m/s & 8 m/s respectively. After how much time will they meet again at the starting point for the first time?

A. 56 sec

B. 112 sec

C. 168 sec

D. 214 sec

Ans : C

Step1 – find the time taken by each member /player to complete 1 round

Step2 – Calculate LCM(Lap time)

$$\text{LapTm(P)} = \frac{\text{Circumference}}{S_p} = \frac{336}{6} = 56 \text{ sec}$$

$$\text{LapTm(Q)} = \frac{\text{Circumference}}{S_Q} = \frac{336}{8} = 42 \text{ sec}$$

$$\text{LCM}(42,56) = 168 \text{ sec}$$



Circular Motion(Assignment)

Q. A, B & C start together running along a circular track of 500 m at 8 km/hr, 5 km/hr & 3 km/hr respectively. After how much time will all three meet again at the starting point for the first time?

A. 20 min

B. 24 min

C. 30 min

D. 36 min

Ans: C



