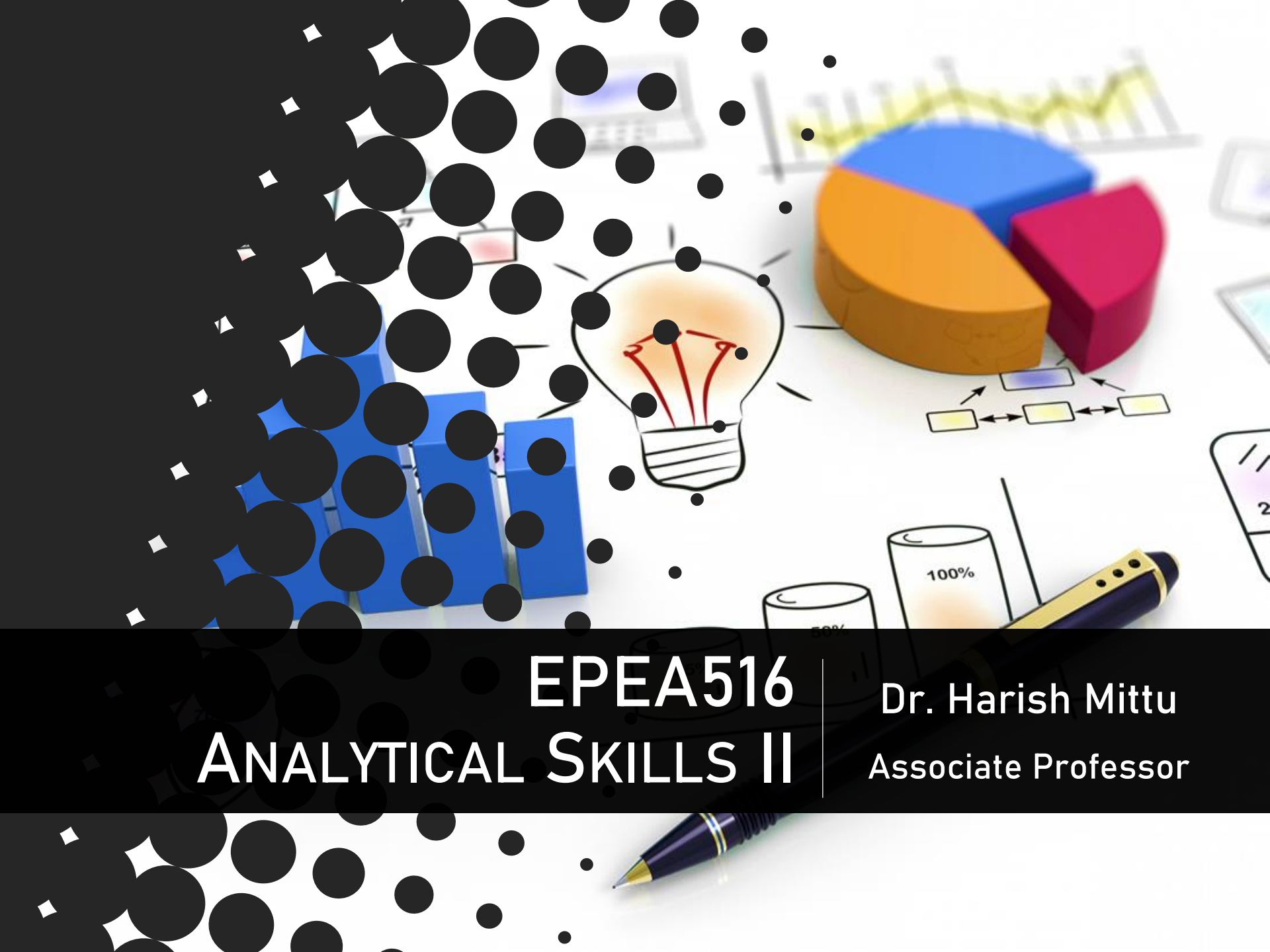

EPEA516
Analytical Skills II

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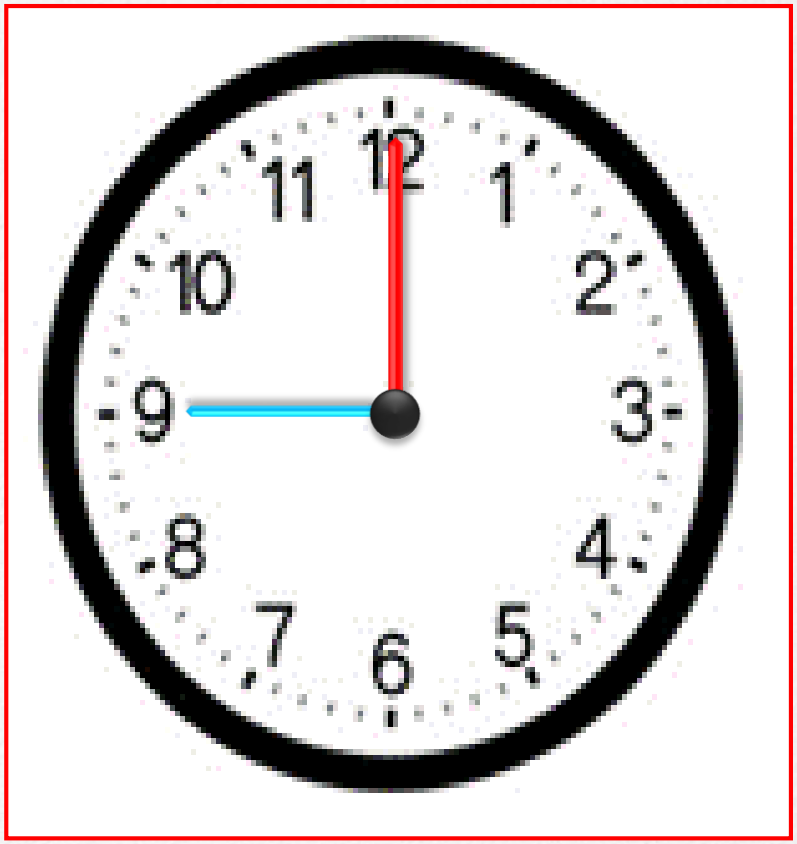
Learning Outcomes

After this lecture, you will be able to

- compute angle between hands of clock in different situations.
- solve problem related to angle computation between hands of clock in various competitive exams.

Example 1

- Find the angle between the minute hand and the hour hand of a clock when the time is 9.20 am.

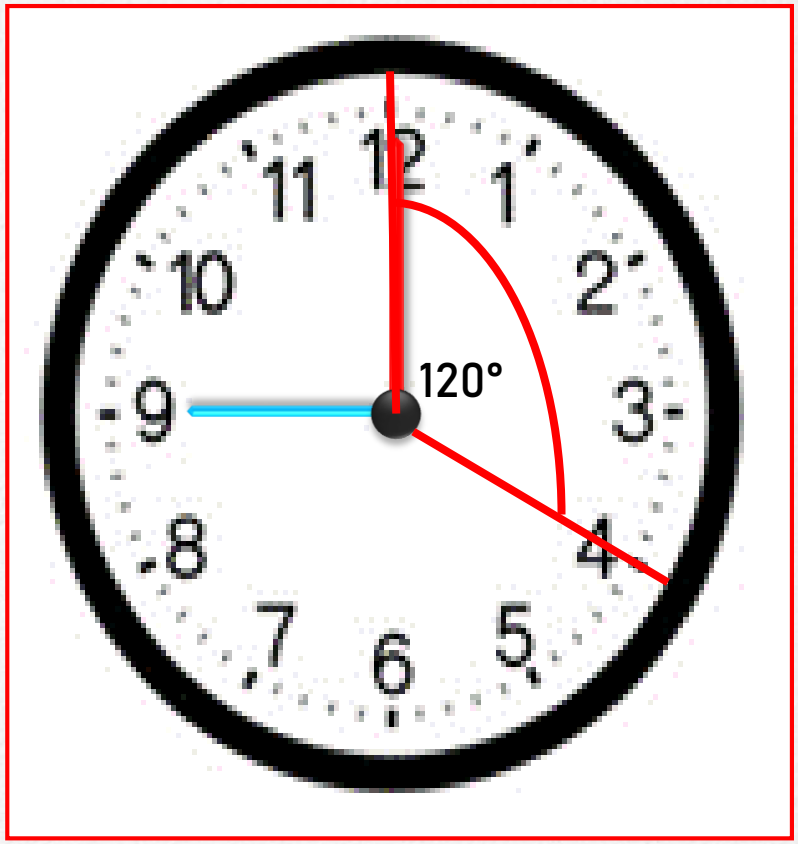


Example 1

- Angle traced by minute hand in 60 min. = 360°
- Angle traced by minute hand in 1 min. = $\frac{360°}{60}$
- Angle traced by it in 20 min.

$$= \frac{360° \times 20}{60}$$

$$= 120°$$



Example 1

- Angle traced by the hour hand in

  12 hours = 360°

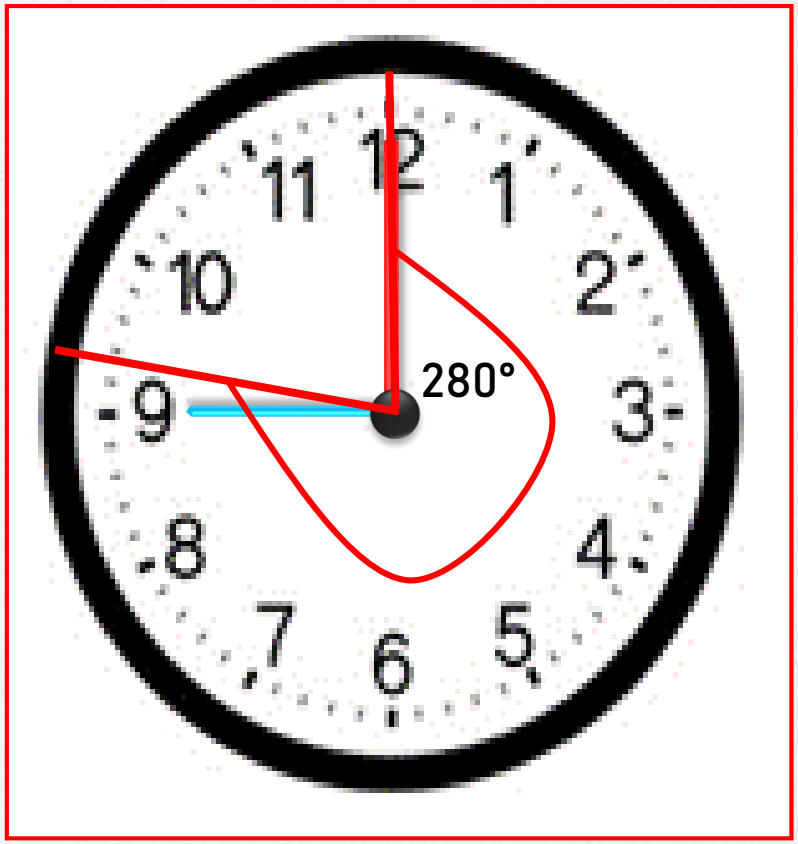
- Angle traced by the hour hand in

  1 hours = $\frac{360°}{12}$

- Angle traced by the hour hand in

  9 hours 20 min. (i.e.9 $\frac{20}{60}$ hr. = 9 $\frac{1}{3}$

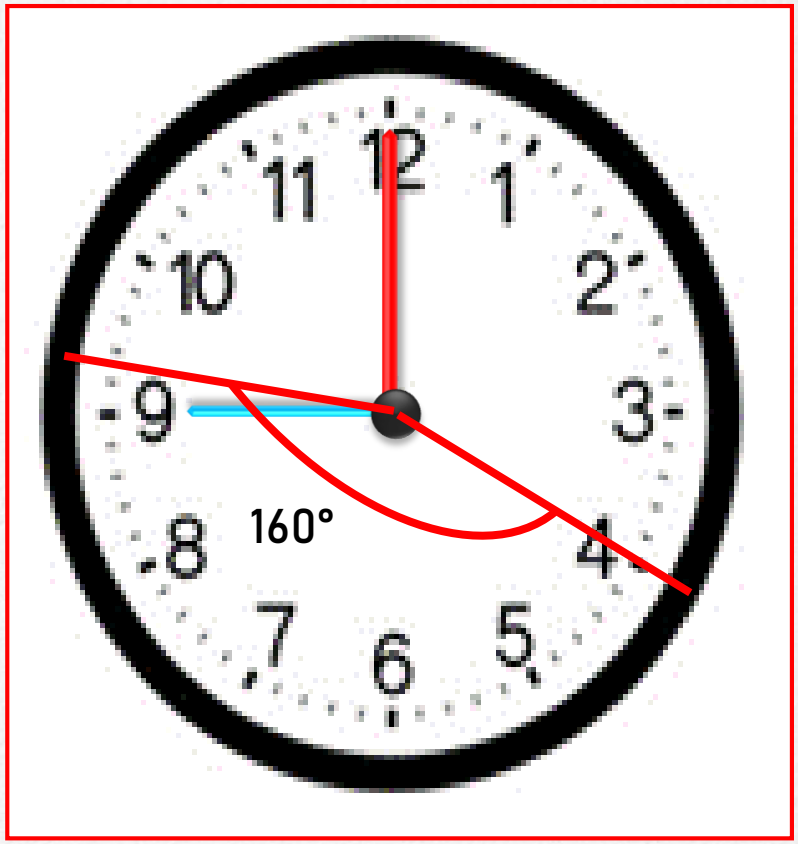
  = $\frac{28}{3}$hr.) = $\frac{360° \times 28}{12 \times 3}$ = 280°



Example 1

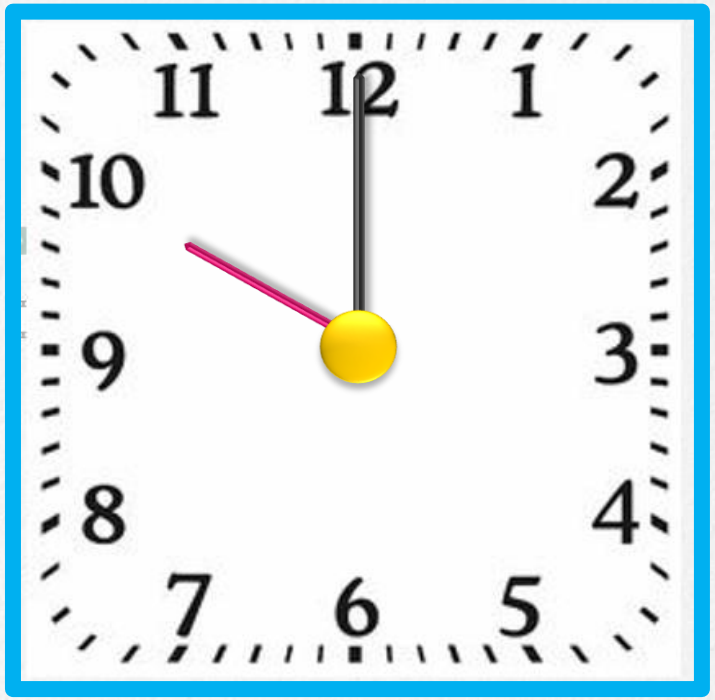
- Angle traced by minute hand in 20 min. = 120 °
- Angle traced by the hour hand in 9 hours 20 min.

  = 280°
- Angle between the minute hand and the hour hand of a clock when the time is 9.20 am = 280° – 120 ° = 160 °



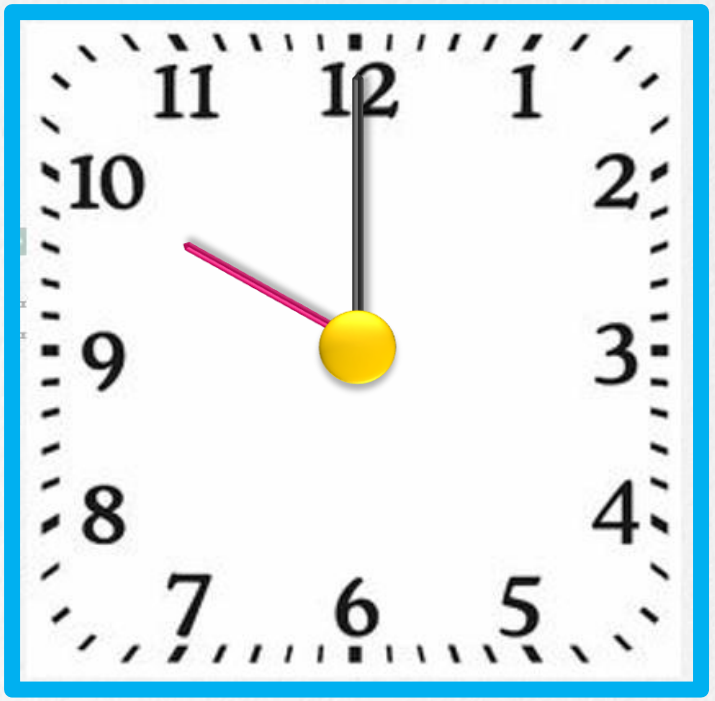
Example 2

- At what time between 10 and 11 o'clock will the hands of a clock be together ?



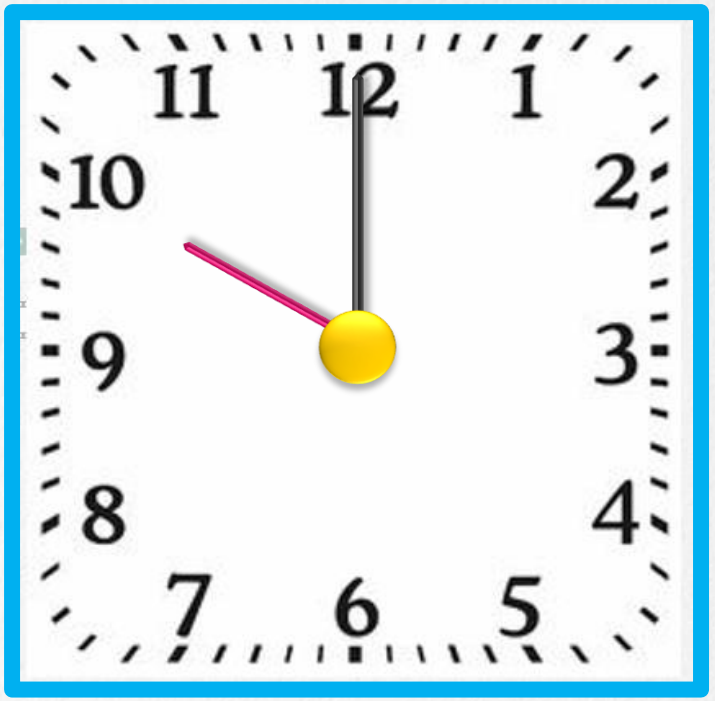
Example 2

- At 10 o'clock, the hour hand is at 10 and the minute hand is at 12, i.e. they are 10 min. spaces apart.
- The minute hand is 10 minutes spaces ahead of the hour hand.
- To be together, the minute hand must gain 50 minutes over the hour hand.



Example 2

- 55 minutes are gained by minute hand in 60 min.
- 1 minute is gained by minute hand in $\frac{60}{55}$ min.
- 50 minutes will be gained by minute hand in $\frac{60 \times 50}{55} = 54\frac{6}{11}$ mins.
- The hands will coincide at = $54\frac{6}{11}$ min. past 10.



Example 3

- At what time between 3 and 4 o'clock will the hands of a clock be together ?

Example 3

- At 3 o'clock, the hour hand is at 3 and the minute hand is at 12, i.e. they are 15 min. spaces apart.
- The minute hand is 15 minutes spaces behind of the hour hand.
- To be together, the minute hand must gain 15 minutes over the hour hand.

Example 3

- 55 minutes are gained by minute hand in 60 min.
- 1 minute is gained by minute hand in = $\frac{60}{55}$ min.
- 15 minutes will be gained by minute hand in = $\frac{60 \times 15}{55} = 16\frac{4}{11}$ min.

- The hands will coincide at $16\frac{4}{11}$ min past 3.

Example 4

- At what time between 5 and 6 o'clock will the hands of a clock be at right angle?

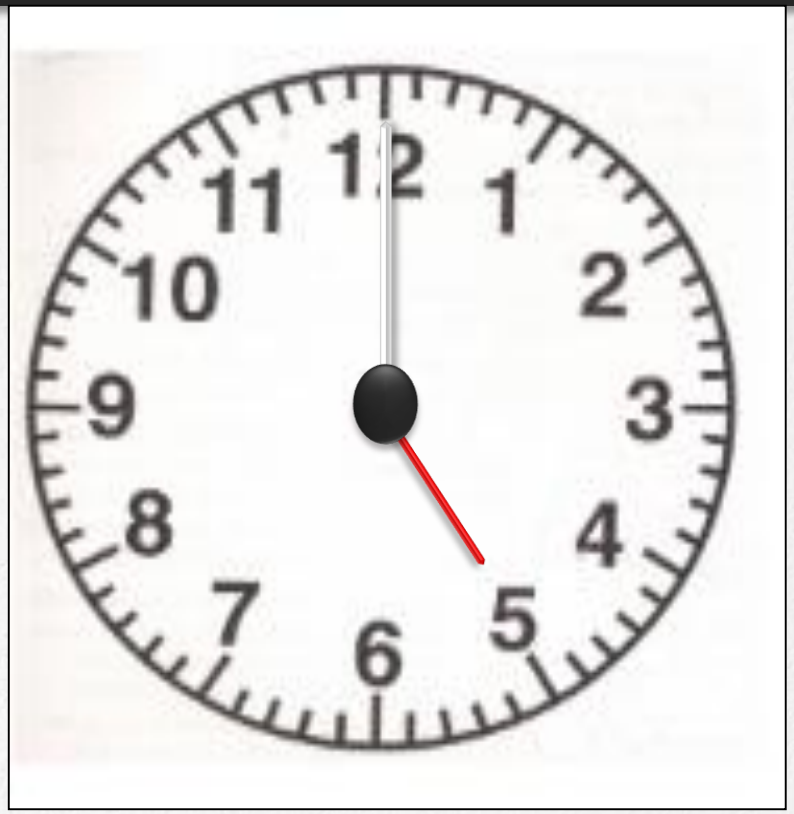
Example 4

- At 5 o'clock, the minute hand will be 25 min. spaces behind the hour hand.
- When the two hands are 15 min. spaces apart, then they are at right angles.
- Case I
  - When minute hand is 15 min. spaces behind the hour hand.
- Case II
  - When the minute hand is 15 min. spaces ahead of the hour hand.

Case I

- Min. hand is 15 min. behind the hour hand
- Min. hand will have to gain

  (25 – 15) = 10 minute spaces
- 55 min. spaces are gained Min. hand in 60 min.



- 10 min. spaces will be gained by Min. hand in $\frac{60 \times 10}{55} = 10\frac{10}{11}$ min.

Case II

- When the minute hand is 15 min. spaces ahead of the hour hand .
- Min. hand will have to gain

  (25 + 15) = 40 minute spaces
- 55 min. spaces are gained Min. hand in 60 min.
- 40 min. spaces will be gained by Min. hand in $\frac{60 \times 40}{55} = 43\frac{7}{11}$ min.

Example 5

- Find at what time between 9 and 10 o'clock will the hands of a clock be in the same straight line but not together.
- At 9 o'clock, the hour hand is at 9 and the minute hand is at 12, i.e. the two hands are 15 min. spaces apart.

Example 5

- To be in the same straight line but not together they will be 30 minute spaces apart.
- So, the minute hand will have to gain (30 – 15) = 15 min. spaces over the hour hand.

Example 5

- 55 minute spaces are gained in 60 min.
- 15 minute spaces will be gained in $\frac{60 \times 15}{55} = 16\frac{4}{11}$ min.
- The hands will be in the same straight line but not together at $16\frac{4}{11}$ min. past 9.

Example 6

- At what time between 8 and 9 o'clock are the hands of a clock 5 minutes apart?

Case I –Minute hand is 3 min. spaces behind

- At 8 o'clock, the minute hand is 40 min. spaces behind the hour hand.
- In this case, the minute hand has to gain (40 – 5) = 35minute spaces.
- 55 min. are gained in 60 min.
- 35 min. are gained in $\frac{60 \times 35}{55} = 38\frac{2}{11}$ min.

- The hands will be 5 min. apart at $38\frac{2}{11}$ min. past 8.

Case – II

- At 8 o'clock, the minute hand is 40 min. spaces behind the hour hand.
- In this case, the minute hand has to gain (40 + 5) = 45minute spaces.
- 55 min. are gained in 60 min.
- 45 min. are gained in $\frac{60 \times 45}{55} = 49\frac{1}{11}$ min.

- The hands will be 5 min. apart at $49\frac{1}{11}$ min. past 8.

Example 7

- Dhruvika leaves home between 8 a.m. and 9 a.m. and returns between 2 p.m. and 3 p.m. to find that the minute and hour hands have interchanged their positions. How long was Dhruvika out of the house?

Example 7

- The hands will interchange positions after crossing each other 6 times i.e. they together will make (6 + 1) or 7 complete revolutions.

Example 7

- Since the hands interchange positions after every $55\frac{5}{13}$ minutes.
- Required time interval = $55\frac{5}{13} \times 7 = 6\text{hr } 27\frac{9}{13}$ min.

Example 8

- A clock is set right at 9 a.m. The clock gains 20 minutes in 24 hours. What will be the true time when the clock indicates 3 p.m. on the following day?
- Time from 9 a.m. on a day to 3 p.m. on the following day

  = 30 hours.
- 24 hours 20 min. of this clock = 24 hours of the correct clock.
- $\frac{73}{3}$ hrs of this clock = 24 hrs of the correct clock.

Example 8

- $\frac{73}{3}$ hrs of this clock = 24 hrs of the correct clock.

- 30 hrs of this clock = $\frac{24 \times 3 \times 30}{73}$ hrs. of the correct clock

$= 29 \text{ hrs } 55 \frac{48}{73}$ of correct clock.

(29hr 59 min. approx.)

The correct time is 29 hrs $55 \frac{48}{73}$ min. (29hr 59 min. approx.) after

9 a.m. i.e. 2 hrs $55 \frac{48}{73}$ min. (2hr 59 min. approx.) min. past 12.

Example 9

- A clock is set right at 5 a.m. The clock loses 16 minutes in 24 hours. What will be the true time when the clock indicates 10 p.m. on 4th day?
- Time from 5 a.m. on a day to 10 p.m. on 4th day = 89 hours.
- Now 23 hrs 44 min. of this clock = 24 hours of correct clock.

Example 9

- $\frac{356}{15}$ hrs of this clock = 24 hours of correct clock.

- 89 hrs of this clock = $\frac{24 \times 15 \times 89}{356}$ hrs of correct clock

  = 90 hrs of correct clock.

- The correct time is 11 p.m.

Example 10

- The minute hand of a clock overtakes the hour hand at intervals of 65 minutes of the correct time. How much a day does the clock gain or lose?
- In a correct clock, the minute hand gains 55 min. spaces over the hour hand in 60 minutes.
- To be together again, the minute hand must gain 60 minutes over the hour hand.

Example 10

- 55 min. are gained in 60 min.
- 60 min. are gained in $\frac{60}{55}$ x 60 =65 $\frac{5}{11}$ min.
- They are together after 65 min.
- Gain in 65 min. = 65 $\frac{5}{11}$ – 65= $\frac{5}{11}$ min.
- Gain in 24 hours i.e. 24 x 60 min = $\frac{5 \times 24 \times 60}{11 \times 65}$ min.
- The clock gains 10 $\frac{10}{43}$ minutes in 24 hours.

Conclusion

- Angle between the hour hand and the minute hand of a clock.
- The hands of a clock be together (coincide).
- The hands of a clock be at right angle.
- The hands of a clock be in the same straight line (not together).
- Time - Hands of a clock x minutes apart.
- True time - Clock gains or loses in x minutes in 24 hours.

Summary

- Computation of angle between hands of clock in different situations.

That’s all for now…