SELF LEARNING MATERIAL
UNIT-4
Directions

4.0 OBJECTIVES:

After reading this unit, you will be able to:

- Finding the Direction Only
- Finding the Distance Only
- Finding both the Distance and Direction

4.1 INTRODUCTION:

Direction is a measurement of position of one thing with respect to another thing or a reference point. Distance between two points is a measurement of the shortest distance, i.e., the displacement between the two points.

The shortest distance between two points may be different from the total distance covered in going from one point to the other.

The problems based on direction and distance have instructions regarding the movement of a person or an object from a starting point (also called origin) upto an end point (also called destination).

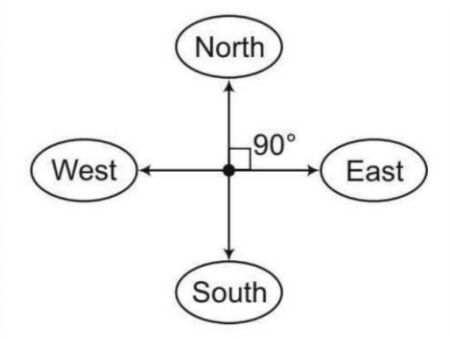
These instructions generally provide magnitude as well as direction of the movement. These questions are designed to test the candidate's ability to sense direction.

Questions on direction and distance are simpler than other questions, if the student possesses the right knowledge of the directions.

Prime Directions

There are four prime directions as shown below

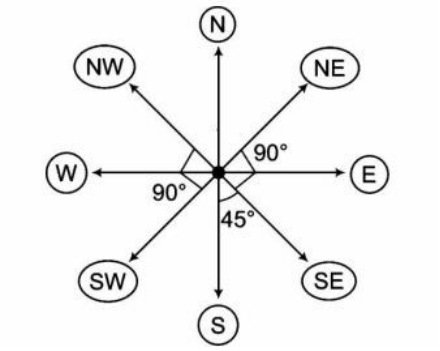
1. North 2. South 3. East 4. West
The angle between any two prime directions is 90°.



Subdirections/Cardinal Directions

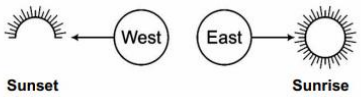
A direction between two main or prime directions is known as a subdirection/cardinal direction. There are four subdirections as given below

1. North-East (NE) 2. South-East (SE) 3. South-West (SW) 4. North-West (NW) The angle between any two adjacent subdirections is 90°.



Concept of Directions

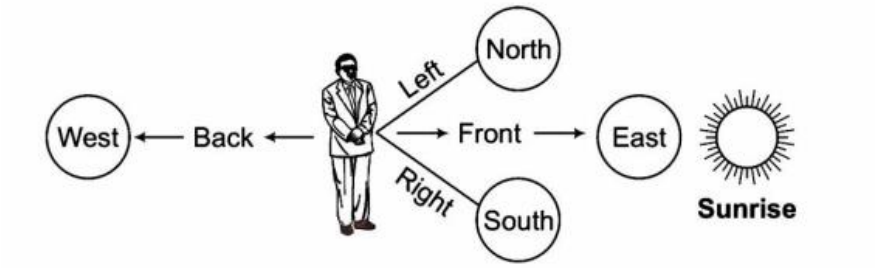
It is based on the position of the Sun. The Sun rises in the East and sets in the West.



If we face the Sun when it rises, then our position is as follows

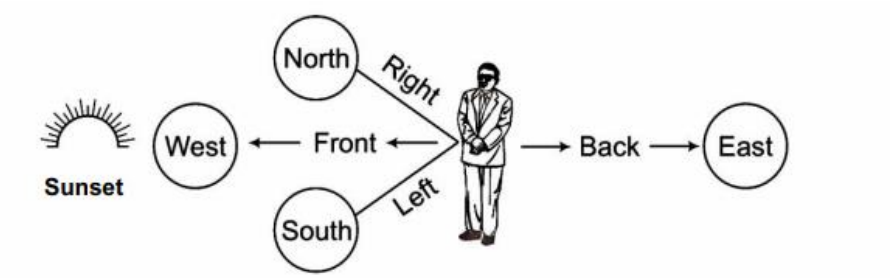
• Direction towards our front = East

• Direction towards our left hand = North
• Direction towards our back = West
• Direction towards our right hand = South



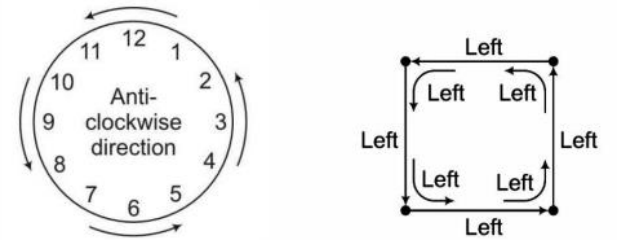
If we face sunset, then our position is as follows

•Direction towards our back = East
•Direction towards our right hand = North
•Direction towards our front = West
•Direction towards our left hand = South

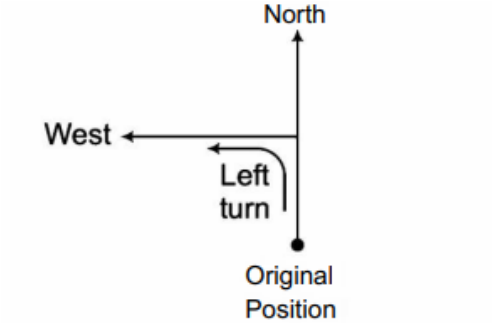


Concept of Turn

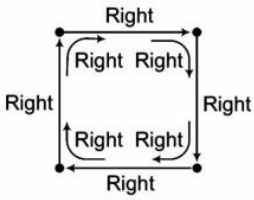
1. Left Turn (Anti-clockwise Turn)—When a person turns in a direction opposite to motion of a clock, then this turn is called left turn or anti-clockwise turn.



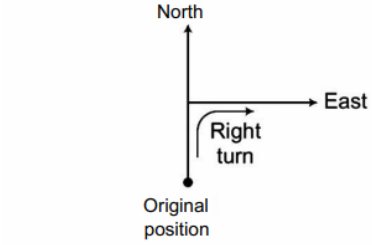
• When a person goes towards North from his original position and turns anti-clockwise, then it is his left.



2. Right Turn (Clockwise Turn)—When a person takes a turn in the direction of motion of clock, then this turn is called right turn or clockwise turn.



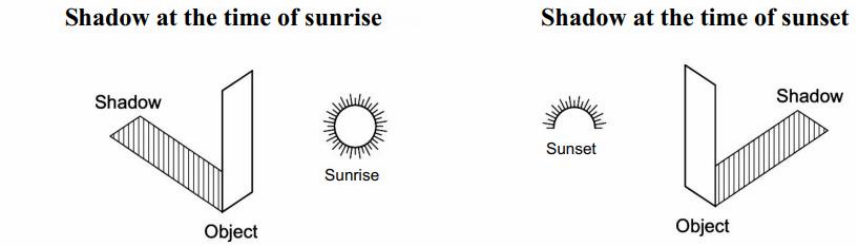
• When a person goes towards North and turns clockwise, then it is his right.



Concept of Shadow

In the morning, when the Sun rises in the East, the shadow of any person or object is in the West direction. Similarly, in the evening, when the sun sets in the West, the shadow of a person or an object is towards the East.

At 12:00 noon, there will be no shadow as the rays of the Sun are vertically downwards at that time.



4.2 Finding the Direction Only

There are broadly five types of questions asked in various competitive examinations based on finding the direction only

A. When Initial Direction is Given

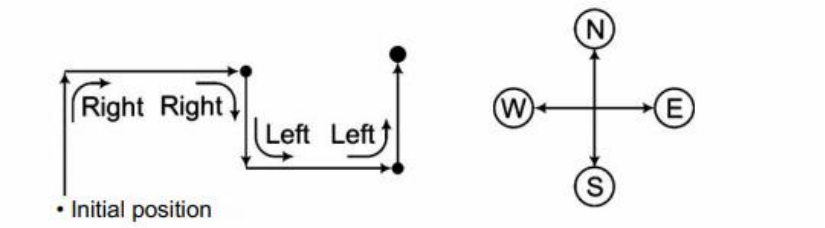
In this type of questions, initial direction of a person's movement along with the various turns taken during the course of a journey is given. The objective is to determine the final direction in which the person is moving.

Example 4.1: Vandana is going Northwards. She turns right, moves some distance and again turns to her right. After moving some distance she turns to her left, goes forward and again turns to her left. In which direction now is Vandana going?

(a) North (b) South-West (c) South (d) West

Solution:

Clearly, Vandana is going towards North.



B. When Final Direction is Given

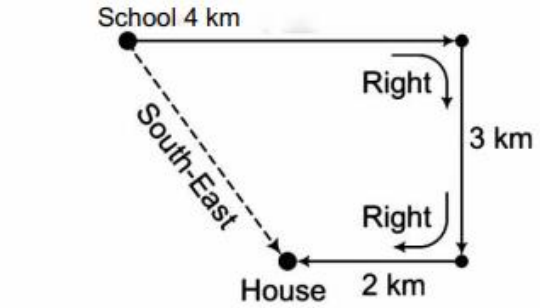
In this type of questions, various turns taken during a journey are given along with the final direction. The initial direction is required to be determined.

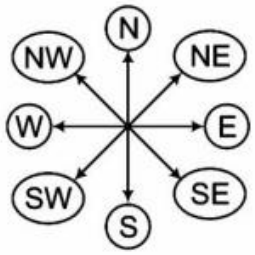
Example 4.2: Shiv goes 4 km straight from his school. He turns to his right and walks 3 km. He again moves 2 km after turning right to reach his house. If his house is located in South-East from his school, then in which direction Shiv started moving initially from his school?

(a) North-East (b) West (c) East (d) North

Solution:

Clearly, he started moving towards East initially.





C. Directions After Replacement

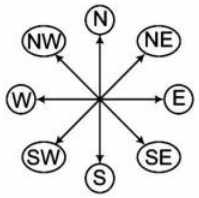
In this type of questions, one direction gets designated by some other direction, there by changing the designation of other directions accordingly. It is required to determine the new designation of any one (or more) of the remaining directions.

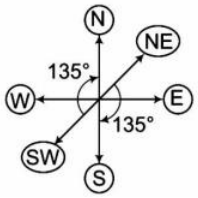
Example 4.3: If South-West becomes North, then what will North-East be?

(a) North (b) South-east (c) East (d) South

Solution:

Clearly, directions are moving 135° clockwise. Hence, North-East will become South moving 135° clockwise





D. When Shadow is Given

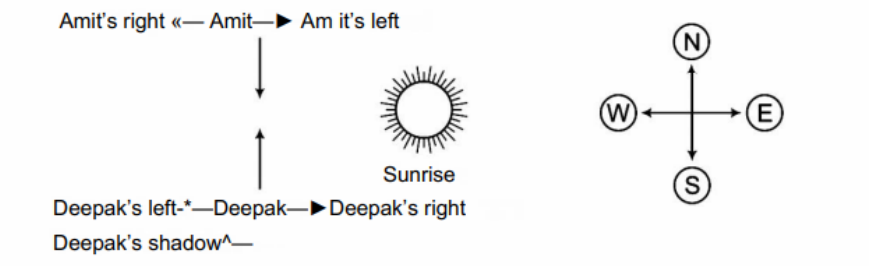
In this type of questions, the direction of shadow form action is given and based on this information the direction of a person is to be found out.

Example 4.4: At sunrise, Amit and Deepak are having a conversation standing in front of each other. The shadow of Deepak is formed towards the right hand of Amit. What direction is Deepak facing?

(a) North-East (b) South (c) East (d) North

Solution:

Clearly, Deepak is facing North



E. Clock Based Directions

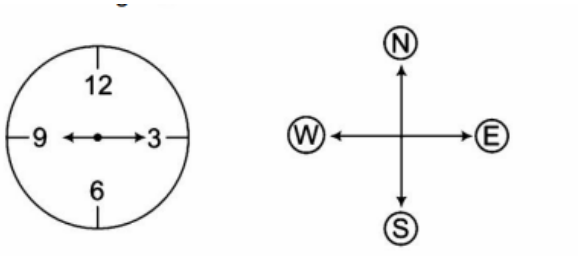
Sometimes direction based problems involve application of knowledge of clocks and the relative positioning of both hands of clocks at particular time. In these type of questions, direction of minute or hour hand is to be found out as per the given time.

Example 4.5: The time on the watch is 9:15 and the hour hand points towards West. The direction of the minute hand is

(a) North (b) South (c) East (d) West

Solution:

So, when hour hand is pointing towards West, then the minute hand will be pointing towards East at 9 :15.



CHECK YOUR PROGRESS 4.1:

1. A man walks 6 km South, turns left and walks 4 km, again turns left and walks 5 km. Which direction is he facing now?

(a) South (b) North (c) East (d) West

2. One evening before sunset, two friends Raman and Arjun were talking to each other face to face. If Raman's shadow was exactly to his left side, which direction was Arjun facing?

   (a) West (b) East (c) North (d)south

3. A clock is so placed that at 12 noon its minute hand points towards North-East. In which direction does its hour hand point at 1: 30 pm?

   (a) North (b) South (c) East (d) West

4. City D is to the West of city M. City R is to the South of city D. If city K is to the East of city R, then in which direction is city K located in respect of city D?

   (a) North (b) East (c) North-East (d) South-East

5. Kamal is facing South. He turns 135° in the anti-clockwise direction and then 180° in the clockwise direction. What direction is he facing now?

   (a) North (b) South-West (c) East (d) North-West

   # # Answers are given at the end of the document.

4.3 Finding the Distance Only

There are two types of questions based on finding the distance that are asked in various competitive examinations

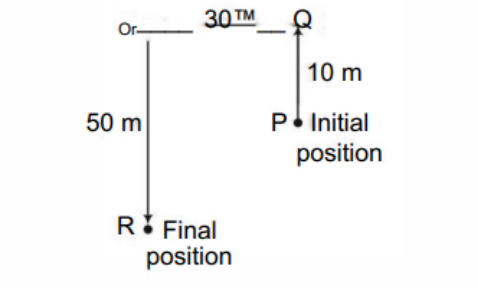
A. Finding the Total Distance

In this type of questions, it is asked to determine the total distance cover by a particular person or object.

Example 4.6: Vipul goes Northward 10 m. He turns left and walks 30 m, then the again turns left and walks 50 m, then how much distance Vipul travelled?

(a) 60 m (b) 20 m (c) 10 m (d) 90 m

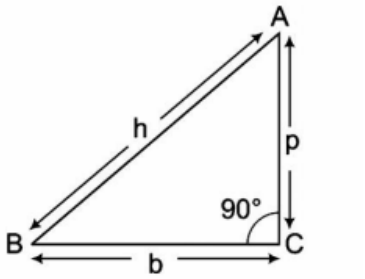
Solution: Total distance = PQ + QO + OR = 10+ 30+ 50 = 90 m



B. Finding the Minimum Distance

In this type of questions, minimum distance between initial and final points is to be found out

To find the minimum distance between the starting and end point, we use the Pythagoras Theorem which is stated as given below "In a right angled triangle, square of the hypotenuse (h) is equal to the sum of the squares of its base (b) and perpendicular (p).



h^2=b^2 +p^2

where, h = AB = Hypotenuse, b = BC = Base, p = AC = Perpendicular AB (or BA) is the minimum or shortest distance to reach A from B (or to reach B from A).

Example 4.7: Kavi walks Northward upto 10 m. He turns left and walks 30 m. Finally, he turns left and walks 50 m. At what distance Kavi is now from his starting position?

(a) 50 m (b) 10 m (c) 20 m (d) 90 m

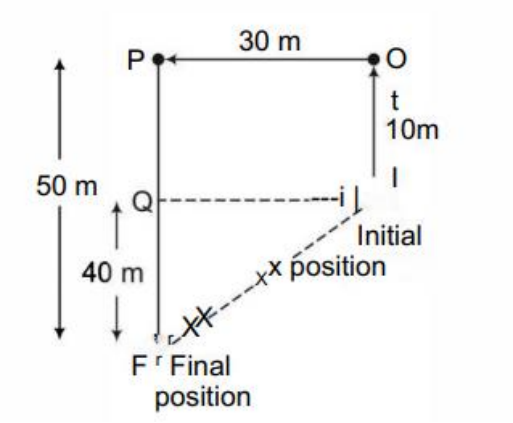
Solution:

According to the question, the direction diagram is drawn as shown in figure

IO = 10 m, OP = 30 m, PF = 50 m
QI = OP = 30 m, PQ = IO = 10m
QF = PF - PQ = 50 - 10 = 40 m

F represents the final position.

Required distance, IF = SQRT((QI)^ 2 + (QF)^ 2)
= SQRT(7900+1600)
= 72500
= 50 m



CHECK YOUR PROGRESS 4.2:

1. A and B start walking in opposite directions. A covers 3 km and B covers 4 km. Then, A turns right and walks 4 km while B turns left and walks 3 km. How far is each from the starting point?

   (a) 10 km (b) 8 km (c) 5 km (d) 4 km

2. Vijay starts walking straight towards East. After walking 75 m he turns to the left and walks 25 m straight. Again he turns to the left and walks a distance of 40 m straight. Again he turns to the left and walks a distance of 25 m. How far is he from the starting point?

   (a) 140 m (b) 115 m (c) 50 m (d)35 m

   # # Answers are given at the end of the document.

4.4 Finding both the Distance and Direction

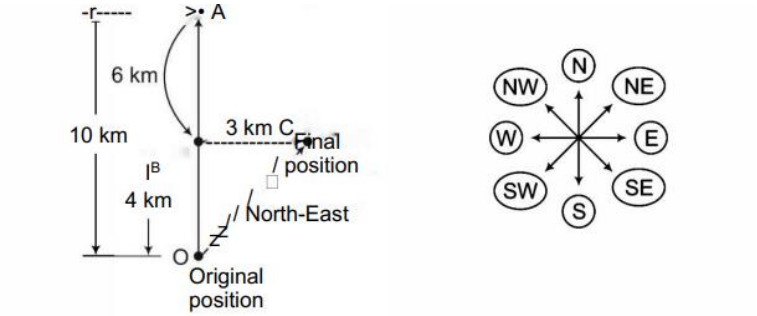
In this type of questions, it is asked to determine both distance and direction

Example 4.8:

Mahima goes 10 km North, then goes 6 km South, again she moves on 3 km East. At what distance is she now from original position and in which direction?

(a) 5 km North-East
(b) 5 km South-East
(c) 8 km North-East
(d) 10 km South-East

Solution:



Here, AB = 6 km, BC = 3 km, AO = 10 km and OB = AO - AB = (10 - 6)= 4 km
OC = SQRT((OB)^ 2 + (BC)^ 2) = SQRT(16+9) = SQRT(25) = 5 km

Hence, Mahima is at a distance of 5 km in the North-East direction in respect of original position.

CHECK YOUR PROGRESS 4.3:

1. Shreya started from point P and walked 2 m towards West. She, then took a right turn and walked 3 m before taking a left turn and walking 5 m. She finally took a left turn, walked 3 m and stopped at a point Q. How far is point Q from point P?

(a) 2 m (b) 6 m (c) 7 m (d) 8 m (e) 12m

2. Mohan walked 30 m towards South, took a left turn and walked 15 m. He, then took a right turn and walked 20 m. He again took a right turn and walked 15 m. How far is he from the starting point?

(a) 95 m (b) 50 m (c) 70 m (d) Cannot be determined (e) None of these

3. Ankit started walking towards North. After walking 30 m, he turned towards left and walked 40 m. He, then turned left and walked 30 m. He again turned left and walked 50 m. How far is he from his original position?

(a) 50 m (b) 40 m (c) 30 m (d) None of these

4. Laxman went 15 km to the West from house, then turned left and walked 20 km. He, then turned East and walked 25 km and finally turning left covered 20 km. How far is he now from his house?

(a) 15 km (b) 20 km (c) 25 km (d) 10 km

5. A and B start walking from the same point A goes North and covers 3 km, then turns right and covers 4 km. B goes West and covers 5 km, then turns right and covers 3 km. How far apart are they from each other?

(a) 10 km (b) 9 km (c) 8 km (d) 5 km

 # # Answers are given at the end of the document.

SUMMARY:

- Concept of finding the Direction is explained
- Concept of finding the Distance is explained
- Concept of finding the Direction & Distance is explained

4.5 Glossary:

Direction : a course along which someone or something moves.
Distance : the length of the space between two points.
Displacement : Shortest distance between two points.

4.6 Suggested Readings:

- Quantitative Aptitude for Competitive Examinations by R.S.Agarwal. Published by S. CHAND
- Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMS etc.
- Quantitative Aptitude by Pearson Publications

4.7 Practice exercise:

1. A man goes towards East 5 km, then he takes a turn to South-West and goes 5 km. He again takes a turn towards North-West and goes 5 km With respect to the point from where he started, where is he now?

(a) At the starting point
(b) In the West
(c) In the East
(d) In the North-East

2. Nikhil walked 30 m towards East took a left turn and walked 20 m. He again took a left turn and walked 30 m. How far and in which direction is he from his starting point?

(a) 20 m, North
(b) 80 m, North
(c) 20 m, South
(d) 80 m, South
(e) Data inadequate

3. Rakesh is standing at a point. He walks 20 m towards the East and further 10 m towards the South, then he walks 35 m towards the West and further 5 m towards the North, then he walks 15 m towards the East. What is the straight distance (in m) between his starting point and the point where he reached last?

(a) 0
(b) 5
(c) 10
(d) Cannot be determined

4. Anoop starts walking towards South. After walking 15 m he turns towards North. After walking 20 m, he turns towards East and walks 10 m. He, then turns towards South and walks 5 m. How far is he from his original position in which direction?

(a) 10 m, North
(b) 10 m, South
(c) 10 m, West
(d) 10 m, East

5. Village Chimur is 20 km to the North of village Rewa. Village Rahate is 18 km to the East of village Rewa. Village Angne is 12 km to the West of Chimur. If Sanjay starts from village Rahate and goes to village Angne, in which direction is he from his starting point?

(a) North
(b) North-West
(c) South
(d) South-East

6. A rat runs 20 m towards East and turns to right, then runs 10 m and turns to right, runs 9 m and again turns to left, runs 5 m and then turns to left, runs 12 m and finally turns to left and runs 6 m. Now, which direction is the rat facing?

(a) East
(b) North
(c) West
(d) South

7. Starting from a point S, Mahesh walked 25 m towards South. He turned to his left and walked 50 m. He, then again turned to his left and walked 25 m. He again turned to his left and walked 60 m and reached a point T. How far Mahesh is from point S and in which direction?

(a) 10 m, West
(b) 25 m, North
(c) 10 m, East
(d) 25 m, West

8. Mohan walked 30 m towards South, took a left turn and walked 15 m. He, then took a right turn and walked 20 m. He again took a right turn and walked 15 m. How far is he from the starting point?

(a) 95 m
(b) 50 m
(c) 70 m
(d) Cannot be determined
(e) None of the above

9. Two buses start from the opposite points of a main road, 150 km apart. The first bus runs for 25 km and takes a right turn and then runs for 15 km. It then turns left and runs for another 25 km and takes the direction back to reach the main road. In the mean time, due to the minor break down the other bus has run only 35 km along the main road. What would be the distance between the two buses at this point ?

(a) 65 km
(b) 80 km
(c) 75 km
(d) 85 km

10. Ravi starts walking towards North. After walking 15 m he turns towards South. After walking 20 m, he turns towards East and walks 10 m. He, then turns towards North and walks 5 m. How far is he from his original position and in which direction?

(a) 10 m, North
(b) 10 m, South
(c) 10 m, East
(d) 10 m, West

11. Raman starts from point P and walks towards South and stops at point Q. He now takes a right turn followed by a left turn and stops at point R. He finally takes a left turn and stops at point S. If he walks 5 km before taking each turn, towards which direction will Raman have to walk from point S to reach point Q?

(a) North
(b) South

(c) West
(d) East

12. Town D is to the West of town M. Town R is to the South of town D. Town K is to the East of town R. Town K is towards which direction of town D?

(a) South
(b) East
(c) North-East
(d) South-East
(e) None of these

13. Rama travels a distance of 5 km from a place A towards North, turns left and walks 3 km, again turns right and walks 2 km. Finally he turns right and walks 3 km to reach the place B. What is the distance between A and B?

(a) 7 km
(b) 13 km
(c) 2 km
(d) 10 km

14. A started from a place, after walking for 1 km, he turns to the left, then walking for 1/2 km, he again turns to left. Now, he is going Eastward direction. In which direction, did he original start?

(a) West
(b) East
(c) South
(d) North

15. Starting from a point M, Harish walked 18 m towards South. He turned to his left and walked 25 m. He, then turned to his left and walked 25 m. He, then turned to his left and walked 18 m. He again turned to his left and walked 35 m and reached a point P. What is the direction of P in respect of M?

(a) East
(b) West
(c) North
(d) None of these

ANSWERS:

CHECK YOUR PROGRESS 4.1

1. b
2. c
3. c
4. d
5. b

CHECK YOUR PROGRESS 4.2

1. c
2. d

CHECK YOUR PROGRESS 4.3

1. c
2. b
3. d
4. d
5. b

Practice exercise 3.7

1. c
2. a
3. b
4. d
5. b
6. b
7. a
8. b
9. a
10. c
11. a
12. d
13. a
14. a
15. d