

LOGICAL REASONING
MODULE 10 – CLOCKS

1. Find the angle between the hour hand and the minute hand of a clock when the time is 3.25?

- (a) 47.5° (b) 57.5° (c) 45.5° (d) 55.5°

Solution:

At 3 o'clock, Minute hand is at 12 while the Hour hand is at 3. Again, the minute hand has to sweep through (30×5) i.e. 150° for reaching the figure 5 to show 25 mins.

Simultaneously the Hour hand will also rotate for 25 mins. Thus, starting from the mark, 3 the hour hand will cover an angle $= (25 \times 30) / 60 = 12.5^\circ$

Hence, Angle between Hour and the Minute hand $= (60 - 12.5) = 47.5^\circ$

Shortcut:

Angle between the hour and the minute hand $(\theta) = 30H \sim \frac{11}{2}M$

$$\theta = (30 \times 3) \sim \left(\frac{11}{2} \times 25\right)$$

$$\theta = 90 \sim 137.5$$

$$\theta = 47.5^\circ$$

2. At what time between 5.30 and 6 will the hands of a clock be at right angles?

- (a) 43 $\frac{5}{11}$ min. past 5 **(b) 43 $\frac{7}{11}$ min. past 5**
(c) 40 min. past 5 (d) 45 min. past 5

Solution:

At 5 o'clock, the hands are 25 min. spaces apart. To be at right angles and that too between 5.30 and 6, the minutes hand has to gain $(25 + 15) = 40$ min. spaces.

55 min. spaces are gained in 60 min.

40 min. spaces are gained in $= ((60/55) * 40)$ min. or $43 \frac{7}{11}$ min.

Therefore, required time = $43 \frac{7}{11}$ min. past 5.

3. How many times do the hands of a clock coincide in a day?

(a) 20

(b) 21

(c) 22

(d) 24

Solution:

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). The hands coincide 22 times in a day.

4. A watch which gains uniformly is 2 minutes low at noon on Monday and is 4 min. 48 sec fast at 2 p.m. on the following Monday. When was it correct?

(a) 2 p.m. on Tuesday

(b) 2 p.m. on Wednesday

(c) 3 p.m. on Thursday

(d) 1 p.m. on Friday

Solution:

Time from 12 p.m. on Monday to 2 p.m. on the following Monday = 7 days 2 hours.

=170 hours. The watch gains $= (2 + 4 \times \frac{4}{5})$ min = $\frac{34}{5}$ min. in 170 hrs.

Now, $\frac{34}{5}$ min is gained in 170 hrs. 2 min are gained in $(170 \times \frac{5}{34} \times 2)$ hrs.

Watch is correct 2 days 2 hrs after 12 p.m. on Monday, i.e., it will be correct at 2 PM on Wednesday.

5. An accurate clock shows 2 o'clock in the morning. Through how many degrees will the hour hand rotate when the clock shows 9 o'clock in the evening?

(a) 144°

(b) 210°

(c) 168°

(d) 570°

Solution:

We know that the angle traced by the hour hand in one hour is 30° .

The total angle traced by the hour hand in 19 hours (2 AM to 9 PM) is $30 \times 19 = 570^\circ$.

6. A boy saw the clock when it is 5 a.m. The clock loses 8 minutes in half a day. What will be the true time when he sees the clock at 10 p.m. on 4th day?

- (a) 9 PM (b) 10 PM (c) **11 PM** (d) 12 PM

Solution:

Time from 5 AM on a day to 10 PM on 4th day = 89 hours.

Now 23 hrs 44 min. of this clock = 24 hours of correct clock.

Therefore $356 / 15$ hrs of this clock = 24 hours of correct clock.

89 hrs of this clock = $(24 \times (15/356) \times 89)$ hrs = 90 hrs

So, the correct time is 11 PM.

7. A clock is started at 12 PM. By 600 seconds past 5 PM, the hour hand has turned through?

- (a) 145° (b) 150° (c) **155°** (d) 160°

Solution:

The total angle traced by the hour hand is the angle traced in 5 hours and 10 minutes.

We know that the angle traced by the hour hand in one hour is 30° and in one minute is $1/2^\circ$.

Therefore, $(30^\circ \times 5) + (10 \times 1/2^\circ) = 155^\circ$ is the angle traced by the hour hand.

8. At what time, between 3 o'clock and 4 o'clock will both the hour hand and minute hand coincide with each other?

- (a) 3:30 (b) **3:16 $4/11$** (c) 3:16 $11/4$ (d) 3:16 $7/11$

Solution:

Coincide means 00 angle.

$$0 = 11/2m - 30 \times 3$$

$$11m = 90 \times 2 = 180$$

$$m = 180/11 = 16 \frac{4}{11}$$

So, time = 3:16 $4/11$.

9. A clock gains 15 minutes per day. It is set right at 12 noon. What time will it show at 4.00 am, the next day?

- (a) 4:10 am (b) 4:45 am (c) 4:20 am (d) 5:00 am

Solution:

The clock gains 15 min in 24 hours.

Therefore, in 16 hours, it will gain 10 minutes.

Hence, the time shown by the clock will be 4:10 am

10. How much does a watch lose per day, if its hands coincide every 64 minutes?

- (a) 32 $\frac{8}{11}$ min (b) 36 $\frac{5}{11}$ min (c) 90 min (d) 96 min

Solution:

55 min. spaces are covered in 60 minutes.

60 minutes spaces are covered in $\left(\frac{60}{55} \times 60\right)$ min = $65 \frac{5}{11}$ min.

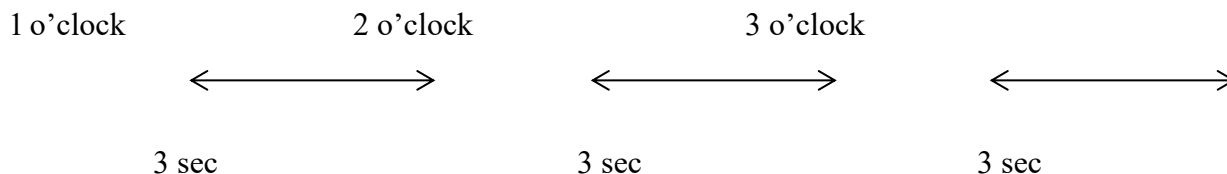
Loss in 64 min = $\left(65 \frac{5}{11} - 64\right) = \frac{16}{11}$ min

Loss in 24 hrs = $\frac{16}{11} \times \frac{1}{64} \times 24 \times 60$ min = $32 \frac{8}{11}$ min

11. The clock at Hogwarts has a special way of telling the time. It does not have any hand or numbers on it, but it has a chimer. If the time is 1 o'clock, it chimes once. If the time is 2 o'clock, it chimes twice, and so forth. The time gap between any two chimes is 3 seconds. How many seconds would it take for Harry Potter to know the time, after the first chime is heard, if it is 3 o'clock?

- (a) 6 seconds (b) 9 seconds (c) 12 seconds (d) 3 seconds

Solution:



After 3 o'clock we need to wait for another 3 seconds to check whether the clock will chime further. Hence the answer is 9 seconds.

12. A clock gains 20 seconds for every 3 hours of time. If a clock is set at a correct time of 2 am on Friday, what would it indicate at 6:30 pm, Saturday?

- (a) 6.32.00 pm (b) 6.32.46 pm **(c) 6.34.30 pm** (d) 6.38.56 pm

Solution:

From 2.00 am Friday to 6.30 pm Saturday we have

24 hours (till 2 am Saturday) + 12 hours (till 2 pm Saturday) + 4.5 hours = 40.5 hours

20 seconds in 3 hours

\therefore ? seconds in 40.5 hours

\therefore ? = 270 seconds = 4.5 minutes

Time shown = 6.30 pm + 4.5 minutes = 6 hours 34 minutes 30 seconds = 6.34.30 pm

13. At what time between 3 and 4 o'clock will the minute hand and the hour hand remain on the same straight line but face opposite directions?

- (a) 3:49 (b) 3:15 (c) 3:39 $\frac{1}{11}$ **(d) 3:49 $\frac{1}{11}$**

Solution:

On straight line means 180° angle.

$$180 = 11/2 M - 30 H$$

$$180 = 11/2 M - 30 * 3$$

$$180 = 11/2 M - 90$$

$$(180 + 90) 2 = 11 M$$

$$M = 540/11 = 49 \frac{1}{11}$$

14. The reflex angle between the hands of a clock at 10.25 is?

- (a) 180° (b) $192 \frac{1}{2}^\circ$ (c) 195° **(d) $197 \frac{1}{2}^\circ$**

Solution:

$$\text{Angle traced by hour hand in } \frac{125}{12} \text{ hrs} = \left(\frac{360}{12} \times \frac{125}{12} \right)^\circ = 312 \frac{1}{2}^\circ$$

Angle traced by minute hand in 25 min

$$\left(\frac{360}{60} \times 25^\circ\right) = 150^\circ$$

$$\text{Therefore, reflex angle} = 360^\circ - \left(312 \frac{1}{2}^\circ - 150^\circ\right) = 360^\circ - 162 \frac{1}{2}^\circ = 197 \frac{1}{2}^\circ$$

15. A watch loses 5 minutes every hour and was set right at 8 AM on Monday. When will it show the correct time again?

(a) 8 AM on Sunday

(b) 8 AM on Tuesday

(c) 8 AM on Saturday

(d) 8 AM on Wednesday

Solution:

It loses 5 minutes in 1 hour \rightarrow It loses 1 minute in 12 minutes

It will lose 12 hours (or 720 minutes) in $720 \times 12 \text{ minutes} = 144 \text{ hours} = 6 \text{ days}$

It will show the correct time again at 8 AM on Sunday

HOME WORK

16. Find the angle between the hour hand and the minute hand of a clock when the time is 5.45.

(a) 97.5°

(b) 90°

(c) 100°

(d) 95°

Solution:

Angle traced by the hour hand in 12 hours = 360°

Angle traced by the hour hand in 5 hours 45 minutes = $(360 \times 23) / (12 \times 4) = 172.5^\circ$

Angle traced by the minute hand in 60 minutes = 360°

Angle traced by the minute hand in 45 minutes = 270°

Therefore, the angle between the hour hand and the minute hand at 5.45

$$= (270 - 172.5) = 97.5^\circ$$

17. A faulty clock gains 6 seconds in 10 minutes, and it is set right at 9 AM. What is the correct time when the clock is at 11 PM?

- (a) 10:52:24 PM **(b) 10:51:36 PM** (c) 10:51:24 PM (d) 10:52:36 PM

Solution:

A clock gains 6 sec. in 10 min. So, in 1 hour, it gains 36 sec.

From 9 AM to 11 PM, time passed is 14 hours.

In 14 hours, the clock has gained $36 \times 14 = 504$ sec.

At 11 PM, the correct time is 10:51:36 PM

18. What is the reflex angle between the minute hand and hour hand at 08:45?

- (a) 356° (b) 354.5° **(c) 352.5°** (d) 350°

Solution:

At 8 o'clock, the hour hand is at 240° from the vertical.

In 45 minutes, angle made by hour hand $= 240^\circ + 45 \times 0.5 = 262.5^\circ$

Angle made by minute hand $= 6 \times 45 = 270^\circ$

Angle between the hour hand and minute hand $= 270 - 262.5 = 7.5^\circ$

So, reflex angle is $360 - 7.5 = 352.5^\circ$

19. How many times in a day are the hands of a clock in straight line but in opposite direction?

- (a) 20 **(b) 22** (c) 24 (d) 48

Solution:

The hands of a clock point in opposite directions (in the same straight line) 11 times in every 12 hours. (Because between 5 and 7 they point in opposite directions at 6 o' clock only).

So, in a day, the hands point in the opposite directions 22 times.

20. At what time between 9 and 10 o'clock will the hands of a watch be together?

(a) 45 min. past 9 (b) 50 min. past 9 **(c) 49 $\frac{1}{11}$ min. past 9** (d) 48 $\frac{2}{11}$ min. past 9

Solution:

To be together between 9 and 10 o'clock, the minute hand has to gain 45 min. spaces.

55 min. spaces gained in 60 min.

45 min. spaces are gained in

$\left(\frac{60}{55} \times 45\right)$ min . or 49 $\frac{1}{11}$ min

Therefore, the hands are together at 49 $\frac{1}{11}$ min. past 9