CLOCK

A clock always has three hands i.e. a short hand that indicates hour, a long hand that indicates minute and a thin long hand to indicate second. A clock is divided into 12 hours and 60 minutes. So we will discuss only about hour and minute hand makes a complete circle then it crosses 60 divisions and makes 60 minutes. During this period the hour hand complete one hour and that is equal to a distance of 5 minutes. In other words, when the minute hand completes a distance of 60 minutes then the hour hand completes a distance of 5 minutes. Thus, the minute hand covers a distance of 55 minutes more than the hour needle i.e minute hand covers a distance of 55 minutes more than the hour needle i.e. minute hand 60 – 5 (hour hand) = 55 minutes.

CLOCK BEHAVIOUR

In each hour, both the hands show their mutual relation.
1. They meet each other once in this condition.
→ Difference of 0 minute (when both the hands meet each other than the difference in time is 0 minute)
→ an angle of 0^0 is made (when both the hands meet each other, an angle of 0^0 is made.
2. They are opposite to each other once → in this condition
→ there is a difference of 30 minutes and
→ an angle of 180^0 is made
3. They make an angle of 90^0
`(i.e. right angle) twice →in this condition
→ there is a difference of 15 minutes and
→ 90^0 angle is made.

Example 1: when does the minute and hour hands meet each other between 4 and 5 o'clock?

a.4o'clock 20 9/11 minutes
b.4o'clock 21 9/11 minutes
c. 4o'clock 27 9/11 minutes
d.4o'clock 19 9/11 minutes

Solution (b)

At 4 o'clock, there is a difference of 20 minutes between the hour and minute hands. Wshen the minute hand will pass and come to hour hand (i.e. at 4 o'clock) then it would travel a distance of 20 minutes. But, by that time the hour hands will move slightly away from 4 o'clock. So, both the hands will meet each other slightly ahead of 4 o'clock.
Assuming both the hands slightly ahead of 4 o'clockk i.e. at x minute
Therefore the distance covered by the hour hands is = x minutes
The distance covered by minute hands → (20 + x)

The extra distance covered by the minute hand in compared to hour hand in 12/11 minutes
Because, Minute hand travels 20 minutes more distance in compared to hour hand in 12/11 x 20 minutes
= 21 9/11 minutes
Therefore both the hand will meet each other at 4 o'clock 21 9/11 minutes

TRICK

When both the hands will meet each other then there will be difference of 0 minutes and o angle will be made.

Formula Minute = 2/11 (first hour x 30 + angle)

OR

$= 2/11 (H_2 \times 30 + A^0)$

(M = Minute, H_1 = First Hour, A = Angle)

According to the question, H1 = 4, A = 0, M?

M = 2/11 (4 x 30 + 0)

= 2/11 x 120 = 240/11

= 21 9/11 minutes

Therefore, at 4 o'clock 21 9/11 minutes both the hands of the clock will meet each other.

TO FIND ANGLE BETWEEN HANDS

Some Time Question for Finding Angle between Two Hands (Minute & Hours).There is Very Simple Trick to Find Angle.

Trick ⟶ Angle = $\left| H \times 30^0 - 11/2\ M^0 \right|$

Hours Minute

By this trick we can solve any type of question related to angle between hands.

Example: How many degree angle between hands at 25 past 2?

Solution: 2 (H) : 25 (M)

Trick = A = $\left| H \times 30^0 - 11/2\ M^0 \right|$

= $\left| 2 \times 30^0 - 11/2^0 \times 25 \right|$

$= |60^0 - 275/2^0|$

$= |120^0 - 275/2^0|$

$= |-155/2^0| \longrightarrow$ 77.5 Answer

NOTE: Remember one thing in case of 12 hours we consider 12 as 0.

Example: How many degree angles between hands at 12:25?
Solution: Trick = A = H x 30 – 11/2 M

12 (H) :35 (M)

↓

O (ZERO)

$= |0 \times 30 - 11/2 \times 35|$

$= |0 - 385/2|$

$= |192.5|$ **Ans.**

FAST AND SLOW CLOCK

When the actual time and the time indicated by the clock are same then it is said that the clock is right because it is neither fast nor slow. A clock is said to be fast when kthe actual time is 7 and the clock indicates 7:10 hours. A clock is said to be slow when the actual time is 7 and the clock indicates 6:50 hours.

Example 1: On Sunday, at 3 p.m. Ramesh's clock indicated 5 minutes slow than the actual time. Then on Tuesday, at 3 p.m. the clock indicated 3 minutes fast than the actual time. When did the clock show the correct or actual time?

a.Monday 7 a.m. b.Monday 9 p.m.
c.Tuesday 7 a.m. d.Tuesday 9 p.m.

Solution (b)

On the Sunday, at 3 p.m. the clock was 5 minutes slow and on Tuesday, at 3 p.m. the clock was 3 minutes fast . So all together, the clock was (5 + 3) = 8 minutes fast.

The time from Monday 3 p.m. to Tuesday 3 p.m. is 48 hours

Therefore, 48 hours = 8 minutes fast.

Therefore, the time taken to be fast by 1 minute = 6 hours

In the beginning the clock was 5 minutes slow. So it will indicatae the correct time when it is 5 minutes fast.

Because, to travel 1 minute faster, it will take 6 hours

Therefore, to travel 5 minute faster, it will take = 6 x5 = 30 hours

Thus, after 30 hours, the clock will travel the time by which it was slow (i.e. 5 minutes) and the actual time will be indicated.

Sunday	Monday	Monday
3 pm	3 pm	9 pm
	24 hour	6 hour

Thus, at 9 p.m. on Monday, the clock will show the correct time.

EVERY 24 HOURS OR IN EACH DAY

1. Both the hands meet each other at every hours. But both the hands meet each other 11 times in 12 hours and 22 times in 24 hours.
2.Both the hands are opposite to each other only once in every hour. But they are opposite to each other 11 times in 12 hours and 22 times in every 24 hour.
3.Both the hands are in a straight line 44 times in 24 hours.
a.22 times when they meet and
b.22 times when they are opposite to each other.

THE CHANGES IN THE POSITION OF HANDS

Some questions based on the changes in the position of the hands. To solve them, the following points are required to be noticed:
In the given diagram, the hour hand is indicated by H and the minute hand is indicated by M and the centre point is O. If the hour hand placed at OH moves to OM and the minute hand placed at OM moves to OH then it is said that the position of the hands have changed. The change in the position of hands is in the following conditions:

1. **When both the hand changes their position without crossing each other.**
2. **When both the hands have to change their position by crossing each other.**

When both the hands need not cross each other.

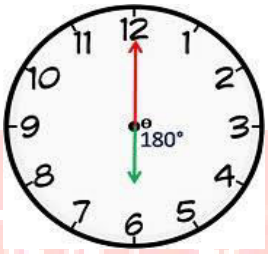
In the above diagram, both the hands will change their position without crossing each other. When the hands change each other's position, the minute hand will move from M and will go through P

and will react to H. thus the distance covered is MPH. During this period the hour hand will move from H and reach M. Thus HM is the distance covered by minute hand.
Therefore, both the hands did not cross each other in this process.
It is clear from the diagram that if the distance travelled by the minute hand is MPH and the distance travelled by the hour hand is HM minute are add together, then it will be equal to 60 minutes. Thus, in the process, both the hands travelled a distance of 60 minutes.
We know that when the minute had complete one circle, it travels, a distance off 5 minutes. Therefore, the ratio between the distance travelled by both the hands is 60:5 or 12:1. The hands travel different distance according to their speed.
Therefore, the distance travelled by the hour hand HM

= (60/12 + 1) X 1 = 60/13 minutes = 4 8/13 minutes

In the beginning, the difference in distance between both the hands are HM = 4 8/13 minutes
Thus, both the hands will change their position when the hour hand is 4 8/13 minutes behind the minute hand.

When both hands have to cross each other



In the above diagram, the difference in the distance between both the hands is move than the difference in the distance between both hands of the previous diagram. In this condition, the changes in the position of the hands are in the following ways:

i) When the minute hand will reach 12, the hour hand will reach 2. When the minute hand will move ahead, it will cross the hour hand between 2 and 3. And it will complete one circle as it reaches M.

ii) When the minute hand after crossing its previous position M will reach 12 then the hour hand will reach 3. When the minute hand will move ahead of 12 and will reach its previous position H, then the hour hand will move ahead of 3 and will reach to the previous position of minute hand M. Thus, there will be change in the position of both the hands. During this period, the minute hand will travel a distance of MPH. Now, when this distance of MPH is added to the total distance travelled by the hour hand i.e. HM, then, it makes a complete circle.

It should be noticed that in this process both the hands have crossed each other only once and both the hands made two complete circle i.e. (one complete circle by the minute hand + MPH + HM = 2 complete circle)
The total distance travelled by both the hands = 2 x 60 = 120 minutes
The distance travelled by the hour hand HM = 120/12 + 1 = 2 x 60/13 minutes
The distance between both the hands in the initial stage = HM = 2 x 60/13 minutes
Thus, this distance is double the distance of the initial condition 60/13.