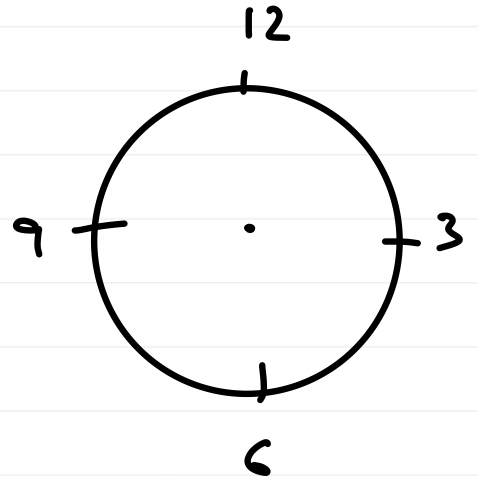


Clocks

Theory

Clock \rightarrow 12 hrs $\rightarrow 360^\circ$



Hour-hand:-

$$1 \text{ hr} = 30^\circ$$

$$1 \text{ hr} = 60 \text{ min}$$

$$1 \text{ min} = 0.5^\circ \text{ (hour hand moves } 0.5^\circ \text{ per min)}$$

Minute-hand:-

$$60 \text{ min} = 360^\circ$$

$$1 \text{ min} = 6^\circ \text{ (min hand moves } 6^\circ \text{ per min)}$$

\rightarrow For every min

angle btw (hour hand & min hand) $\rightarrow 5.5^\circ \uparrow$
per min.

1) Angle (θ) btw hour hand & min hand at
time $t = H : M$.

$$\Rightarrow \theta = \left| \frac{11}{2} M - 30 H \right|$$

Q) θ b/w hour hand & min-hand at time
 $t = 5:10$.

$$\begin{aligned}\theta &= \frac{11}{2} \times 10 - 30(5) \\ &= 55 - 150 \\ &= -95^\circ\end{aligned}$$

Q) $T : 4:25$

$$\begin{aligned}\theta &= \frac{11}{2} \times 25 - 30(4) \\ &= 137.5 - 120 \\ &= 17.5^\circ.\end{aligned}$$

2) Time at which hour's hand & min hand coincide b/w interval A - B.

$$S-St = (\text{Angle from 12'clock to A})$$

☆ If they said that hour's hand & minutes hand should be at an angle θ b/w A & B interval.

$$S-St = (\text{Angle from 12'clock to A}) \pm \theta$$

↓
Derivation: $\theta = \left| \frac{11}{2} M - 30 H \right|$

↓
 $5.5 M = 30 H \pm \theta \rightarrow \boxed{5.5 t = 30 H \pm \theta}$

Q) Time b/w 3 & 4 where both hour's hand & minutes hand coincide?

$$5.5 t = 30(3)$$

$$t = \frac{90}{5.5}$$

$$\boxed{t = 16 \frac{4}{11} \text{ past } 3}$$

Q) Time b/w 5 & 6 where both hands are at 90° to each other?

① $5.5 t = 30(5) + 90^\circ$ ② $5.5 t = 30(5) - 90^\circ$

$$t = \frac{240}{5.5}$$

$$\boxed{t = 43 \frac{7}{11} \text{ min past } 5}$$

$$t = \frac{60}{5.5}$$

$$\boxed{t = 10 \frac{10}{11} \text{ min past } 5}$$

Q) Time b/w 8 & 9 where both hands are at 180° to each other?

① $5.5 t = 30(8) + 180^\circ$
 $= \frac{420}{5.5}$

② $5.5 t = 30(8) - 180^\circ$
 $= 240 - 180^\circ$

$$= \frac{840}{11} > 1 \text{ hour}$$

~~X~~

$$= \frac{60}{5.5}$$

$$t = 10 \frac{10}{11} \text{ min after 8}$$

a) Coincide apart (or) 0° apart :-

In 1 hour = 1 time

12 hours = 11 times

24 hours = 22 times

b) 180° Apart (or) Straight line (non coinciding)

In 1 hour = 1 time

12 hours = 11 times

24 hours = 22 times

c) 90° Apart (or) Right angle

1 hour = 2 times

12 hours = 22 times

24 hours = 44 times.

