Quantitative – Exam No. 02

Clock Problems

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Formulas:

1. The following formula is used to calculate the angle between hour hand and minute hand:

$$Angle = |30(x) - \frac{11(y)}{2}|$$

Where:

$$x = Hour\ hand\ units$$

$$y = Minute\ hand\ units\ \mathbf{2.}$$

Limits for x, y and angle values:

$$0 \le x \le 11\,0$$

$$\le y \le 59$$

$$0 \le angle \le 180$$

3. If value of x is equal to 12, then we will use x = 0 in the formula.

4. If the value of answer is greater than 180, then subtract the answer from 360. For example, if answer is 250, then subtract the answer from 360 i.e., 360 – 250 = 110.

5. If the value of answer is negative, then ignore the negative sign. For example, if answer is –120, then after ignoring the negative sign, answer will be 120.

6. There are 360 degrees in a clock.

7. There are 360 degrees in a π-chart. (PP)

8. Telling the time:

The following picture shows how to tell the time:

It's ... o'clock

It's five to ...   It's five past ...

It's ten to ...   It's ten past ...

It's (a) quarter to ...   It's (a) quarter past ...

It's twenty to ...   It's twenty past ...

It's twenty-five to ...   It's twenty-five past ...

It's half past ...

2:00 - It's two o'clock.	2:30 - It's half past two.
2:05 - It's five past two.	2:35 - It's twenty-five to three.
2:10 - It's ten past two.	2:40 - It's twenty to three.
2:15 - It's quarter past two.	2:45 - It's quarter to three.
2:20 - It's twenty past two.	2:50 - It's ten to three.
2:25 - It's twenty-five past two.	2:55 - It's five to three.

9. Conversions:

$$1 \ year = 365 \ days \qquad\qquad 1 \ day = 24 \ hours$$

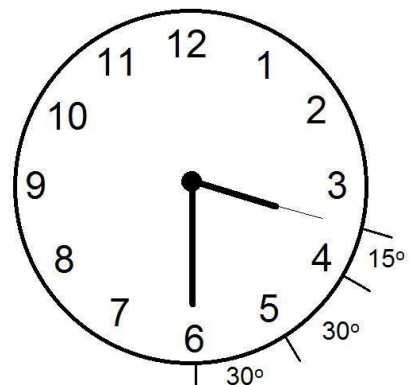$$1 \ hour = 60 \ minutes \quad 1 \ minute = 60 \ seconds \quad 1 \ hour = 30 \ degrees$$

OR

$$1 \ degree = \frac{1}{30} \ hour$$

$$1 \ minute = 6 \ degrees$$

OR

$$1 \ degree = \frac{1}{6} \ minute$$

10. The hour hand and minute hand of a clock coincides 22 times during one day.

$$Coinciding\ time = \frac{30 \times Smaller\ time}{5.5}$$

Alternative Formula:

$$Coinciding\ time = \frac{60 \times Smaller\ time}{11}$$

Exercise:

1. Find the angle between the hour hand and the minute hand of a clock if the time is 08:50?

Solution:

$$Angle = 30(x) - \frac{11(y)}{2}$$

$$Angle = 30(8) - \frac{11(50)}{2}$$

$$Angle = 240 - \frac{550}{2}$$
$$Angle = 240 - 275$$

$$Angle = -35 \quad \text{Ignore}$$

negative sign.

$$Angle = +35$$

2. Find the angle between the hour hand and the minute hand of a clock if the time is 12:20?

Solution:

Since value of x is 12, so we will use x = 0 in the formula:

$$Angle = 30(0) - \frac{11(20)}{2}$$

$$Angle = 0 - \frac{220}{2}$$

$$Angle = 0 - 110$$

$$Angle = -110 \text{ Ignore}$$

negative sign.

$$Angle = +110$$

3. Find the angle between the hour hand and the minute hand of a clock if the time is 09:30? (PP) **Solution:**

$$Angle = 30(x) - \frac{11(y)}{2}$$

$$Angle = 30(9) - \frac{11(30)}{2}$$

$$Angle = 270 - 165$$

$$Angle = 105$$

4. Find the angle between the hour hand and the minute hand of a clock if the time is quarter past 8?

Solution:

If the time is quarter past 8, it means time is 08:15.

$$Angle = 30(x) - \frac{11(y)}{2}$$

$$Angle = 30(8) - \frac{11(15)}{2}$$

$$Angle = 240 - \frac{165}{2}$$

$$Angle = 240 - 82.5$$

$$Angle = 157.5$$

5. Find the angle between the hour hand and the minute hand of a clock if the time is half past 2? (PP) **Solution:**

If the time is half past 2, it means time is 02:30.

$$Angle = 30(x) - \frac{11(y)}{2}$$

$$Angle = 30(2) - \frac{11(30)}{2}$$
$$Angle = 60 - 165$$

$$Angle = -105 \text{ Ignore}$$

negative sign.

$$Angle = +105$$

6. Find the angle between the hour hand and the minute hand of a clock if the time is quarter to 1?

Solution:

If the time is quarter to 1, it means time is 12:45. Since value of x is greater than 12, so we will use x = 0 in the formula:

$$Angle = 30(x) - \frac{11(y)}{2}$$

$$Angle = 30(0) - \frac{11(45)}{2}$$

$$Angle = 0 - \frac{495}{2}$$

$$Angle = -247.5 \text{ Ignore}$$

negative sign.

$$Angle = +247.5$$

Since the angle value is greater than 180, so we will subtract the answer from 360 as follows:

$$Angle = 360 - 247.5$$

$$Angle = 112.5$$

7. Find the angle between the hour hand and the minute hand of a clock if the time is 10 to 9?

Solution:

If the time is 10 to 9, it means 10 minutes $\frac{11(y)}{2}$ left in 9'O clock. So, time is 08:50. $Angle = 30(x) -$

$$Angle = 30(8) - \frac{11(50)}{2}$$

$$Angle = 240 - \frac{550}{2}$$

$$Angle = 240 - 275$$

$$Angle = -35 \text{ Ignore}$$

negative sign.

$$Angle = +35$$

8. A clock is showing time 04:39. If its minute hand rotates 12 degrees, what time it will show then? (PP) **Solution:**

We know that:

$$1 \ degree = \frac{1}{6} minute \ hand \ rotation$$

$$12 \ degrees = 12 \times \frac{1}{6} minute \ hand \ rotation$$

$$12 \ degrees = 2 \ minute \ hand \ rotation$$

So, time will be 04:41.

9. A clock is showing time 03:15. If its hour hand rotates 10 degrees, what time it will show then? (PP) **Solution:**

We know that:

$$1 \text{ } degree = \frac{1}{30} \text{ } hour \text{ } hand \text{ } rotation$$

$$10 \text{ } degrees = 10 \times \frac{1}{30} \text{ } hour \text{ } hand \text{ } rotation$$

$$10 \text{ } degrees = \frac{1}{3} \text{ } hour \text{ } hand \text{ } rotation$$

Converting hours into minutes as follows:

$$10 \text{ } degrees = (\times 60) \quad \frac{1}{3} \quad minutes \text{ } hand \text{ } rotation$$

$$10 \text{ } degrees = (\times 20) \quad \frac{1}{1} \quad minutes \text{ } hand \text{ } rotation$$

$$10 \text{ } degrees = 20 \text{ } minutes \text{ } rotation$$

So, the time will be 03:35.

10. A clock's minute hand is 10 cm long. What area it will cover from 09:30 am to 09:35 am? (PP) **Solution:**

We know that:

$$Area \text{ } of \text{ } circle = \pi r^2$$

We have to find the area covered in 5 minutes. Complete circle contains 60 minutes, so we have to find area of 5/60=1/12th part of the circle:

$$Area \text{ } of \text{ } circle \quad (09:30 \text{ } to \text{ } 09:35) = \frac{1}{12} \times \pi r^2$$

$$(09:30 \text{ } to \text{ } 09:35) = \frac{1}{12} \times \pi (10)^2$$

$$Area \text{ } of \text{ } circle \quad (09:30 \text{ } to \text{ } 09:35) = \frac{1}{12} \times \pi (100)$$

$$Area \text{ } of \text{ } circle$$

$$Area \text{ } of \text{ } circle \quad (09:30 \text{ } to \text{ } 09:35) = \frac{25\pi}{3} (cm)^2$$

11. 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? (PP)

Solution:

We know that 6 hours have been passed, so:

$$1 \; hour \; hand \; rotation = 30 \; degrees$$

$$6 \; hour \; hand \; rotation = 6 \times 30 \; degrees$$

$$6 \; hour \; hand \; rotation = 180 \; degrees$$

12. If the minute hand of a clock moves 36 degrees, how many minutes of the time have passed? (PP)

Solution:

We know that:

$$1 \; degree = \frac{1}{6} minute$$

$$36 \; degrees = 36 \times \frac{1}{6} minutes$$

$$36 \; degrees = 6 \; minutes$$

13. Add 7 hours 37 minutes, 4 hours 51 minutes and 17 hours 8 minutes? (PP) **Solution:**

Days	:	Hours	:	Minutes
0 0	:	0 7	:	3 7
0 0	:	0 4	:	5 1
0 0	:	1 7	:	0 8
0 0	:	2 8	:	9 6

Converting 96 minutes in to hours (96 = 60 + 36, 1 hour and 36 minutes):

0 0	:	2 9	:	3 6

Converting 29 hours in to days (29 = 24 + 5, 1 day and 5 hours):

$$0\ 1\ :\ 0\ 5\ :\ 3\ 6$$

So, it will be 1 day 5 hours 36 minutes.

14. Find the angle of minute hand between 03:50 pm to 04:15 pm? (PP)

Solution:

We know that 25 minutes have been passed, so:

$$1\ minute\ hand\ rotation = 6\ degrees$$

$$25\ minutes\ hand\ rotation = 6 \times 25\ degrees$$

$$25\ minutes\ hand\ rotation = 150\ degrees$$

15. Subtract 6 hours 47 minutes from 9 hours 13 minutes? (PP) **Solution:**

Days	:	Hours	:	Minutes
		0 8		7 3
0 0	:	0̷ 9̷	:	1̷ 3̷
0 0	:	0 6	:	4 7
0 0	:	0 2	:	2 6

So, it will be 2 hours 26 minutes.

16. Add 7 hours 19 minutes, 5 hours 16 minutes, 2 hours 12 minutes and 9 hours 17 minutes? (PP)

Solution:

Days	:	Hours	:	Minutes
0 0	:	0 7	:	1 9
0 0	:	0 5	:	1 6
0 0	:	0 2	:	1 2

$$0\,0 \quad : \quad 0\,9 \quad : \quad 1\,7$$
$$0\,0 \quad : \quad 2\,3 \quad : \quad 6\,4$$

Converting 64 minutes in to hours (64 = 60 + 4, 1 hour and 4 minutes):

$$0\,0 \quad : \quad 2\,4 \quad : \quad 0\,4$$

Converting 24 hours in to days (24 = 24 + 0, 1 day and 0 hours):

$$0\,1 \quad : \quad 0\,0 \quad : \quad 0\,4 \text{ So,}$$

it will be 1 day 4 minutes.

17. At what time between 8 O' clock and 9 O' clock, the minute hand and the hour hand of a clock coincide?

Solution:

We know that:

$$Coinciding\ time = \frac{30 \times Smaller\ time}{5.5}$$

Substituting the smaller time i.e., 8 O' clock, we get:

$$Coinciding\ time = \frac{30 \times 8}{5.5} = \frac{240}{5.5}$$

$$Coinciding\ time = 43.63 \cong 44$$

So, 8 hours and 44 minutes will be the coinciding time.

18. At what time between 4 O' clock and 5 O' clock, the minute hand and the hour hand of a clock coincide?

Solution:

We know that:

$$Coinciding\ time = \frac{30 \times Smaller\ time}{5.5}$$

Substituting the smaller time i.e., 4 O' clock, we get:

$$Coinciding\ time = \frac{30 \times 4}{5.5} = \frac{120}{5.5}$$

$$Coinciding\ time = 21.82 \cong 22$$

So, 4 hours and 22 minutes will be the coinciding time.

19. How many degrees are covered by the minute hand of a clock in 2 hours? **Solution**:

As,   1min = 6 degree

Or,   120 min = 120 × 6 degree   (2 hours = 120 min)

So it means,   2 hour = 720 degrees