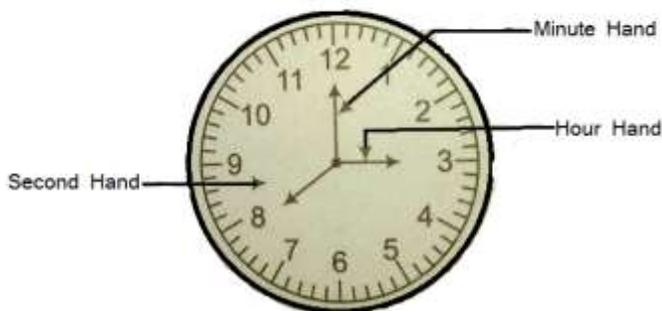


Clock

A clock is an instrument used for indicating and maintaining the time. It is an electronic device that presents the duration of an hour, minute and second.

Different types of question covered in this chapter are as follows.

- **Angle Between the Hands of the clock**
- **Position of Hands of the clock**
- **Faulty clocks**
- **Time Gained or lost by the clock**



The clock represents two things. i.e., minutes an hour. A minute is a unit of time equal to $1/60^{\text{th}}$ of an hour or 60 s i.e, **1 min = 60 s**.

Clocks Concepts :

- The dial of the clock is circular in shape and was divided into 60 equal minute spaces
- 60-minute spaces trace an angle of 360° . Therefore, 1minute space traverses an angle of 6°
- **In 1 hour, Minute hand traverses 60-minute space or 360°** , Hour hand traverses 5-minute space or 30°
- The hands of the clock are **perpendicular** in 15-minute spaces apart
- The hands of the clock are in a straight line and **opposite** to each other in **30-minute** spaces apart.
- The hands of the clock are in a straight line when they coincide or opposite to each other.
- The hands of the clock are perpendicular to **each other for 22 times in 12 hours** and for **44 times** in a day.
- The hands of the clock are **opposite** to each other for **11 times in 12 hours** and 22 times in a day.
- The minute hand gain **55 minutes** over hour hand per hour.

Hence x minute space to be gained by minute hand over hour hand can be calculated as $x \cdot (60/55)$ or $x \cdot (12/11)$

Ex: At what time between 2'O clock and 3'O clock the hands of the clock Ware opposite to each other.

1. $34(6/11)$ past 2'Oclock

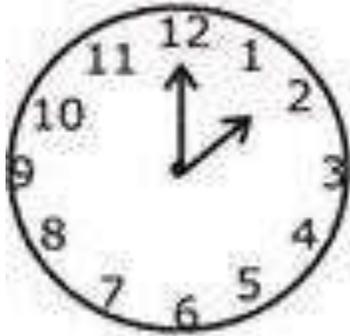
2. $43(7/11)$ past 2'Oclock

3. 56(8/11) past 2'Oclock

4. 64(9/11)past 2'Oclock

Solution:

At 2'O clock, the minute hand will be at 12 as shown below



The minute's hand to coincide with the hour hand it should trace at first 10 minute spaces and then the hands of the clocks to be opposite to each other minute hand should trace 30-minute spaces i.e. totally it should gain $10+30=40$ minute spaces to be opposite to that of the hour hand

We know that,

Minute hand gains 55-minute spaces over hour hand in 1 hour

Therefore, Minute hand gain 40-minute spaces over hour hand in $40 \times (60/55) = 43(7/11)$

Hence the hand of the clock & minute will be opposite to each other at $43(7/11)$ past 2'Oclock

Therefore, **the Correct option is 2'**

When the clock is too fast, too slow

- If a clock or watch indicates 6 hr 10 min when the correct time is 6, it is said that the clock is 10 min too fast. If it indicates 6. 40 when the correct time is 7, it is said to be 20 min too slow. Now let us have an example based on this concept

Ex: My watch, which gains uniformly, is 2 min, & show at noon on Sunday, and is 4 min 48 seconds fast at 2 p.m on the following Sunday when was it correct?

Solution: From Sunday noon to the following Sunday at 2 p.m there are 7 days 2 hours or 170 hours.

The watch gains $2+4 \frac{4}{5}$ min in 170 hrs.

Therefore, the watch gains 2 min in $(2 *170 * 5/34)$ hrs i.e., 50 hours

Now 50 hours = 2 days 2 hrs.

Therefore, 2 days 2 hours from Sunday noon = 2 p.m on Tuesday.

Problems On angles

Before we actually start solving problems on angles, we need to know a couple of basic facts clear:

- **Speed of the hour hand** = 0.5 degrees per minute (dpm)
- **Speed of the minute hand** = 6 dpm
- At 'n' o'clock, the angle of the hour hand from the vertical is $30n$

Example: 1 *What is the angle between the hands of the clock at 7:20*

Solution:

At 7 o'clock, the hour hand is at 210 degrees from the vertical.

In 20 minutes,

Hour hand = $210 + 20*(0.5) = 210 + 10 = 220$ {The hour hand moves at 0.5 dpm}

Minute hand = $20*(6) = 120$ {The minute hand moves at 6 dpm}

Difference or angle between the hands = $220 - 120 = 100$ degrees

Example:2 *Find the reflex angle between the hands of a clock at 05.30?*

Solution:

*Angle between X and Y = $|(X*30) - ((Y*11)/2)|$*

Angle between hands at 5:30

Step 1: $X=5, Y=30$

Step 2: $5*30=150$

Step 3: $(30*11)/2 = 165$

Step 4: $165-150=15$

Thus, the angle between hands at 5:30 is 15 degrees.

Example : 3 *At what time 3&4' o'clock in the hands of the clock together.*

Solution:

Approximately we know at 03:15 hands of the clock together

So $15*60/55=16.36$ min

Problems on incorrect clocks

Such sort of problem arises when a clock runs faster or slower than expected pace. When solving these problems it is best to keep track of the correct clock.

Example: A watch gains 5 seconds in 3 minutes and was set right at 8 AM. What time will it show at 10 PM on the same day?

Solution:

The watch gains 5 seconds in 3 minutes = 100 seconds in 1 hour.

From 8 AM to 10 PM on the same day, time passed is 14 hours.

In 14 hours, the watch would have gained 1400 seconds or 23 minutes 20 seconds.

So, when the correct time is 10 PM, the watch would show 10: 23: 20 PM

Important Points to remember:

- Two right angles per hour (Right angle = 90, Straight angle=180)
- Forty-four right angles per day
- Between every two hours, the hands of the clock coincide with each other for one time except between 11, 12 and 12, 1. In a day they coincide for 22 times.
- Between every two hours, they are perpendicular to each other two times except between 2, 3 and 3, 4 and 8, 9 and 9, 10. In a day they will be perpendicular for 44 times.
- Between every two hours they will be opposite to each other one time except between 5, 6 and 6, 7. In a day they will be opposite for 22 times.