Introduction

In this chapter we will learn to draw line graphs and linear graphs. Let us understand about the line graph.

Line graph: It is a type of graph which dispays the continuous data that is changing over a period of time. It displays the series of data points connected together with the line segments joined consecutively.

Linear graph: It is a straight line graph drawn on a plane which connects points on x and y axis. It shows the linear relationship between the two variables.

Examples

Example 1 – The following table gives the growth chart of a child.

Age (in years)	**2**	**4**	**6**	**8**	**10**
Height (in cm)	**75**	**90**	**110**	**120**	**130**

Draw a line graph for the above data and answer the questions that follow:

(a) What was the height of the child at the age of 5 years?

(b) How much taller was the child at the age of 10 than at the age of 6?

(c) Between which two consecutive periods did the child grow faster?

Solution – The steps to draw a line graph are as follows:

Step 1: First, we draw x-axis and y-axis on a graph paper represented by OX and OY respectively.

Step 2: Then, we take age (in years) along the x-axis and height (in cm) along the y-axis.

Along y-axis, we start with 70 and use kink at the starting.

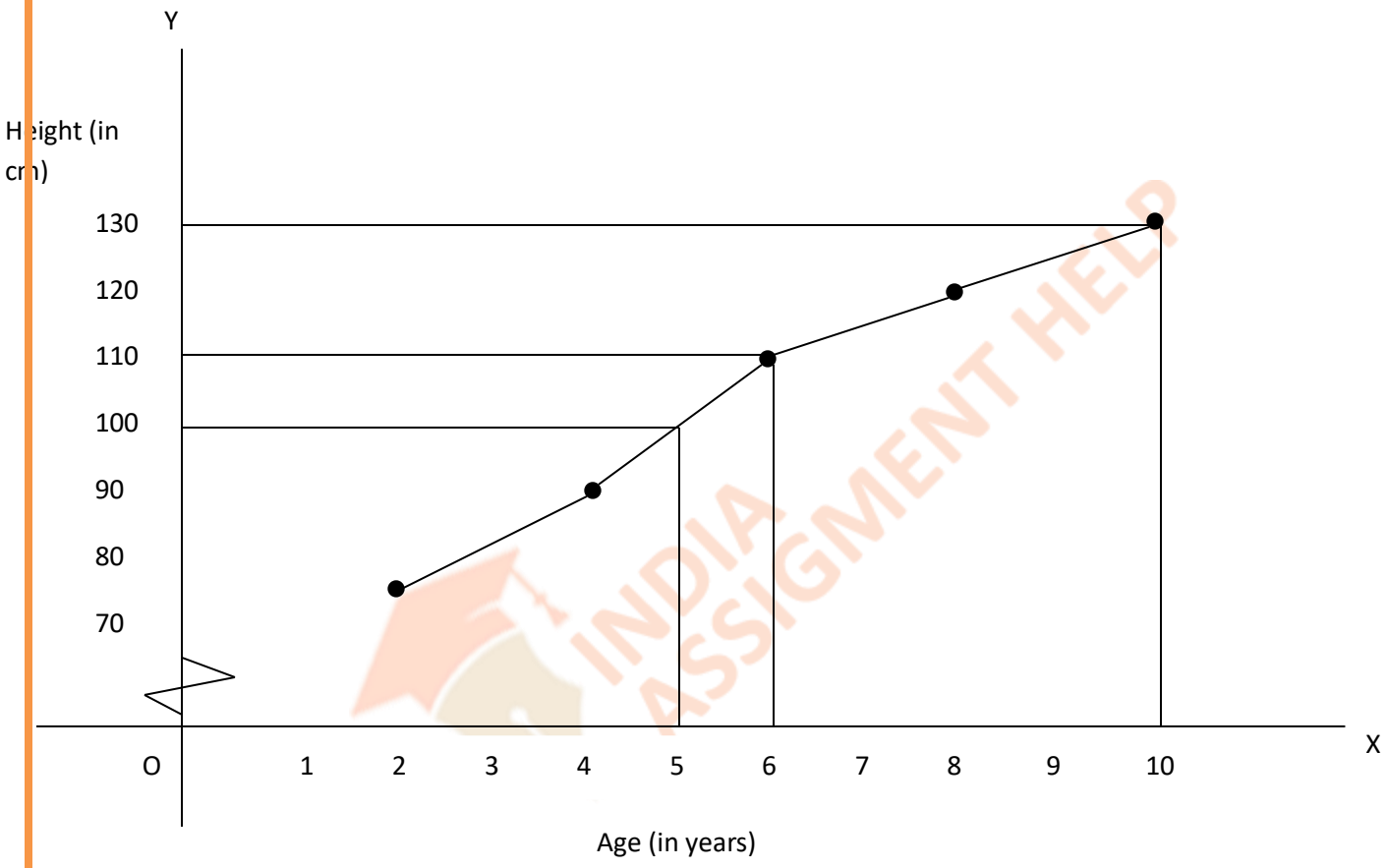
Step 3: Take scale as:

Along the x-axis: 1 unit = 1 year

Along the y-axis: I unit = 10 cm

Step 4: Now, start plotting the points (2, 75), (4, 90), (6, 110), (8, 120) and (10, 130)

Step 5: Connect all these point using line segments to get the required graph.



From the graph, we can answer the questions:

(a) The height of the child at the age of 5 years is 100 cm

(b) At the age of 10 years, height of child = 130 cm

At the age of 6 years, height of child = 110

Thus, difference is 130 - 110 = 20 cm

Therefore, the child is taller by 20 cm at the age of 10 than at the age of 6.

(c) We will find the growth of child between each two consecutive periods

Growth of child between 2 to 4 years = 90 – 75 = 15 cm

Growth of child between 4 to 6 years = 110 – 90 = 20 cm

Growth of child between 6 to 8 years = 120 – 110 = 10 cm

Growth of child between 8 to 10 years = 130 – 120 = 10 cm

Therefore, we get that between 4 to 6 years, the child grew faster.

Example 2 – The table given below shows the data collected for Tanvy's walking on a road

Time (in minutes)	**0**	**5**	**10**	**15**	**20**	**25**
Distance (in km)	**0**	**0.5**	**1**	**1.25**	**1.5**	**1.75**

Draw a line graph for the given data using a suitable scale and answer the questions given below:

(a) In what time periods did tanvy make the most progress?

(b) What is the ratio of the total distance covered in 15 minutes to that covered in 25 minutes?

(c) What is the percentage increase in distance covered in 15 minutes as compared to that in 10 minutes?

Solution – The steps to draw a line graph are as follows:

Step 1: First, we draw x-axis and y-axis on a graph paper represented by OX and OY respectively.

Step 2: Then, we take time (in minutes) along the x-axis and the distance covered (in km) along the y-axis.

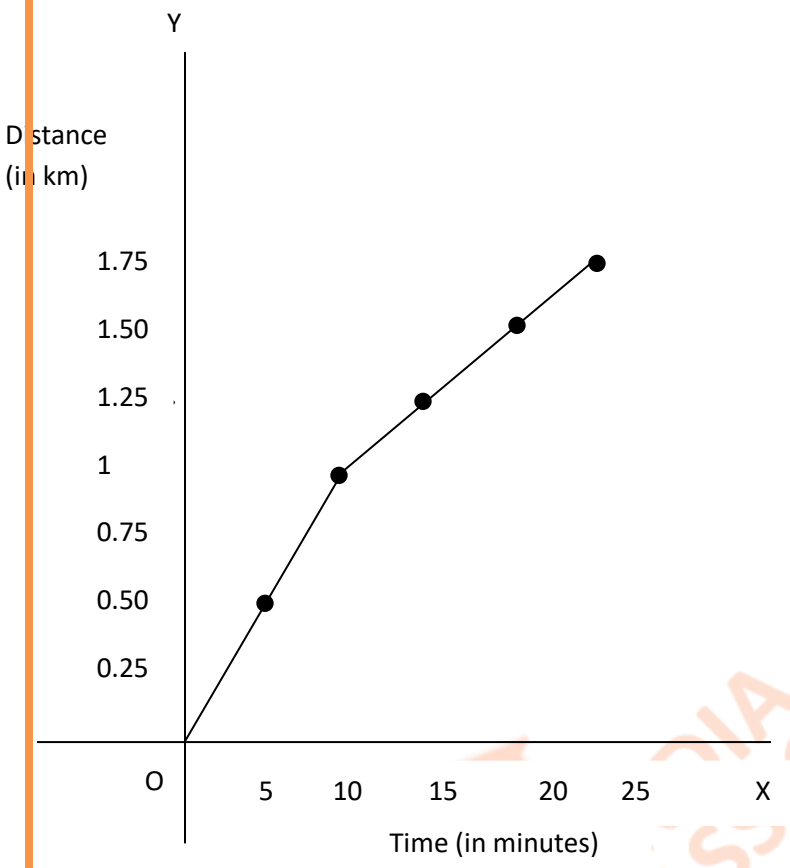
Step 3: Take scale as:

Along the x-axis: 1 unit = 5 minutes

Along the y-axis: I unit = 0.25 km

Step 4: Now, start plotting the points (0, 0), (5, 0.5), (10, 1), (15, 1.25), (20, 1.5) and (25, 1.75)

Step 5: Connect all these point using line segments to get the required graph.



From the graph, we can answer the questions:

(a) It is clear from the graph that tanvy covered the maximum distance in the periods 0 to 5 minutes and 5 to 10 minutes.

(b) Total distance covered in 15 minutes = 1.25 km

Total distance covered in 25 minutes = 1.75 km

Ratio = 1.25/1.75 = 5/7

= 5:7

(c) Distance covered in 10 minutes = 1 km

Distance covered in 15 minutes = 1.25 km

Increase in distance = 1.25 – 1 = 0.25 km

% increase in distance = $\frac{0.25}{1} \times 100$

= 25 %

Example 3 – The table given below shows the population (in thousands) of men and women in a village in different years.

Year	**2013**	**2014**	**2015**	**2016**	**2017**
Number of men	**11.5**	**12.4**	**13**	**13.8**	**14.2**
Number of women	**10.5**	**11.7**	**13**	**14.2**	**15.0**

Draw two line graphs for the above data, using a suitable scale and answer the questions given below:

(a) Find the ratio of the male population and female population in the year 2013.

(b) Find the ratio of the total population of the village in 2015 to that in 2017.

(c) Find the percentage increase in the population of women in 2017as compared to that in 2014.

(d) Between which two years is the increase % in the number of men maximum?

Solution – The steps to draw a double line graph are as follows:

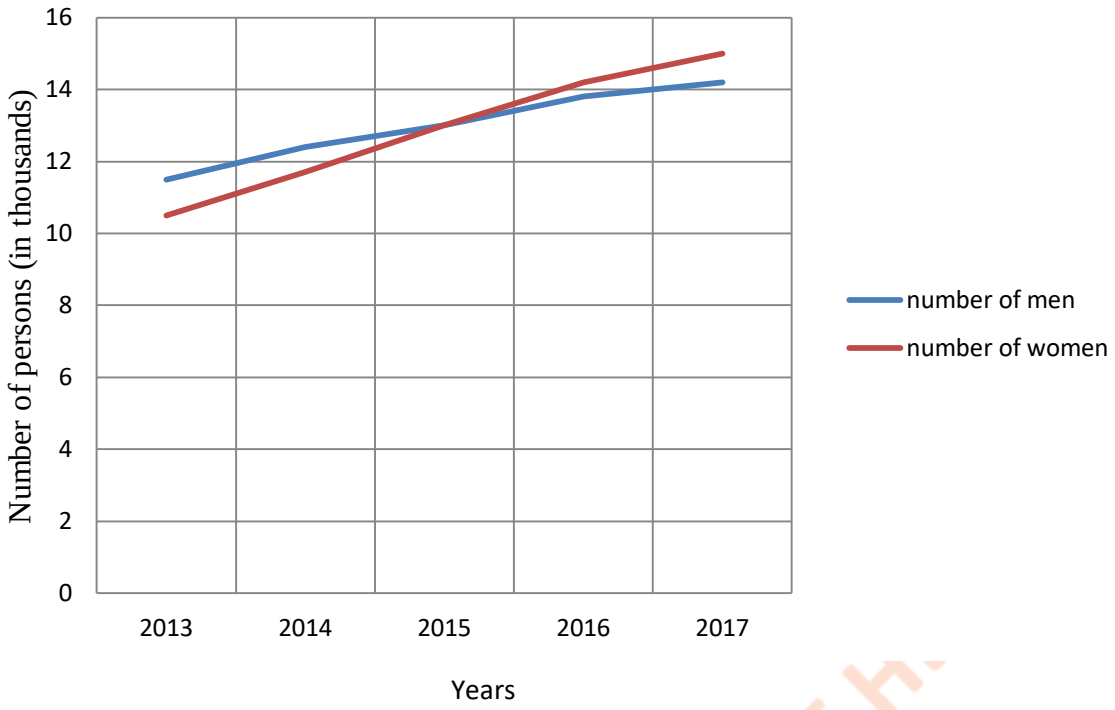
Step 1: First, we draw x-axis and y-axis on a graph paper represented by OX and OY respectively.

Step 2: Then, we take years at equal intervals from 2013 to 2017 along the x-axis and the number of persons in thousands along the y-axis.

Step 3: We plot double line graph which means that we plot the corresponding number of men in each year and the corresponding number of females in each year

Step 4: Now, start plotting the points (2013, 11.5), (2014, 12.4), (2015, 13), (2016, 13.8) and (2017, 14.2) and on joining these points, we get one graph

Also, plot the points (2013, 10.5), (2014, 11.7), (2015, 13), (2016, 14.2) and (2017, 15.0) and on joining these points, we get another graph



From the graph, we can answer the questions:

(a) In the year 2013,

Number of men = 11.5 × 1000 = 11500

Number of women = 10.5 × 1000 = 10500

Ratio = 11500/10500 = 23/21

23: 21

(b) In 2015, total population of the village = number of men + number of women

= 13000 + 13000 = 26000

In 2017, total population of the village = number of men + number of women

= 14200 + 15000 = 29200

Ration of total population in 2015 to that in 2017 = 26000/29200 = 65/73

65: 73

(c) Population of women in 2017 = 15 × 1000 = 15000

Population of women in 2014 = 11.7 × 1000 = 11700

Increase in women population = 15000 – 11700 = 3300

% increase = $\frac{3300}{11700} \times 100$

= 28.2 %

(d) Between 2013-2014,

% increase in men population = $\frac{12400-11500}{11500} \times 100 = \frac{900}{11500} \times 100 = 7.8\%$

Between 2014-2015,

% increase in men population = $\frac{13000-12400}{12400} \times 100 = \frac{600}{12400} \times 100 = 4.8\%$

Between 2015-2016,

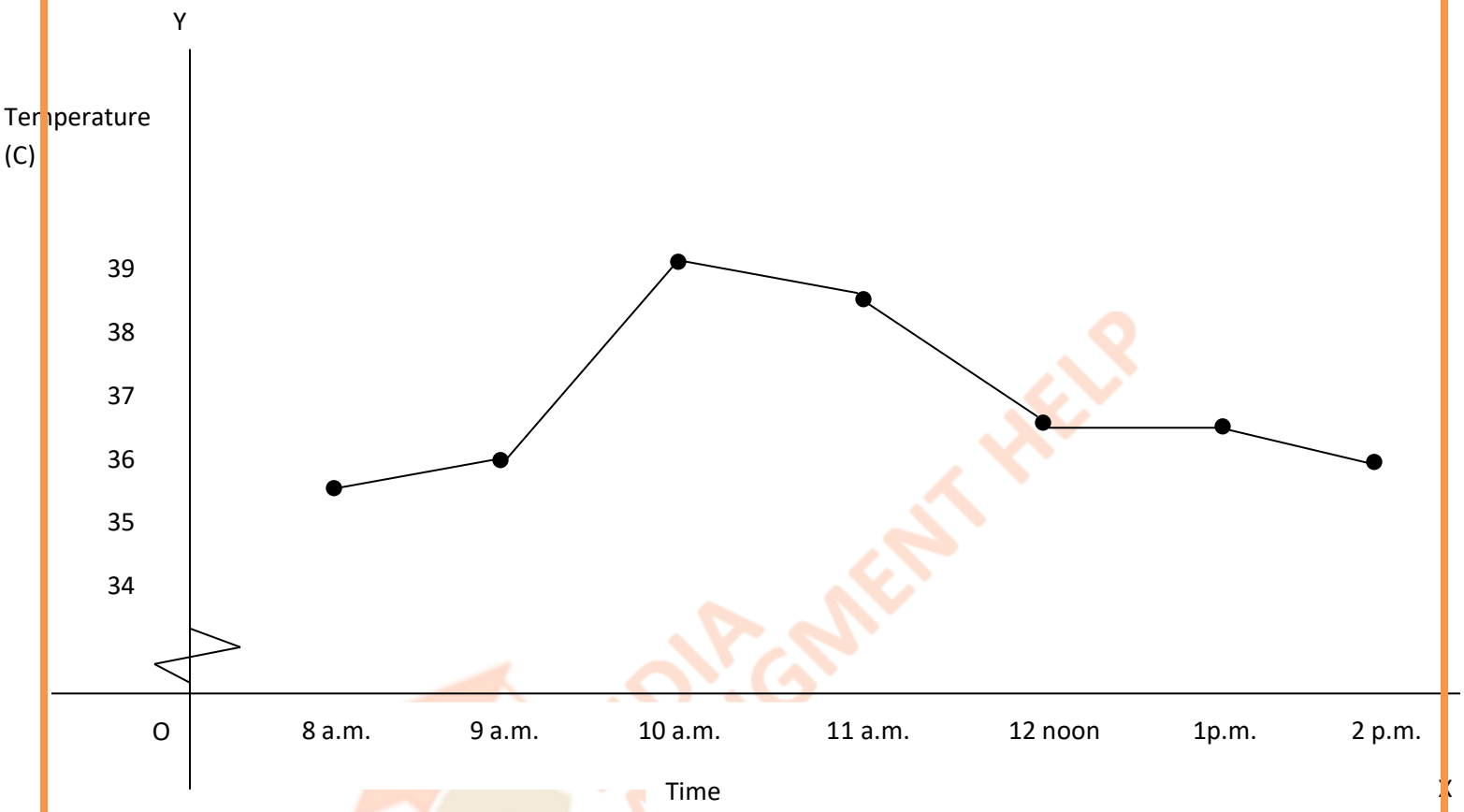
% increase in men population = $\frac{13800-13000}{13000} \times 100 = \frac{800}{13000} \times 100 = 6.15\%$

Between 2016-2017,

% increase in men population = $\frac{14200-13800}{13800} \times 100 = \frac{400}{13800} \times 100 = 2.89\%$

Therefore, the % increase in the number of men is maximum in the years 2013-2014

Example 4 – When Reenu fell sick, her doctor maintained a record of her body temperature taken every hour, as shown in the following graph.



Read the graph carefully and answer the questions given below.

(a) What was the patient's temperature at 12 noon?

(b) When was the patient's temperature 38.5 °C?

(c) What was the patient's temperature at 12.30 p.m.? Why?

(d) During which period of time did the patient's temperature show an upward trend?

(e) The patient's temperature was the same two times during the given period. What were these two times?

Solution – (a) The patient's temperature at 12 noon was 36.5 °C

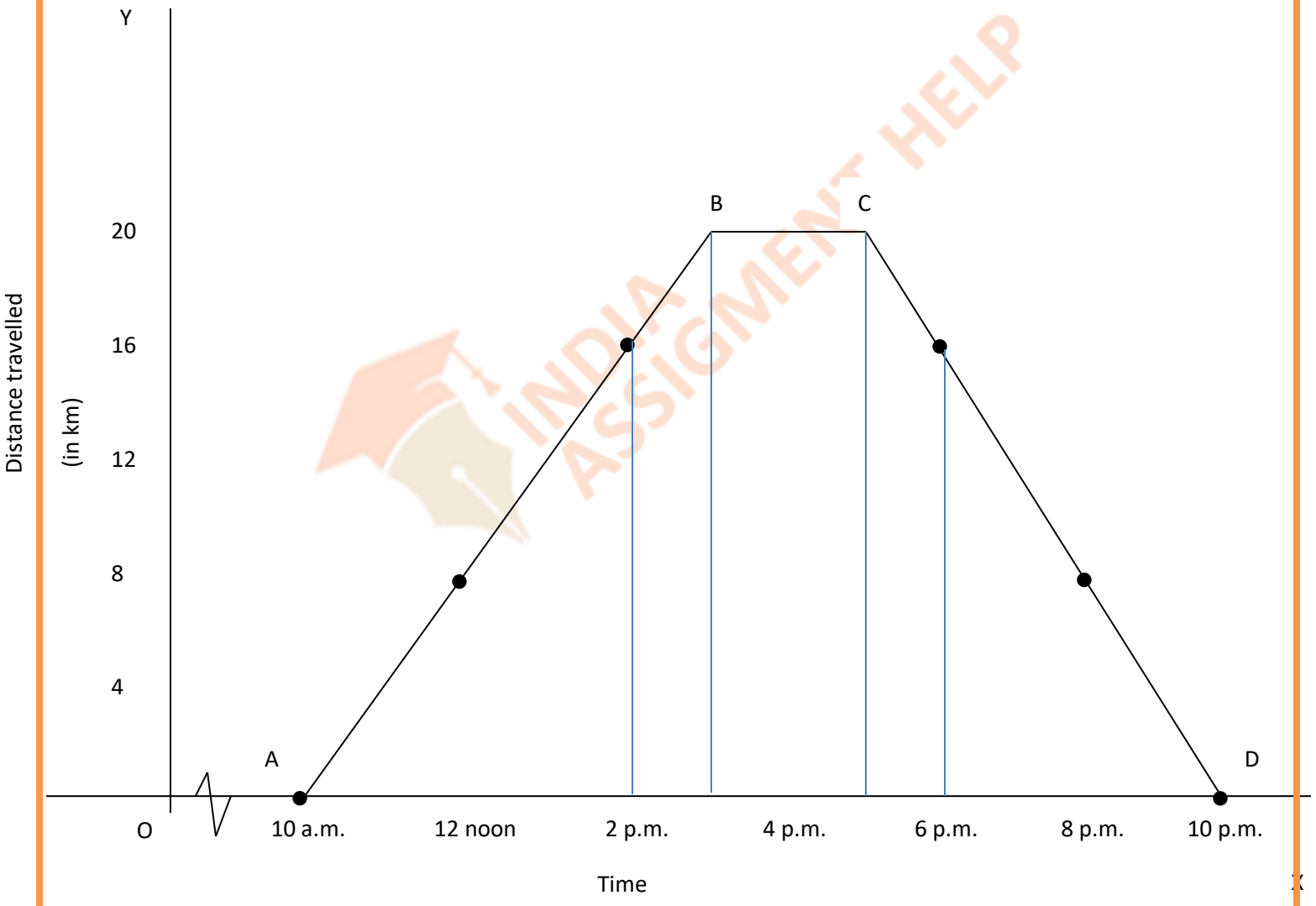
(b) The patient's temperature was 38.5 °C at 11 a.m.

(c) The patient's temperature at 12.30 p.m. was 36.5 °C because the temperature is constant from 12 noon to 1 p.m.

(d) The patient's temperature showed an upward trend during the period 8 a.m. to 10 a.m.

(e) The patient's temperature was 36 °C which is same at 9 a.m. and at 2 p.m.

Example 5 – The graph given below shows the journey of a man who started from his home and returned at the end of the day. Study the graph carefully and answer the questions that follow.



(a) At what time did the man start from his home?

(b) How much distance did he cover in the first four hours of his journey?

(c) What was he doing from 3 p.m. to 5 p.m.?

(d) What was the total distance travelled by him during the day?

(e) How much distance did he travel in the first 8 hours of his journey?

(f) By what time could he cover 16 km of his journey?

(g) At what time did he return home?

(h) Calculate the average speed of the man from A to B and B to C

Solution – (a) From the above graph, it is clear that the man started from his home at 10 a.m.

(b) In the first four hours i.e. from 10 a.m. to 2 p.m., the distance covered by man was 16 km

(c) During the period from 3 p.m. to 5 p.m., the man did not cover any distance. It means that he was doing rest during that period.

(d) The total distance travelled by man during the day = 20 km + 20 km = 40 km

(e) In the first 8 hours i.e. from 10 a.m. to 6 p.m., the distance travelled by man=

20 km + (20 km – 16 km) = (40 – 16) km = 24 km

(f) The man could cover 16 km by 2 p.m.

(g) The man returned to the home at 10 p.m.

(h) Average speed from A to B =?

Distance travelled from A to B = 20 km

Time taken to cover this distance = time from 10 a.m. to 3 p.m. = 5 hours

Therefore, average speed = Distance/time

= 20/5 = 4 km/ hr.

Average speed from B to C =?

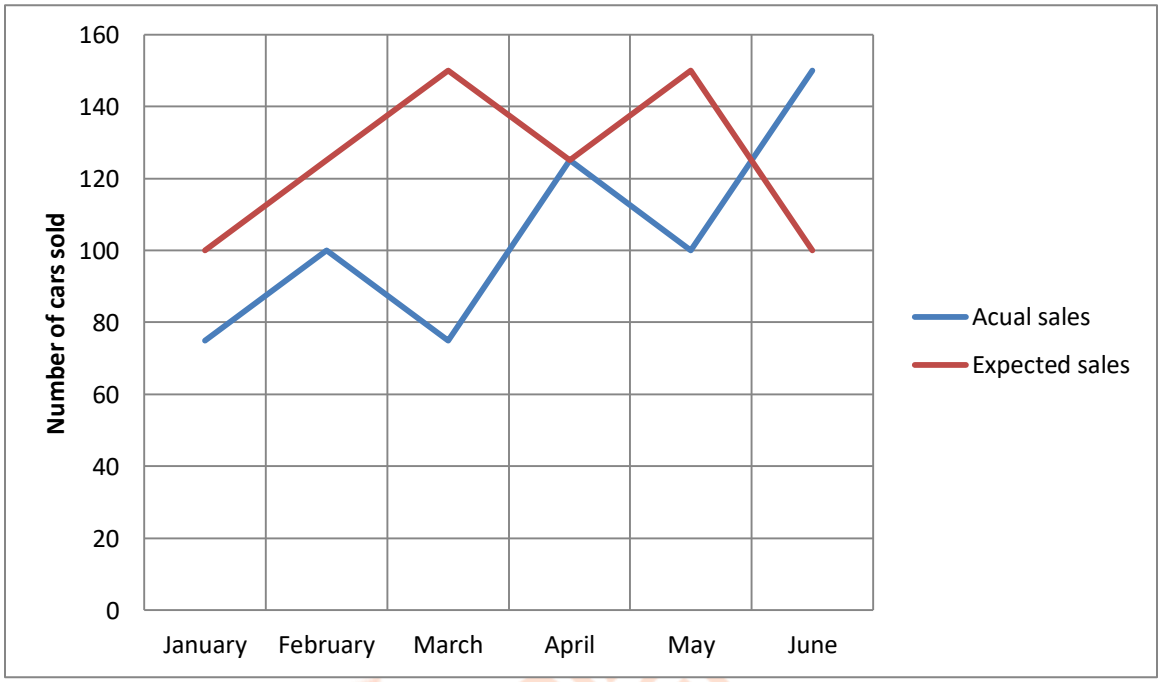
Distance travelled from B to C = 20 km – 20 km = 0 km

Time taken to cover this distance = 2 hours

Therefore, average speed = Distance/time

= 0/2 = 0 km/ hr.

Example 6 – The double line graph given below gives the actual and expected sales of cars of a company for six months. Study the graph and answer the questions that follow:



(a) In which month was the actual sale same as the expected sale?

(b) For which month was the difference between the actual and expected sales the maximum?

(c) For which month was the difference in actual and expected sales the least?

(d) What were the total sales of cars in the months of January, February and March?

(e) What is the average sale of cars in the last 3 months?

(f) Find the ratio of sales in the first 3 months to that in the last 3 months.

Solution – (a) The actual sale is same as the expected sale in the month of April since the two graphs intersect each other in April month.

(b) The difference between the actual sales and expected sales for the different months are as follows:

January = (100 – 75) = 25

February = (125 – 100) = 25

March = (150 – 75) = 75

April = (125 – 125) = 0

May = (150 – 100) = 50

June = (150 – 100) = 50

We can see that the difference is Maximum in the month of March.

(c) From the above part, we can see that the difference is least in the month of April.

(d) Sales of car in the month of January = 75

Sales of car in the month of February = 100

Sales of car in the month of March = 75

Total sales in three months = 75 +100 + 75 = 250

(e) In last 3 months, total sales of car = 125 + 100 + 150 = 375

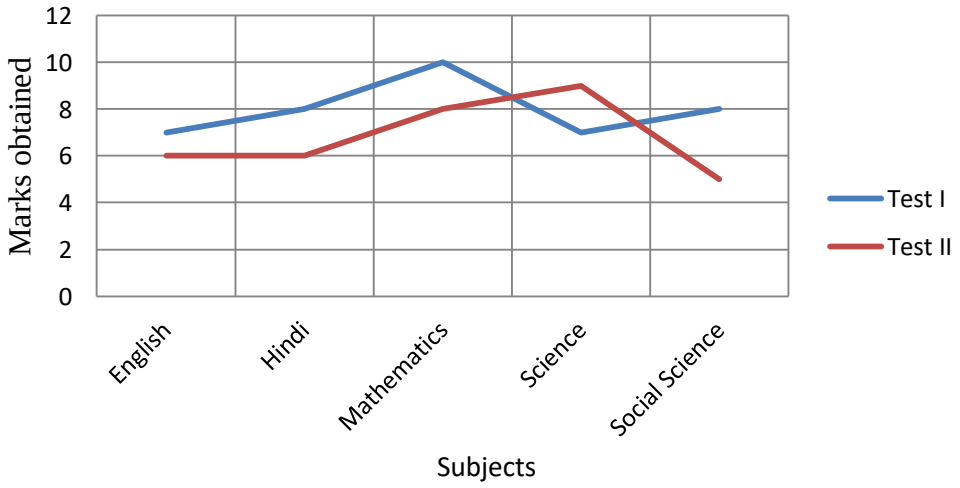
Thus, average sales of car in last 3 months = 375/3 = 125

(f) Total sales of car in first 3 months = 75 + 100 + 75 = 200

Total sales of car in last 3 months = 375

Their ratio = 200:375 = 2:3

Example 7 – The double line graph given below shows the marks obtained out of 10 by Madhu in two different tests. Study the graph and answer the questions that follow:



(a) What information is represented by the axes?
(b) In which subject did she score the highest in test I?
(c) In which subject did she score the least in test II?
(d) What are the marks scored by her in social science in test II?
(e) In which test was the performance better?
(f) In which subject and which test did she score full marks?

Solution – (a) It is clear from the graph that five subjects are shown along the x-axis and the marks obtained are shown along the y-axis.

(b) She scored the highest score 10 in mathematics in test I

(c) She scored the least score 5 in social science in test II.

(d) The marks scored by her in social science in test II is 5.

(e) We will find out the averages of the both test I and II in order to determine the better performance.

Average score in test I = (7 + 8 + 10 + 7 + 8)/5

= 40/5 = 8

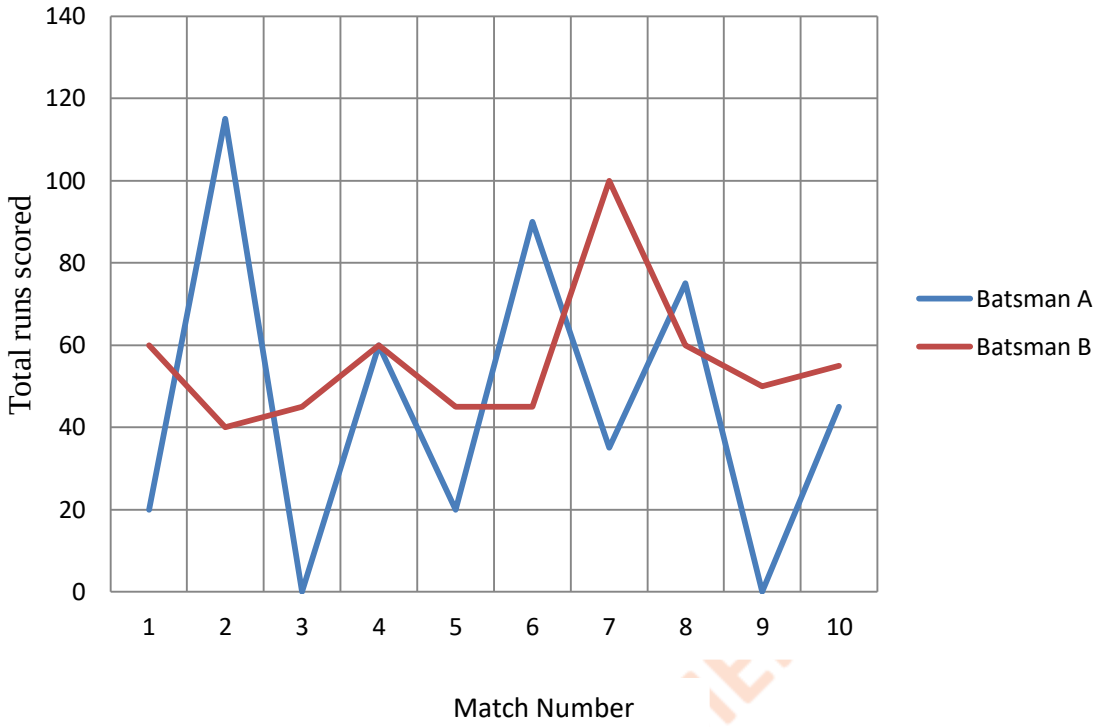
Average score in test II = (6 + 6 + 8 + 9 + 5)/5

= 34/5 = 6.8

Therefore, performance of madhu was better in test I.

(f) She scored full marks i.e.10 in the mathematics subject in test I.

Example 8 – The given graph represents the total runs scored by two batsmen A and B during each of the ten different matches in the year 2017. Study the graph and answer the questions that follow:



(a) What information is given on the two axes in the given graph?

(b) In which two matches did batsman B score the same number of runs?

(c) Were the runs scored by the two batsmen same in any of the matches? If so, in which match

(d) Among the two batsmen, who is steadier? How do you judge it?

Solution – (a) In the above graph, the x-axis shows the ten different matches played during the year 2017 and the y-axis shows the total runs scored by two batsmen in each match.

(b) In the 5^{th} and 6^{th} match, batsmen B scored the same number of runs.

(c) Yes, the runs scored by the two batsmen were in same in the 4^{th} match since the two graphs intersect each other at a point (4, 60)

(d) From the above graph, we can see that graph of batsmen 'A' represents lots of ups and down. In one match, he scored highest 115 but in two matches, he scored 0 also. So his performance is not consistent. On the other hand, the performance of batsmen B in graph is better than A since

batsmen B has never scored less than 40 runs. Therefore, batsman B is more consistent and steadier.

Example 9 – The following table depicts the interests for a year:

Deposits (in Rs)	**1000**	**2000**	**3000**	**4000**	**5000**
Simple interest (in Rs)	**80**	**160**	**240**	**320**	**400**

(a) Does the graph pass through the origin?

(b) Use the graph to find the interest on Rs 2500 for a year.

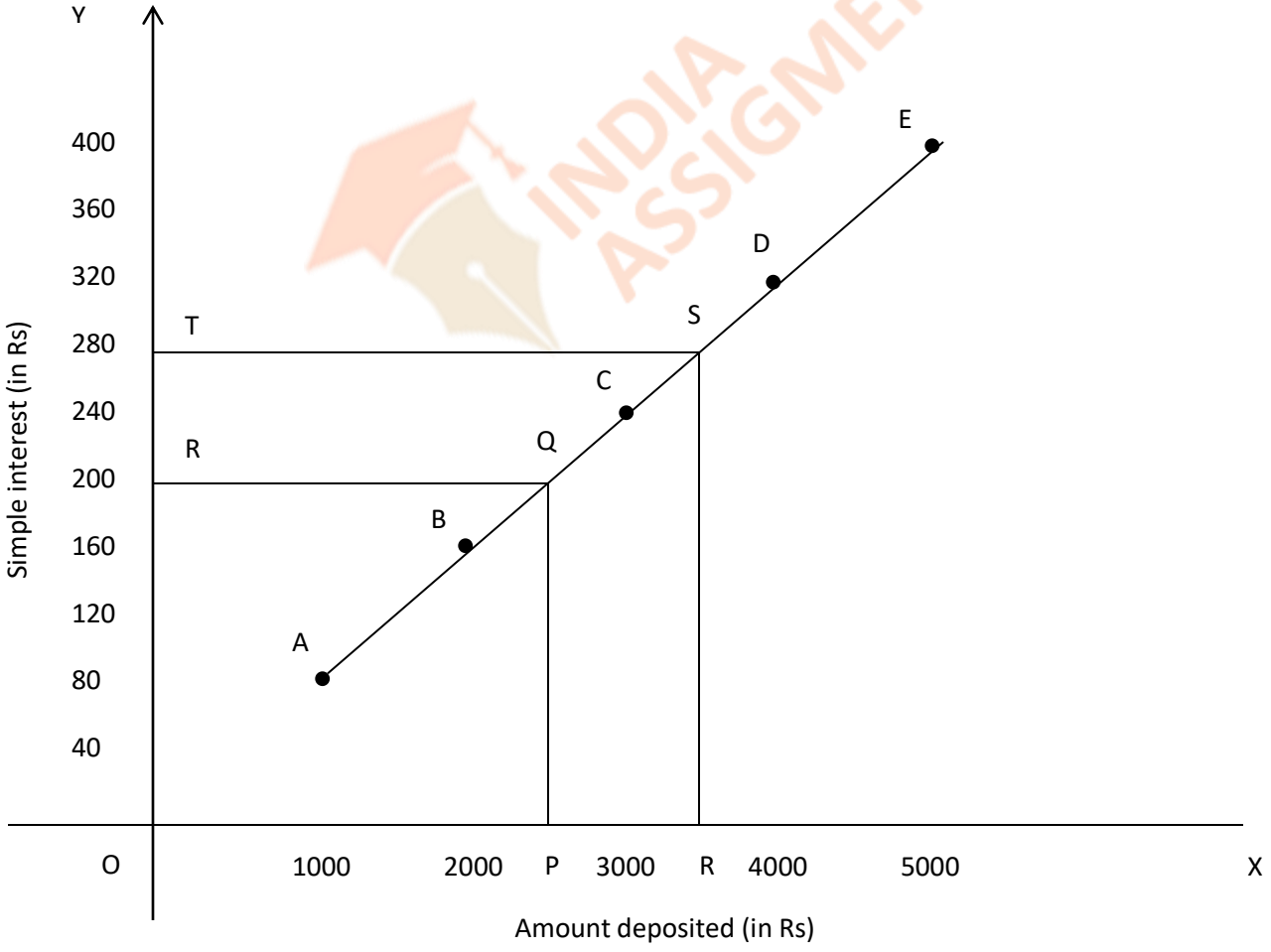
(c) In order to get Rs 280 per year as interest, how much money should be deposited?

Solution – We will first make a graph using the above data:

Let OX and OY be the x-axis and y-axis respectively. O is the origin.

We take Deposits along the x-axis and Simple interest along the y-axis.

We get the required graph by plotting the points (1000, 80), (2000, 160), (3000, 240), (4000, 320) and (5000, 400) as follows:



(a) When we join the points A, B, C, D and E with each other, we get a line ABCDE. But this line does not pass through the origin. However, if we extend this line downward, it will pass through the origin.

(b) When we take Rs2500 along the x-axis and draw PQ parallel to the y-axis and QR parallel to x-axis, we get Rs 200 as simple interest.

(c) When we take Rs280 per year as interest along the y-axis and draw TS parallel to the x-axis and RS parallel to y-axis, we get Rs3500 as amount deposited.

Example 10 – Plot a line graph for the variables x and y, where y is three times x, i.e. , the equation is y = 3x

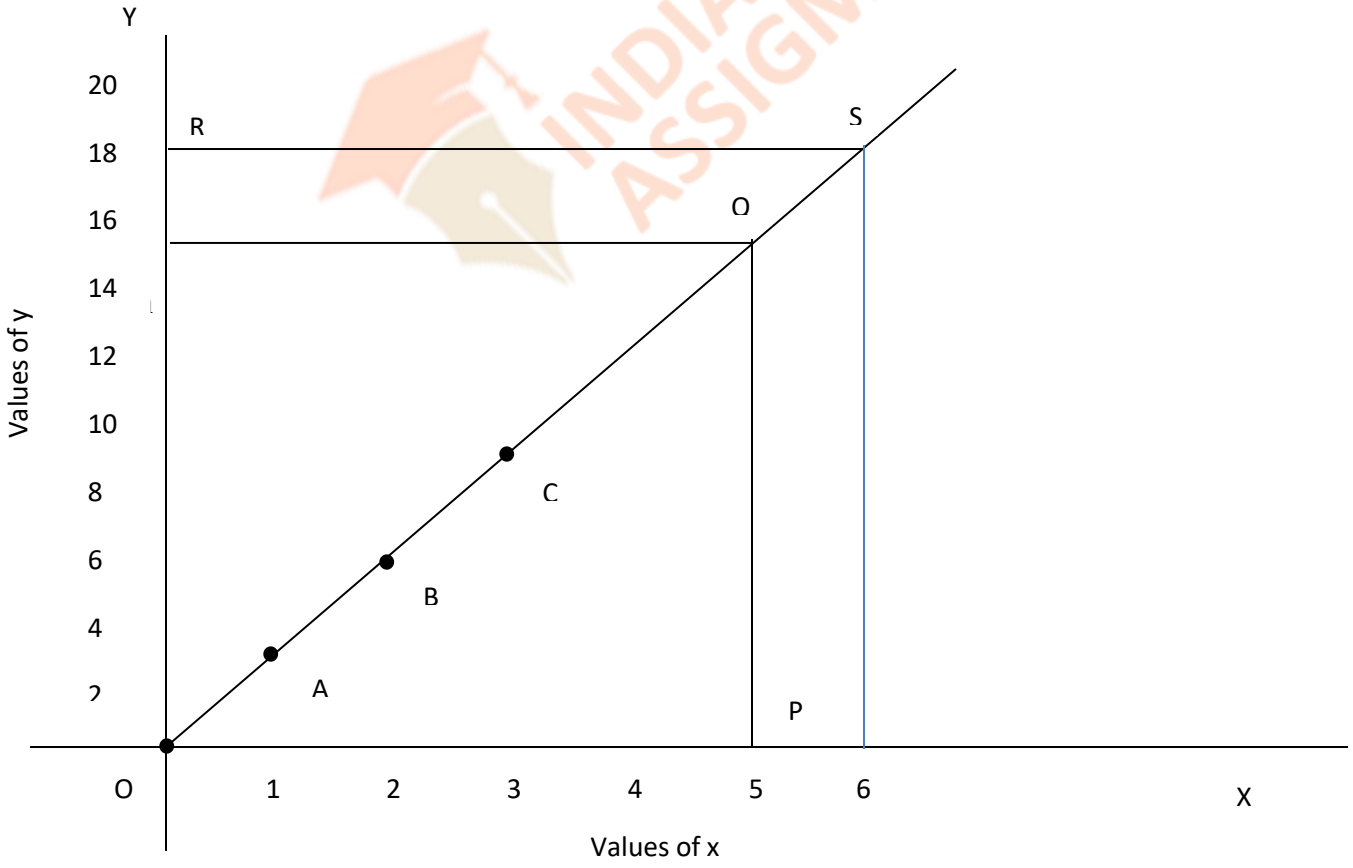
Using the graph, find the value of (a) y, when x = 5 (b) x, when y = 18

Solution – The equation is given to be y = 3x

We draw a table for the values of x and y as follows:

x	0	1	2	3
y	0	3	6	9

Using these values, we plot the points O (0, 0), A (1, 3), B (2, 6) and C (3, 9) on the graph as follows:



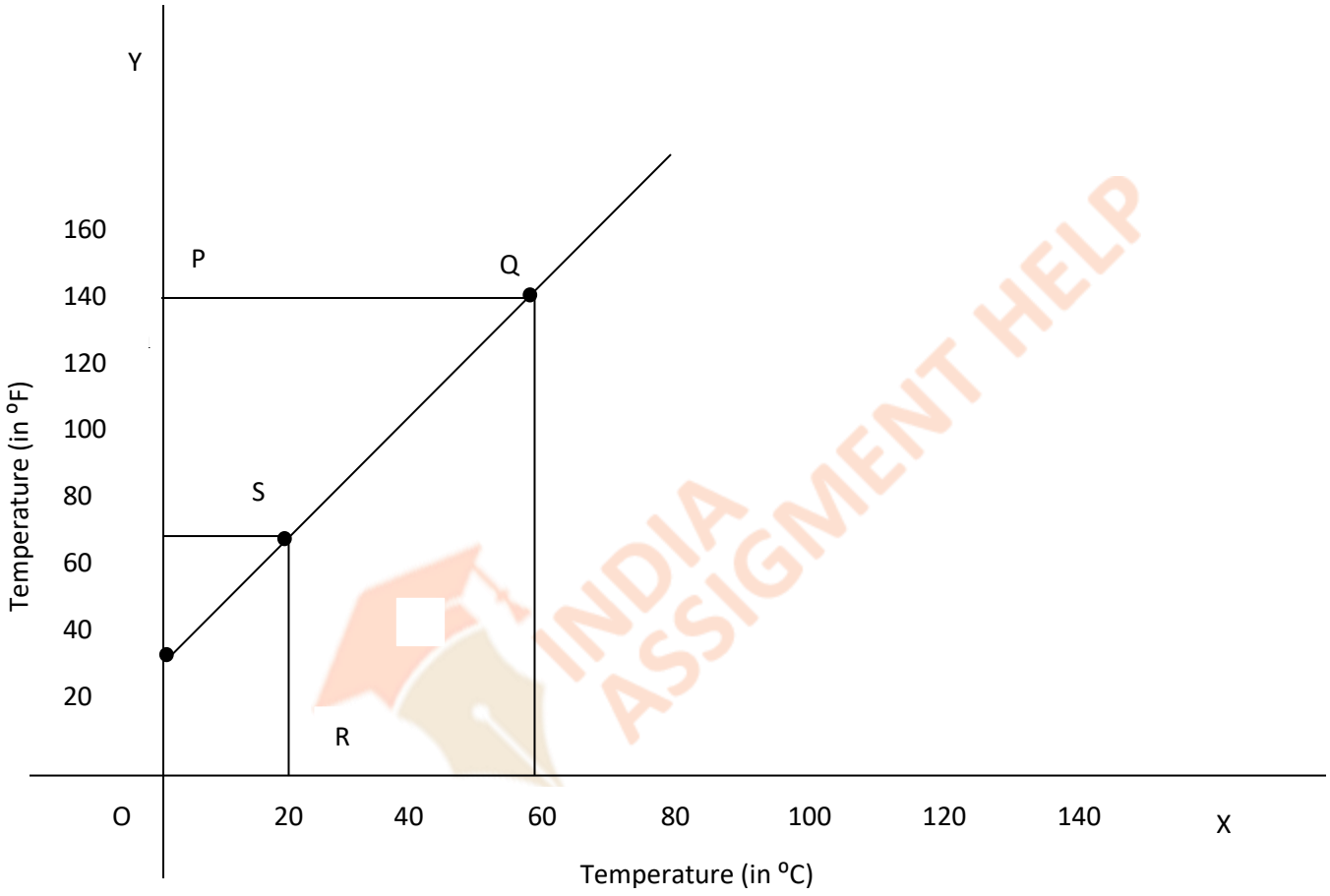
(a) When x = 5, y =?

We take point 'P' at x =5 and draw PQ parallel to y-axis, we get y = 15

(b) When y = 18, x =?

We take point 'R' at y = 18 and draw RS parallel to x-axis, we get x = 6

Example 11 – The following is the conversion graph of temperature in ^{o}C and ^{o}F.



Use the graph to answer the questions given below:

(a) Convert 140 ^{o}F to ^{o}C

(b) Convert 20 ^{o}C to ^{o}F.

Solution – (a) When y = 140 ^{o}F, x =?

We take point 'P' at y = 140 ^{o}F and draw PQ parallel to x-axis, we get x = 60 ^{o}C

(b) When x = 20 ^{o}C, y =?

We take point ‘R’ at x = 20 °C and draw RS parallel to y-axis, we get y = 68 °F

Exercise 23

Q1 The following table depicts the maximum temperature on the seven days of a particular week. Study the table and draw a line graph for the same.

Day	**Sun**	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**
Maximum temp. (in °C)	**25**	**28**	**26**	**32**	**29**	**34**	**31**

Solution – The steps to draw a line graph are as follows:

Step 1: First, we draw x-axis and y-axis on a graph paper represented by OX and OY respectively.

Step 2: Then, we take days along the x-axis and maximum temperature (in °C) along the y-axis.

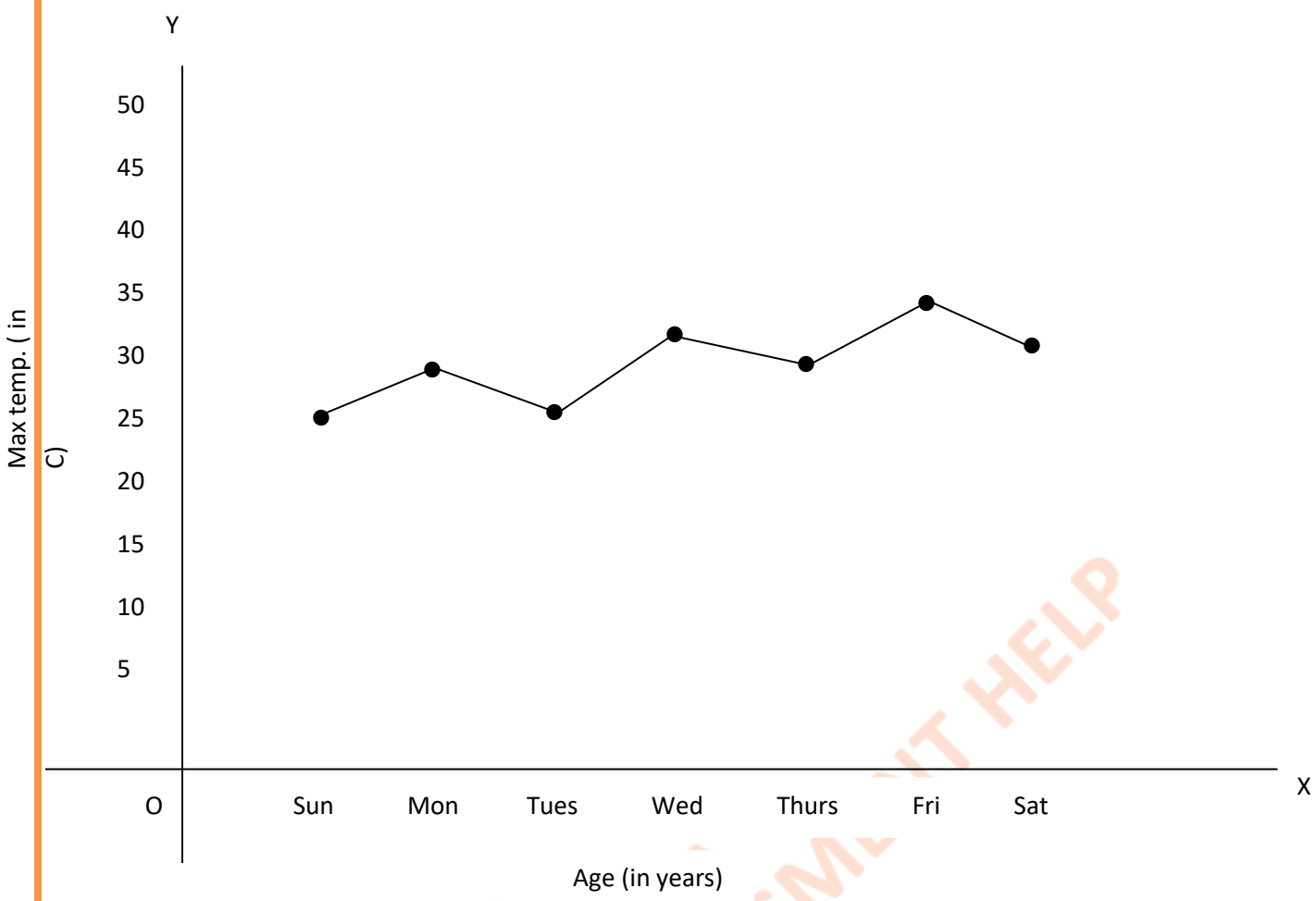
Step 3: Take scale as:

Along the x-axis: 1 unit = 1 day

Along the y-axis: I unit = 5 °C

Step 4: Now, start plotting the points (Sun, 25), (Mon, 28), (Tues, 26), (Wed, 32), (Thurs, 29), (Fri, 34) and (Sat, 31)

Step 5: Connect all these point using line segments to get the required graph.



Question 2 – Consider the following input/output table. Draw a line graph for it.

Input	**1**	**2**	**4**	**5**	**7**
Output	**2**	**5**	**11**	**14**	**20**

Now, use the graph drawn to predict the outputs for the inputs of 3 and 8

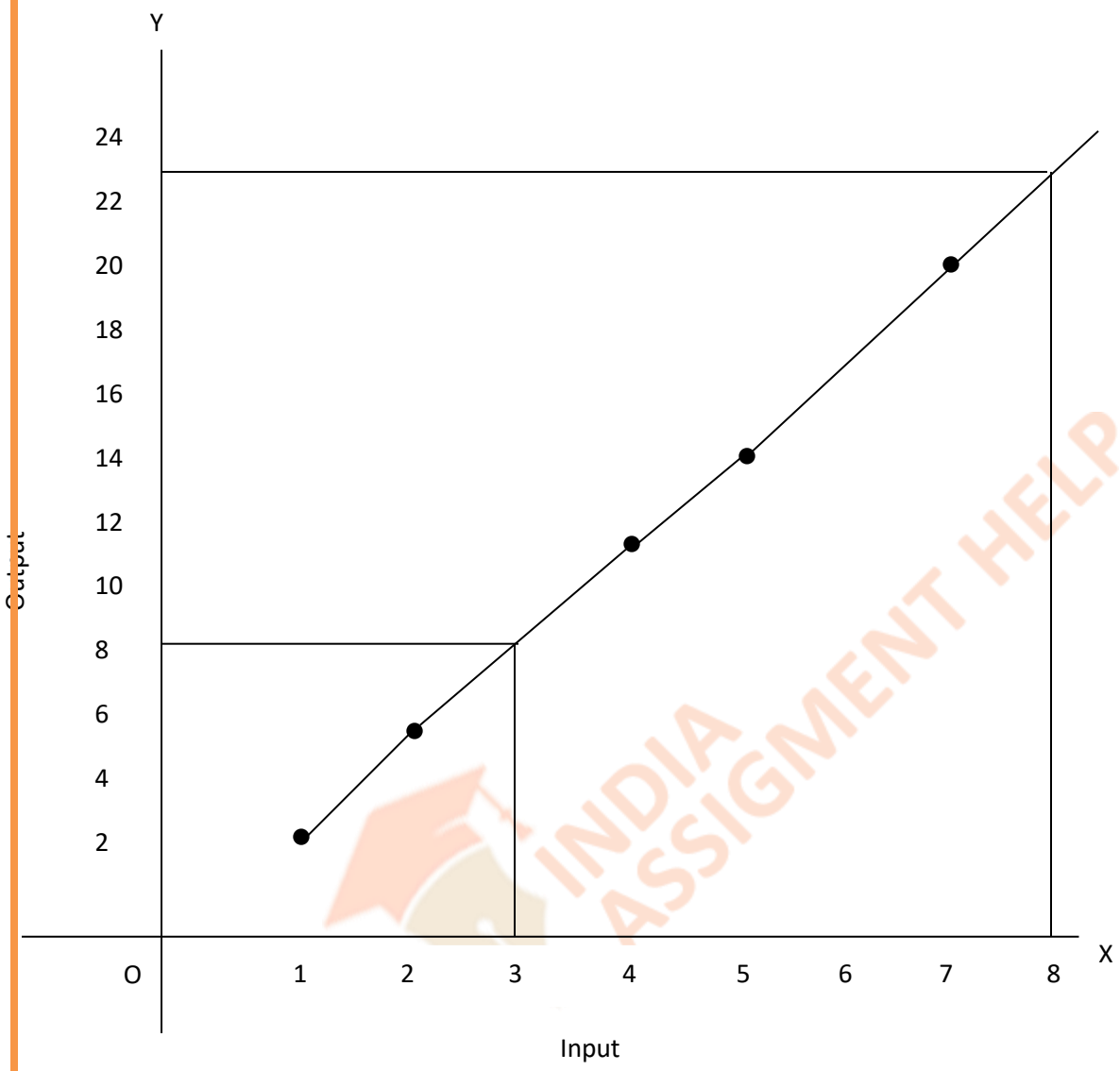
Solution – The steps to draw a line graph are as follows:

Step 1: First, we draw x-axis and y-axis on a graph paper represented by OX and OY respectively.

Step 2: Then, we take input along the x-axis and output along the y-axis.

Step 3: Now, start plotting the points (1, 2), (2, 5), (4, 11), (5, 14) and (7, 20)

Step 4: Connect all these point using line segments to get the required graph.



We can see from the graph that for the input as 3, we get output as 8 and for the input as 8, we get output as 23.

Question 3 – The table given below depicts the annual gross profit of a company for a period of 5 years. Study the table and draw a line graph for the same.

Year	**2013**	**2014**	**2015**	**2016**	**2017**
Gross profit (in lakhs of Rs)	**17**	**15.5**	**11.4**	**12.1**	**14.9**

Solution – The steps to draw a line graph are as follows:

Step 1: First, we draw x-axis and y-axis on a graph paper represented by OX and OY respectively.

Step 2: Then, we take year along the x-axis and Gross profit along the y-axis.

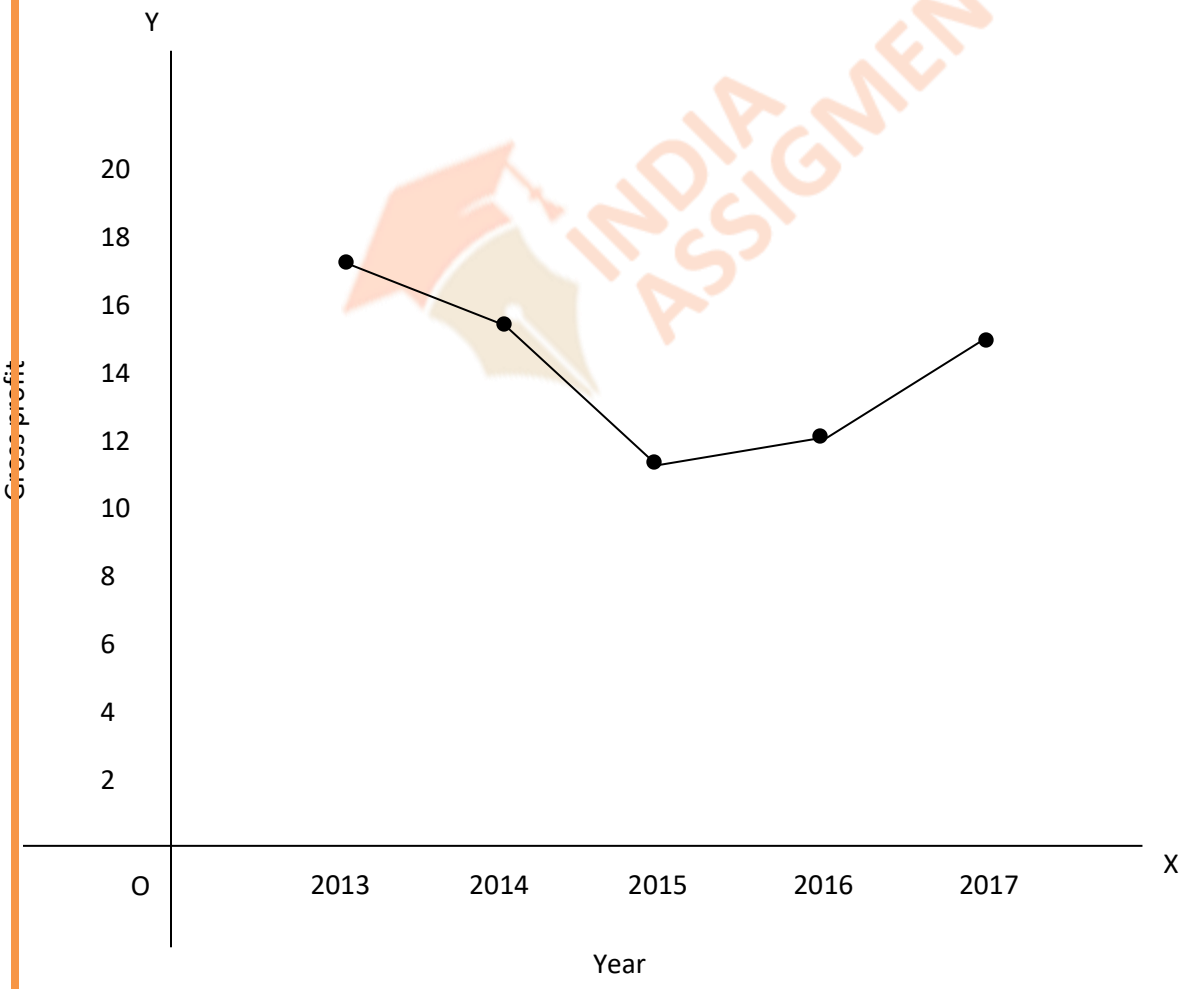
Step 3: Take scale as:

Along the x-axis: 1 unit = 1 year

Along the y-axis: I unit = 2 lakhs

Step 4: Now, start plotting the points (2013, 17), (2014, 15.5), (2015, 11.4), (2016, 12.1) and (2017, 14.9)

Step 5: Connect all these point using line segments to get the required graph



Question 4 – Ajeeta starts off from home at 7 a.m. with her father on a scooter that goes at a uniform speed of 30 km/hr. Her father drops her at her school after half an hour. She stays in the school till 1:30 p.m. and takes an auto rickshaw to return home. The auto rickshaw has a uniform speed of 10 km/hr. Draw the line graph for the given situation and also determine the distance of Ajeeta's school from her home.

Solution – It is given that uniform speed = 30 km/hr.

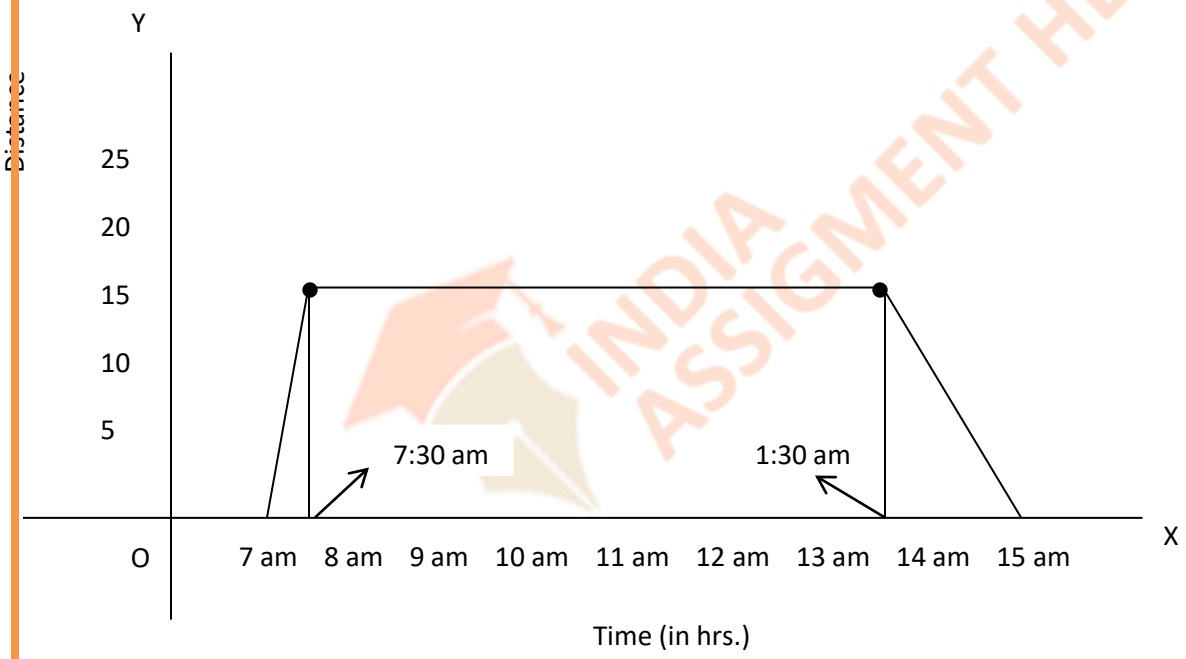
Time = ½ hr.

We know that speed = distance/time

=> Distance = speed × time

=> Distance of ajeeta's school from her home = 30 × 1/2 = 15 km

We will represent this information graphically as follows:



Question 5 – The following table shows the percentage of students who dropped out of school after completing high school.

Year	2005	2007	2009	2011	2013	2015	2017
% of students who dropped out of school	6%	5.5%	5%	4.7%	4.9%	4%	4.5%

Study the above table carefully and draw a line graph to depict it.

Solution – The steps to draw a line graph are as follows:

Step 1: First, we draw x-axis and y-axis on a graph paper represented by OX and OY respectively.

Step 2: Then, we take year along the x-axis and % of students who dropped out of school along the y-axis.

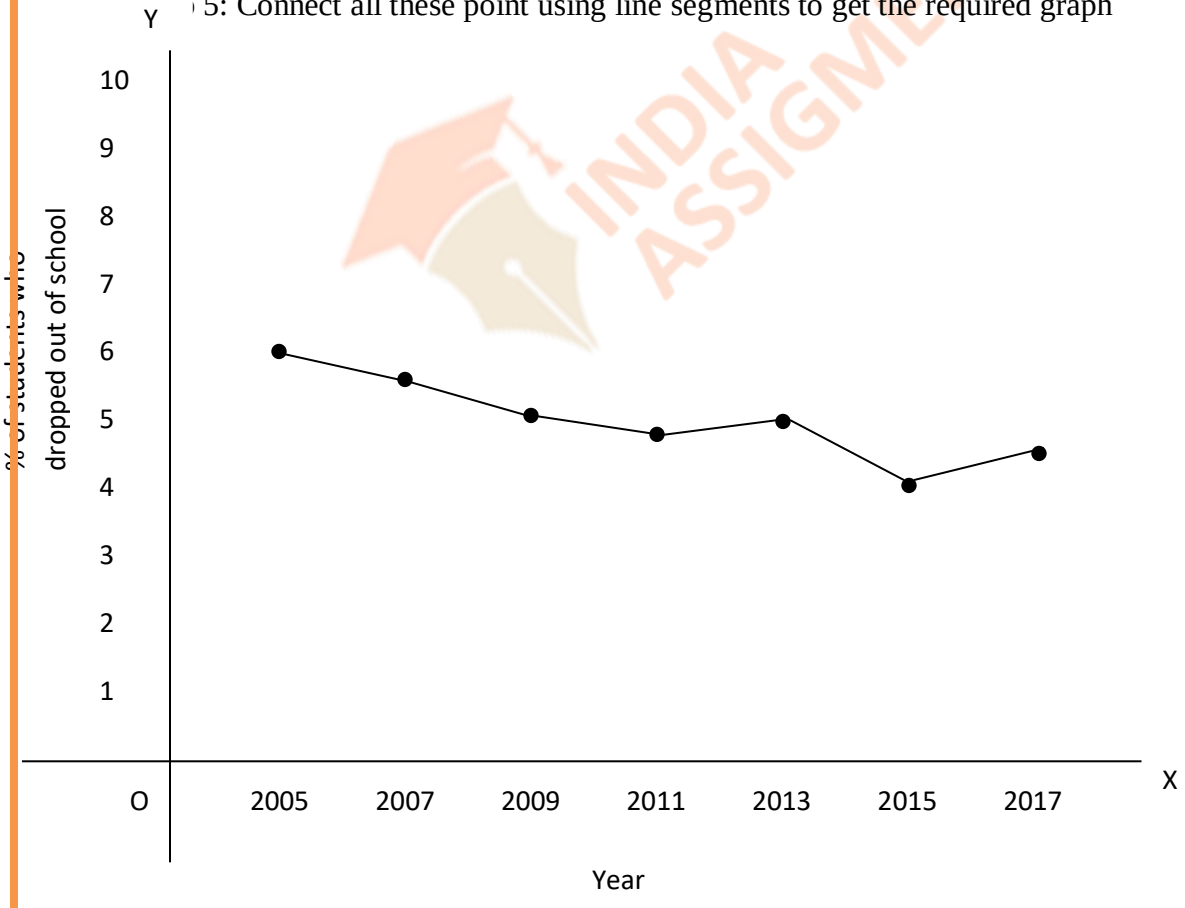
Step 3: Take scale as:

Along the x-axis: 1 unit = 2 year

Along the y-axis: I unit = 1 %

Step 4: Now, start plotting the points (2005, 6%), (2007, 5.5%), (2009, 5%), (2011, 4.7%), (2013, 4.9%), (2015, 4%) and (2017, 4.5%)

Step 5: Connect all these point using line segments to get the required graph



Question 6 – The following chart gives the growth in height in terms of percentage of full height of boys and girls with their respective ages.

Study the table and draw the line graph of the data given below:

Age(in years)	8	9	10	11	12	13	14	15	16	17	18
Boys	72%	75%	78%	81%	84%	88%	92%	95%	98%	99%	100%
Girls	77%	81%	84%	88%	91%	95%	98%	99%	99.5%	100%	100%

Now, use the graph to answer the following questions:

(a) In which year both the boys and the girls achieve their maximum height?

(b) Who grows faster at puberty (14 years to 16 years of age)?

Solution – The steps to draw a double line graph are as follows:

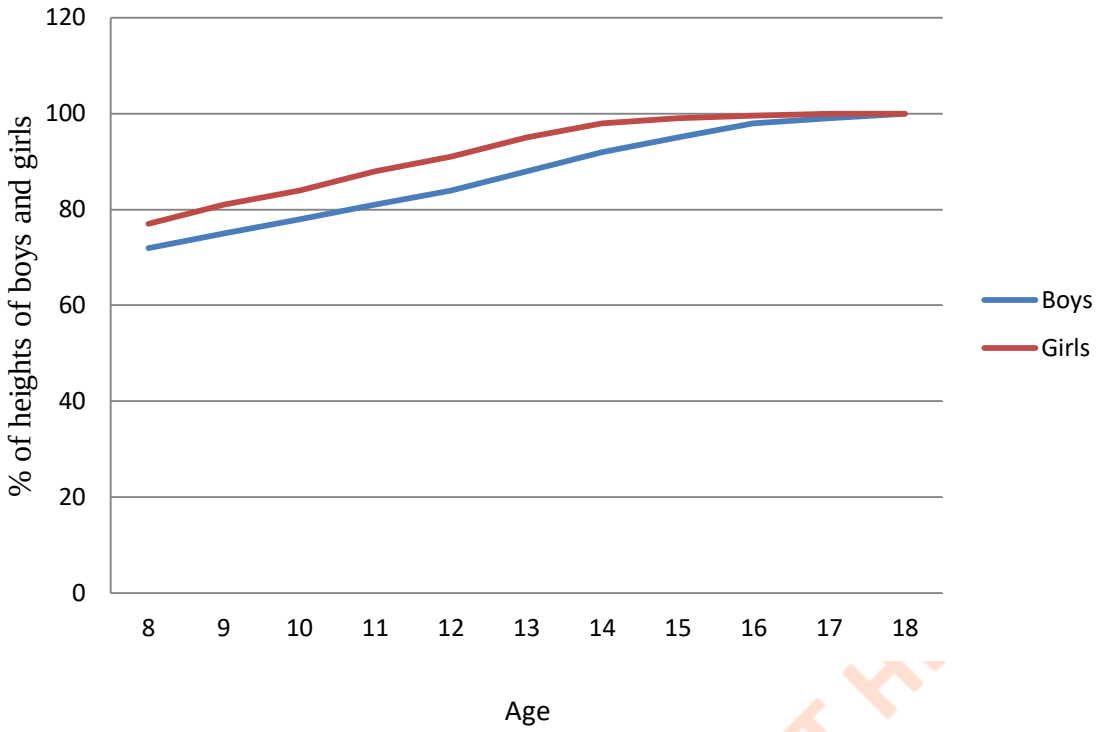
Step 1: First, we draw x-axis and y-axis on a graph paper represented by OX and OY respectively.

Step 2: Then, we take ages at equal intervals from 8 years to 18 years along the x-axis and the heights of boys and girls in percentages along the y-axis.

Step 3: We plot double line graph which means that we plot the corresponding number of boys for each age and the corresponding number of girls for each age

Step 4: Now, start plotting the points (8, 72%), (9, 75%), (10, 78%), (11, 81%), (12, 84%), (13, 88%), (14, 92%), (15, 95%), (16, 98%), (17, 99%) and (18, 100%) and on joining these points, we get one graph.

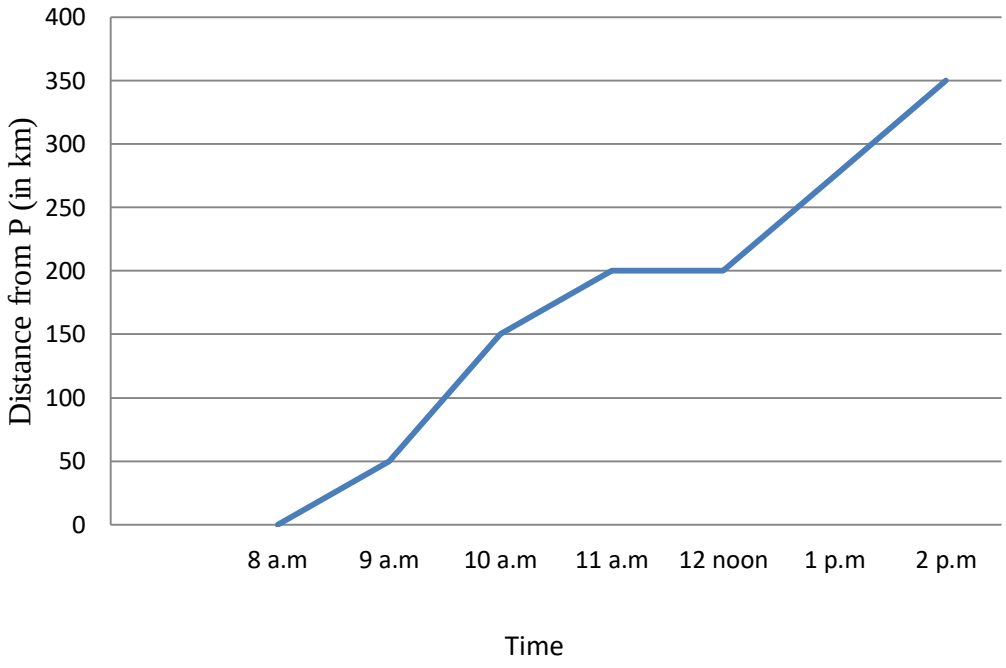
Also, plot the points (8, 77%), (9, 81%), (10, 84%), (11, 88%), (12, 91%), (13, 95%), (14, 98%), (15, 99%), (16, 99.5%), (17, 100%) and (18, 100%) and on joining these points, we get another graph.



(a) In the year 18, both the boys and girls achieve their maximum height i.e. 100%.

(b) It can be seen from the graph that boys grow faster at puberty.

Question 7 – A car is travelling from city P to city Q, which is 350 km apart. The line graph given below describes the distances of the car from the city P at different times.



Study the above graph and answer the questions given below.

(a) What information is given on the two axes?

(b) From where and when did the car begin its journey?

(c) How far did the car go in the first hour?

(d) How far did the car go during the 2^{nd} hour and the 3^{rd} hour?

(e) Was the speed same during first three hours? How do you know it?

(f) Did the car stop for some duration at any place? Justify your answer.

(g) When did the car reach city Q?

Solution – (a) In the above graph, the x-axis shows the time and the y-axis shows the distance of car in km from the city P.

(b) The car is starting its journey from the city P at 8 a.m.

(c) In the first hour, the distance covered by car is 50 km.

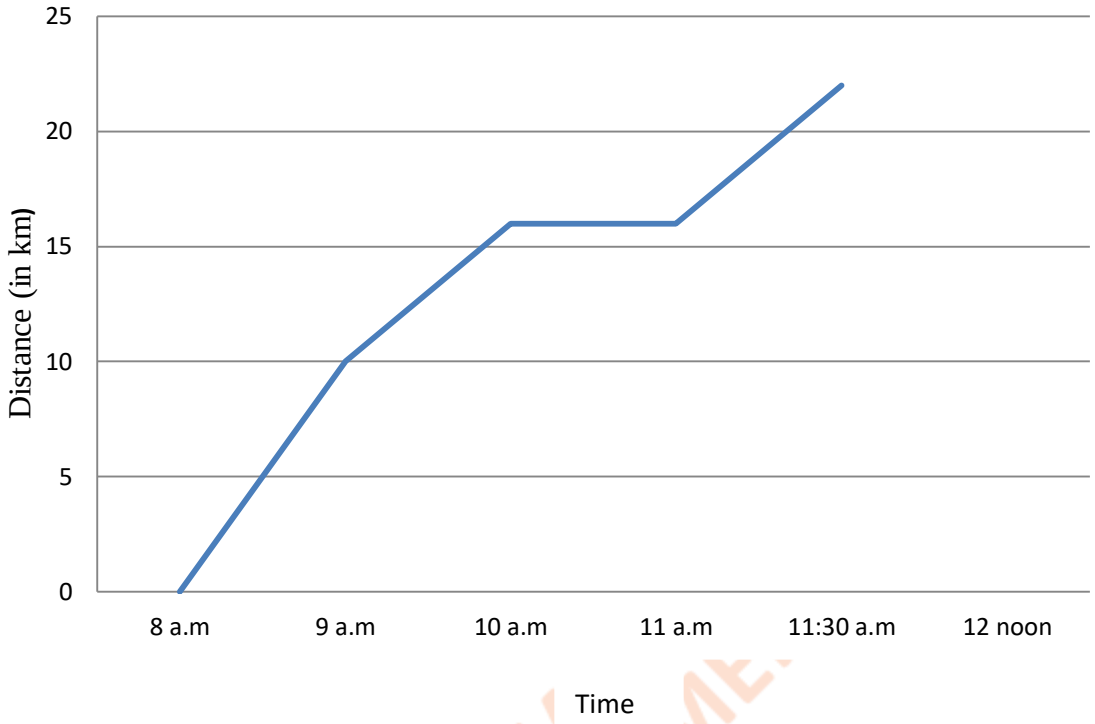
(d) During the second hour, car covered distance of 100 km and during the third hour, car covered distance of 50 km.

(e) Since the distance covered is not uniform during the first three hours, therefore the speed was not same during the first three hours.

(f) Yes, the car stopped at a place between the time periods from 11 a.m. to 12 noon. It is shown in the graph by a horizontal line during that period.

(g) It is clear from the graph that car reached city Q sharp at 2 p.m.

Question 8 – A courier –person cycles from a town to a neighboring suburban area to deliver a parcel to a merchant. His distances from the town at different times are shown by the given graph.



Study the above graph carefully and answer the questions given below:

(a) What is the scale taken for the time-axis?

(b) How much time did the person take for the travel?

(c) How far is the place of the merchant from the town?

(d) Did the person stop on his way? Explain.

(e) During which period did he ride fastest?

Solution – (a) The scale taken for the time-axis is 15 minutes because there are 60 minutes between each interval and 60/4 = 15 min.

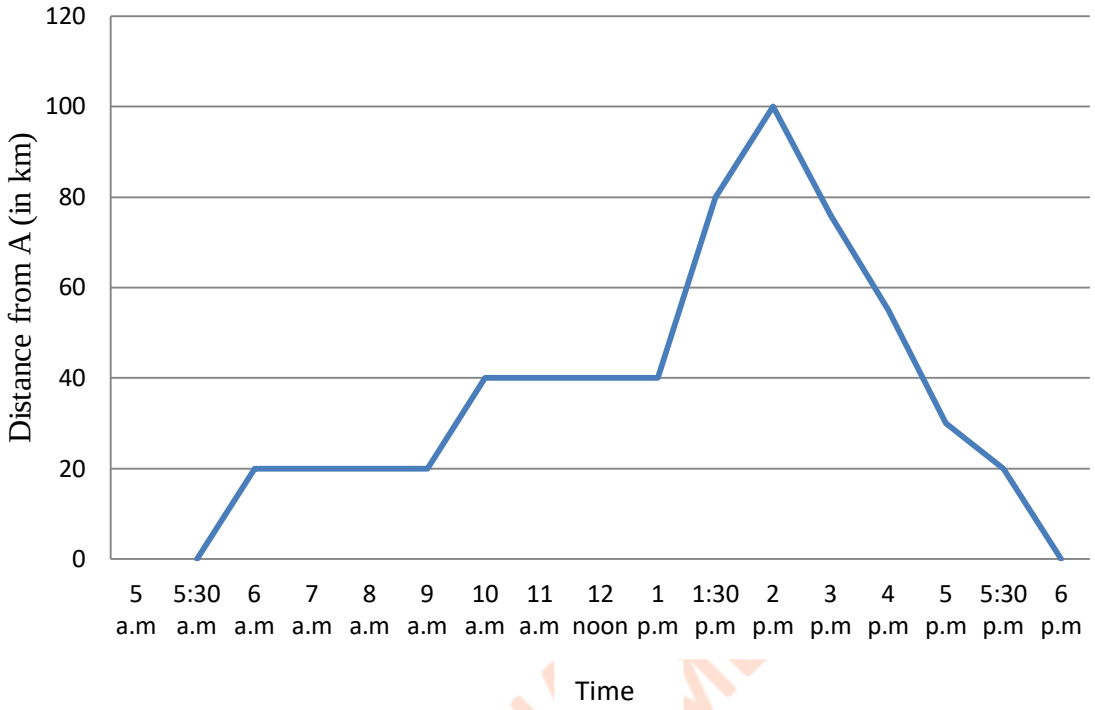
(b) It is clear from the above graph that the person is taking 3 hours and 30 minutes for the travel.

(c) The distance of merchant's place from the town is 22 km.

(d) Yes, the person stopped on his way during the interval 10 a.m. to 11 a.m. It is shown in the graph by a horizontal line during that interval.

(e) The person rode fastest during the period 8 a.m. to 9 a.m.

Question 9 – A man started his journey on his car from location A and came back. The graph given below shows his position at different times during the whole journey



Solution – (a) He is starting from his journey from 5:30 a.m. and ending his journey at 6 p.m.

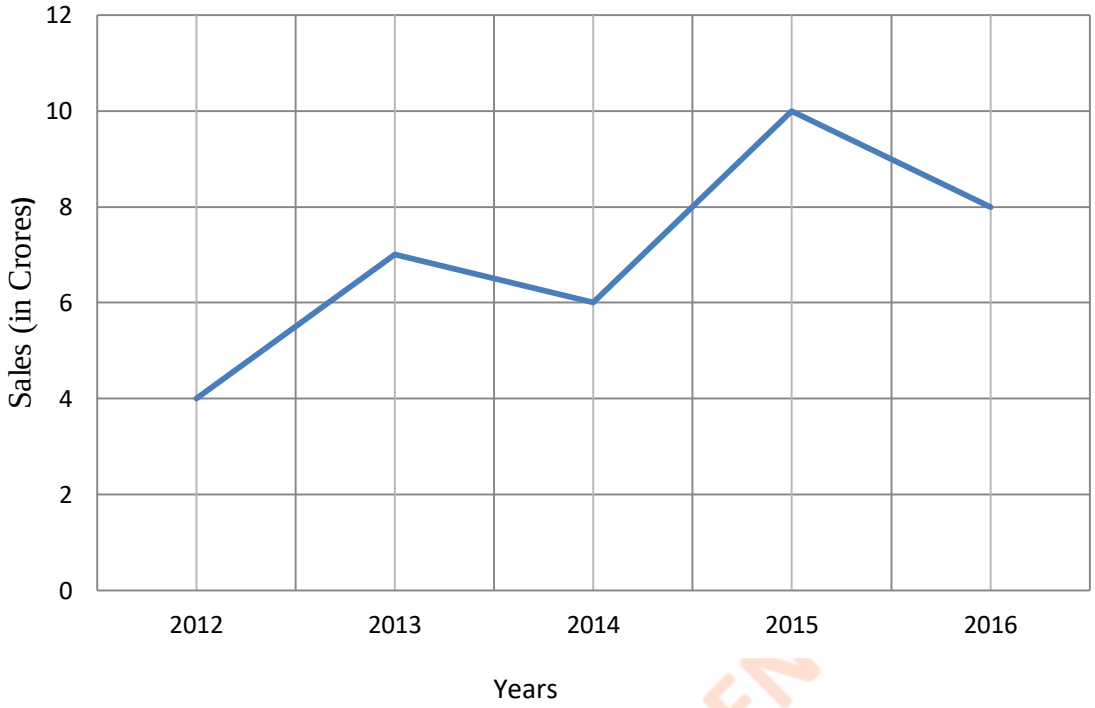
(b) The total duration of the journey was 12 hours and 30 minutes.

(c) From the graph, it is clear that the onward journey was of longer duration.

(d) He did not move for 6 hours since the distance covered by him during the period 6 a.m. to 9 a.m. was constant and also during the period 10 a.m. to 1 p.m., it was constant.

(e) His speed was fastest during the period 2 p.m. to 5:30 p.m.

Question 10 – The line graph given below shows the yearly sales figures for a manufacturing company during the last five years.



Study the above graph carefully and answer the questions given below:

(a) What were the sales in 2013, 2015 and 2016?

(b) Compute the difference between the sales in 2012 and 2016?

(c) In which year was there the greatest difference between the sales as compared to its previous year?

Solution – (a) The sales in the year 2013 were 7 crores.

The sales in the year 2015 were 10 crores.

The sales in the year 2016 were 8 crores.

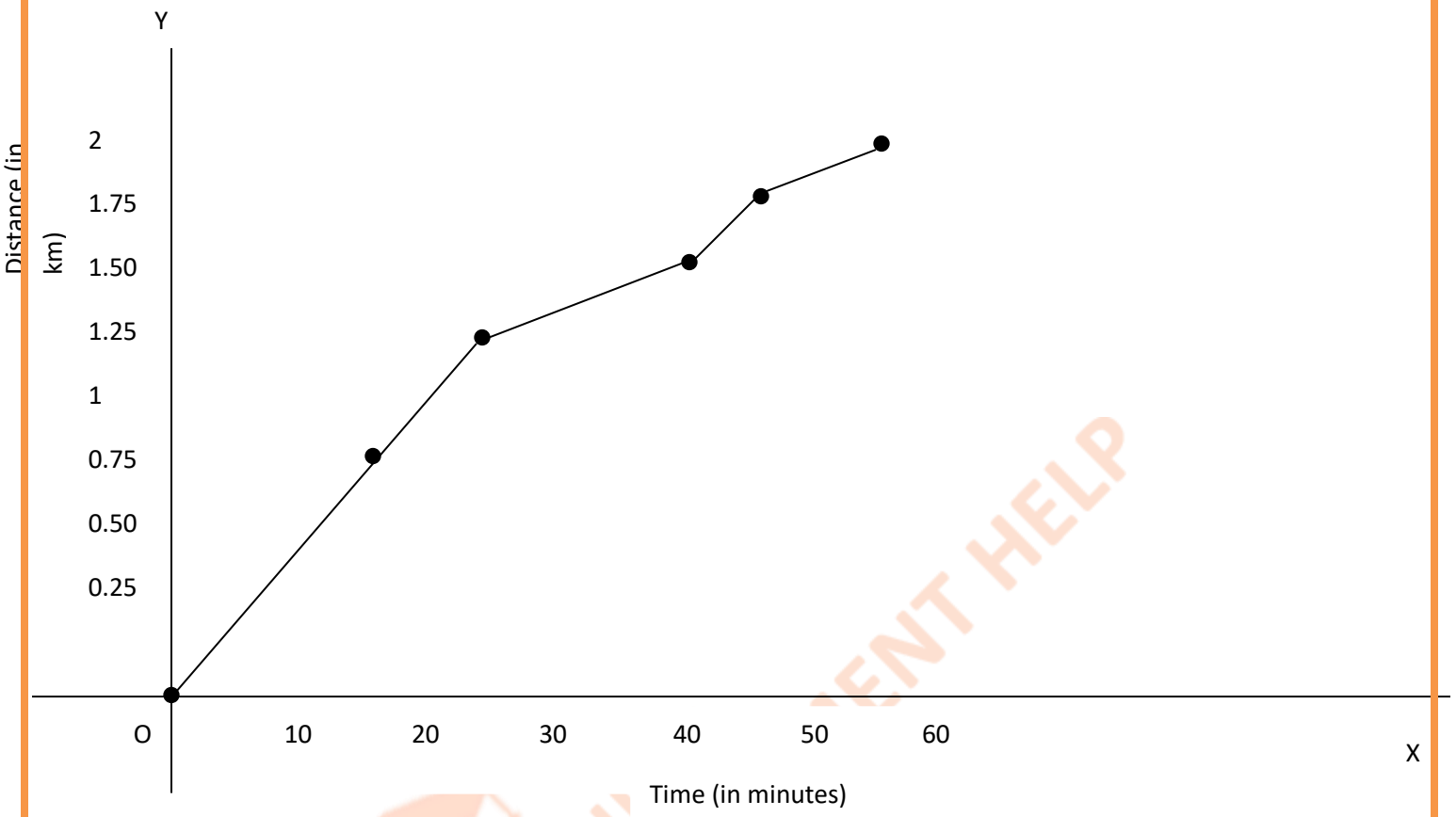
(b) Total sales in 2012 = 4 crores.

Total sales in 2016 = 8 crores

Difference in sales = (8 – 4) cr. = 4 crores.

(d) From the graph, we can see that the greatest difference between the sales was the greatest in the year 2015.

Question 11 – The following is the distance –time graph of Amit's walking.



Study the above graph carefully and answer the questions given below:

(a) When does Amit make the least progress? Explain your answer.

(b) Find his average speed in km/hr.

Solution – (a) During the period from 25 minutes to 40 minutes, amit makes the least progress.

(b) We know that Average speed = Total distance covered/ total time taken

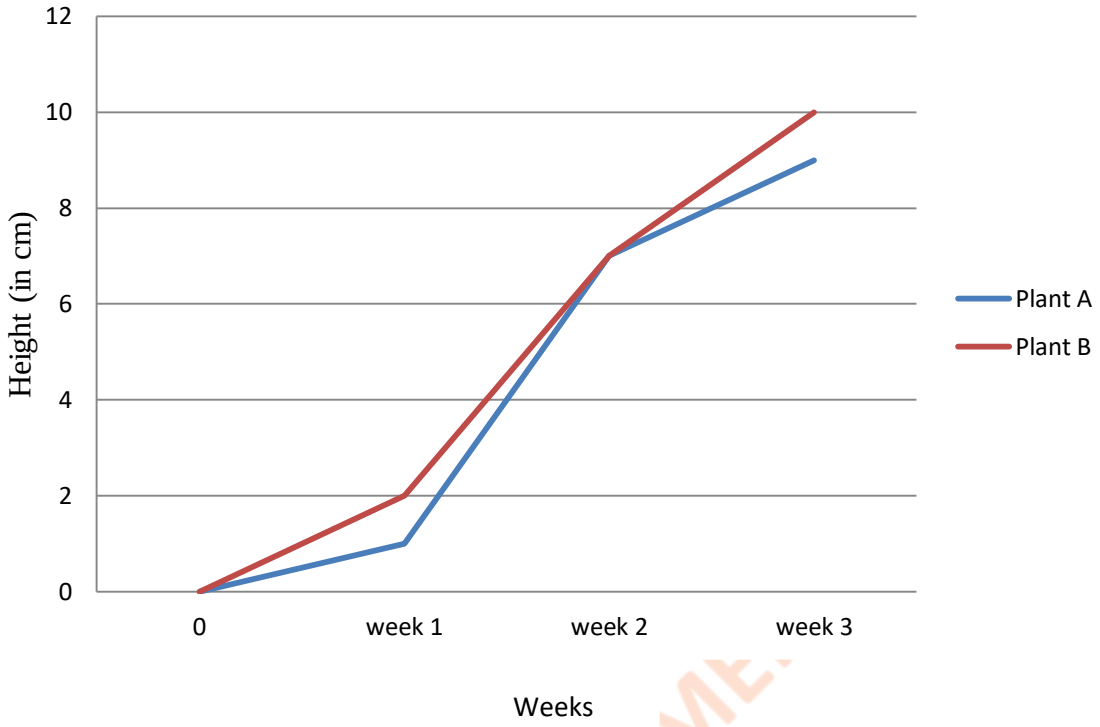
Now, total distance covered = 2 km

Total time taken = 55 minutes

= 55/60 hr. = 11/12 hr.

Thus, Average speed = $2 \times 12/11 = 24/11 = 2.18$ km/hr.

Question 12 – For an experiment in botany, two different plants, plant A and plant B, were grown under similar laboratory conditions. Their heights were measured at the end of each week for three weeks. The results are shown by the line graph given below:



Study the above line graph carefully and answer the questions given below:

(a) How high was plant A after 2 weeks and 3 weeks?

(b) How high was plant B after 2 weeks and 3 weeks?

(c) How much did plant A grow during the 3rd week?

(d) How much did plant B grow from the end of the 2nd week to the end of the 3rd week?

(e) During which week did plant A grow most?

(f) During which week did plant B grow least?

(g) Were the two plants of the same height during any week shown here? Specify.

Solution – (a) After 2 weeks, plant A was 7 cm high

After 3 weeks, plant A was 9 cm high.

(b) After 2 weeks, plant B was 7 cm high

After 3 weeks, plant B was 10 cm high.

(c) During the 3rd week, plant A grew by 2 cm.

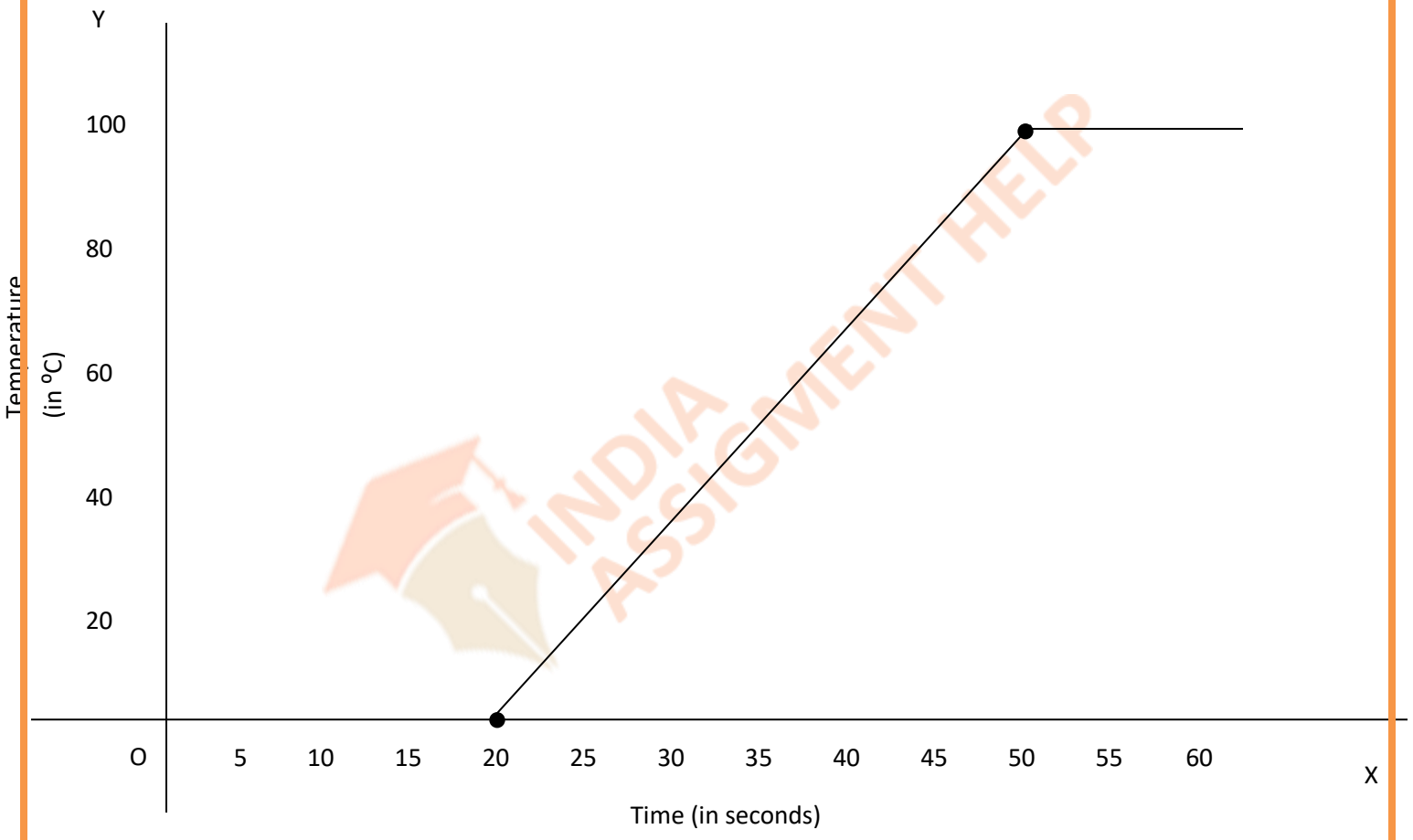
(d) Plant B grew by 3 cm from the end of the 2nd week to the end of the 3rd week.

(e) Plant A grew the most in the 2nd week.

(f) Plant B grew the least in the 1st week.

(g) Yes, plant A and plant B were of same height i.e. 7 cm at the end of 2nd week.

Question 13 – The following line graph shows the change in temperature of a block of ice when heated.



Study the above graph carefully and answer the questions given below:

(a) For how many seconds did the ice block have no change in temperature?

(b) For how long was there a change in temperature?

(c) After how many seconds of heating did the temperature become constant at 100 °C?

(d) What was the temperature after 25 seconds?

(e) What will be the temperature after 1.5 minutes? Justify your answer.

Solution – (a) The ice block had no change in temperature for 20 seconds.

(b) For 30 seconds, there was a change in temperature.

(c) The temperature became constant at 100 °C after 50 seconds of heating.

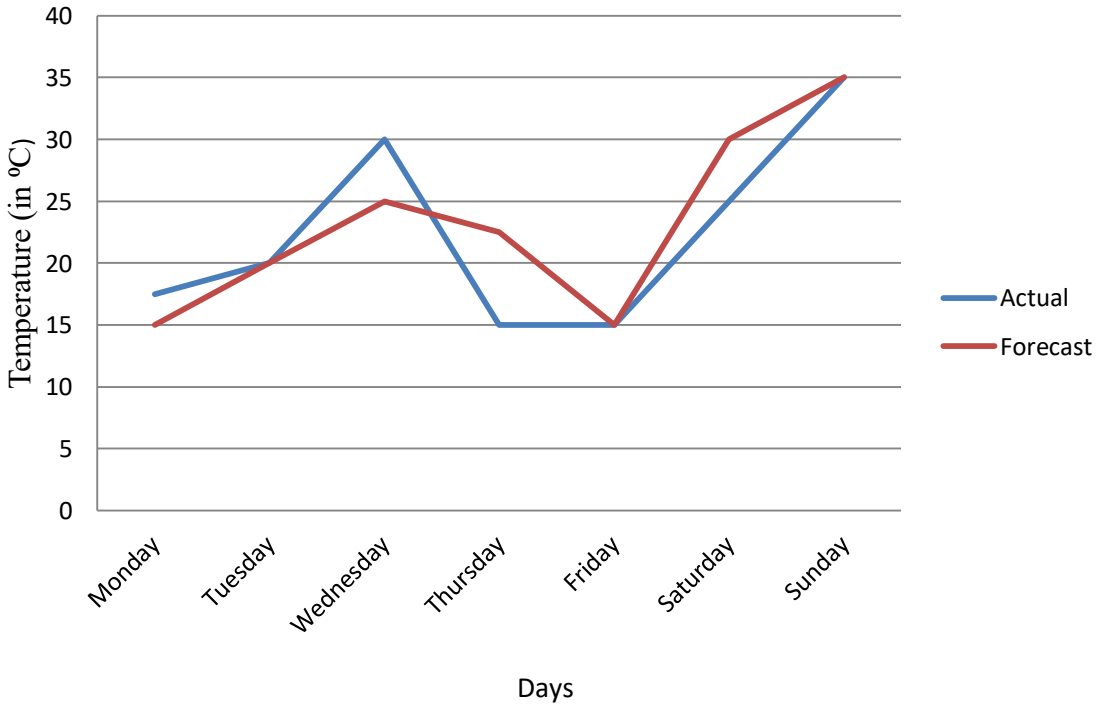
(d) The temperature after 25 seconds was 18 °C.

(e) Time = 1.5 minutes = 1.5 × 60 seconds

= 90 seconds

The temperature after 90 seconds was 100 °C because it is clear from the graph that it remains constant after 50 seconds.

Question 14 – The following line graph shows the temperature forecast and the actual temperature for each day of a week.



Study the above double line graph carefully and answer the questions given below:

(a) On which days was the forecast temperature the same as the actual temperature?

(b) What was the maximum forecast temperature during the week?

(c) What was the minimum actual temperature during the week?

(d) On which day did the actual temperature differ the most from the forecast temperature?

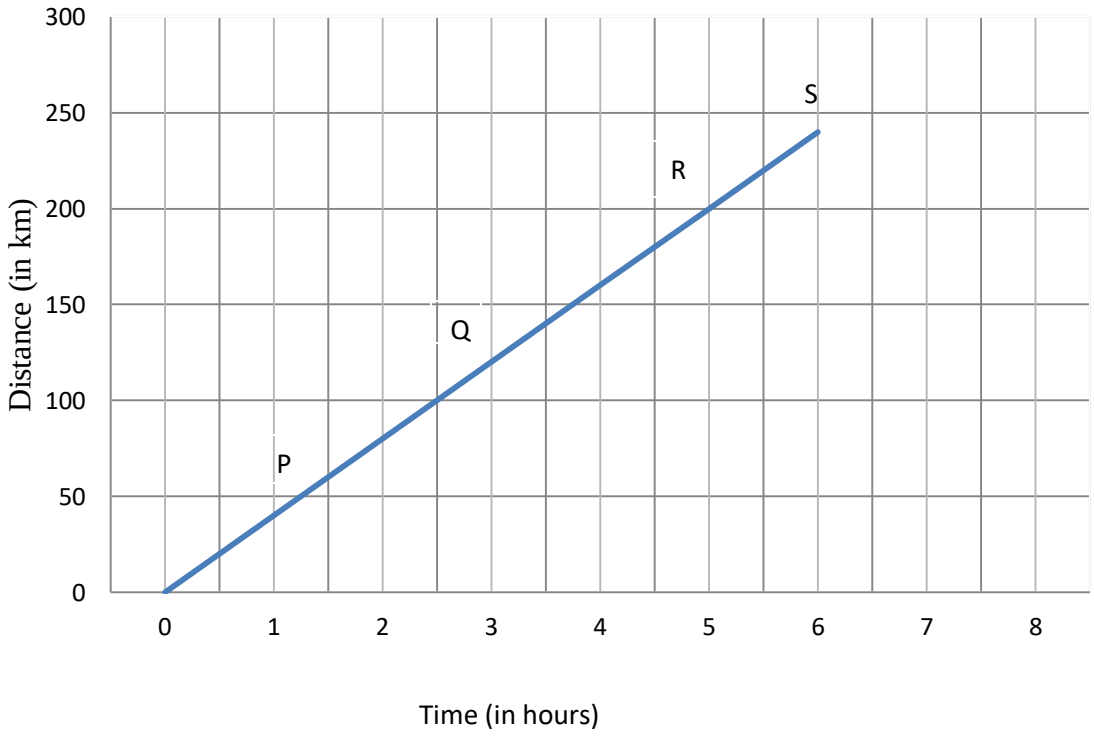
Solution – (a) The forecast temperature is same as the actual temperature on Tuesday, Friday and Sunday.

(b) The maximum forecast temperature during the week was 35 °C.

(c) The minimum actual temperature during the week was 15 °C.

(d) From the graph; it is clear that the actual temperature differ the most from the forecast temperature on Thursday.

Question 15 – The following distance-time graph is for a car travelling to certain places.



Study the above distance-time graph carefully and answer the questions given below:

(a) How far does the car travel in 4 ½ hours?

(b) How much time does the car take to reach R?

(c)How long does the car take to cover 80 km?

(d) How far is Q from the starting point?

(e)When does the car reach the place S after starting?

Solution – (a) It can be seen from the graph that the car travels 180 km in 4 ½ hours.

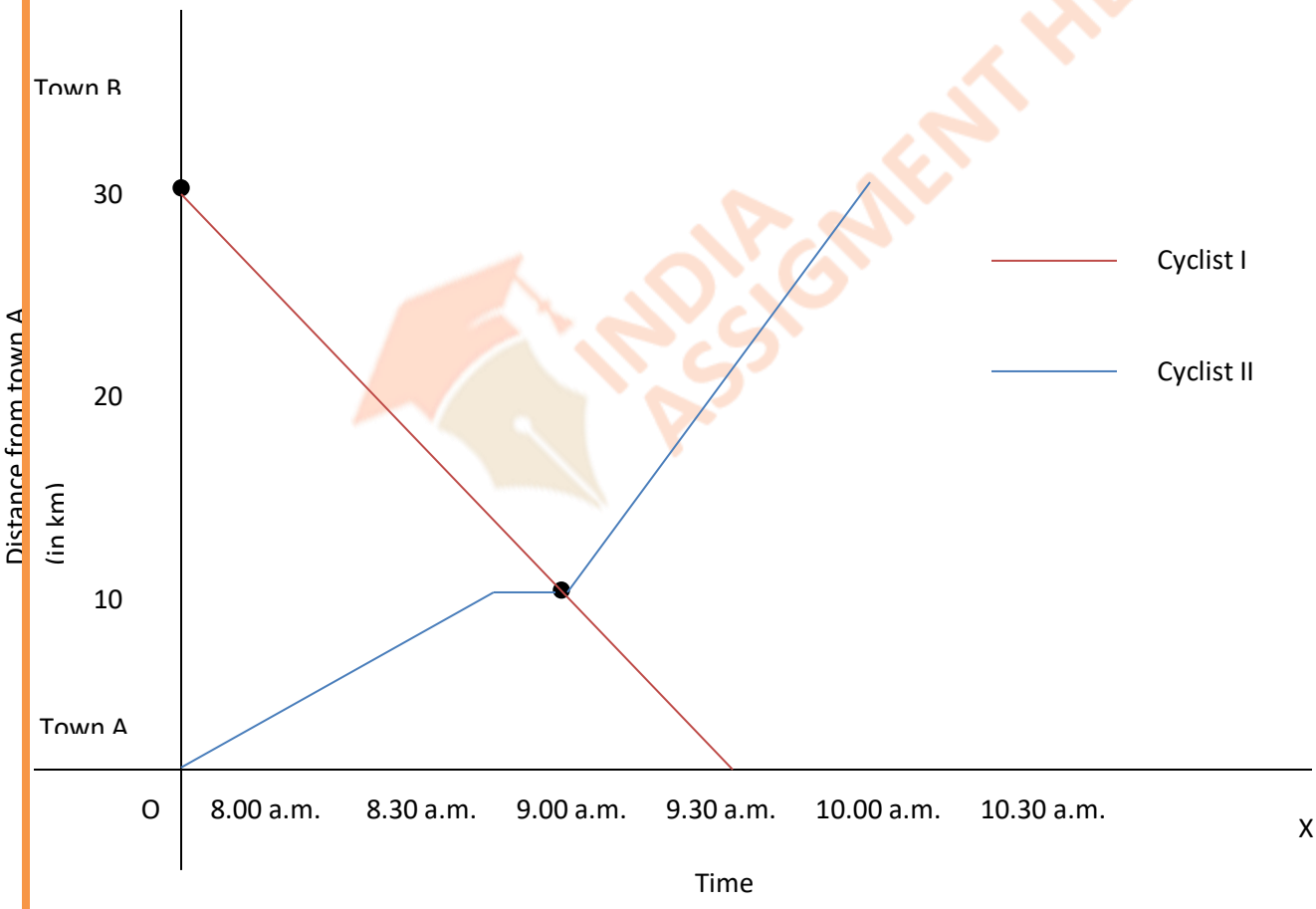
(b) Time taken by car to R is 5 hours.

(c) Car takes 2 hours to cover 80 km.

(d) Q is 120 km far from the starting point.

(e) The car reaches the place S after starting after 6 hours.

Question 16 – The following line graph shows the journey made by two cyclists, cyclist I and cyclist II, one from town B to town A and the other from town A to town B.



Study the above graph carefully and answer the questions given below:

(a) At what time did cyclist II rest? For how long did the cyclist rest?

(b) Was cyclist II cycling faster or slower after the rest?

(c) At what time did the two cyclists meet?

(d) How far had cyclist II travelled when he met cyclist I?

(e) When cyclist II reached town B, how far was cyclist I from town A?

Solution – (a) Cyclist II rest at 8.45 a.m. for time period of 15 minutes.

(b) Cyclist II was cycling faster after the rest.

(c) The cyclist I and cyclist II meet at 9.00 a.m.

(d) Cyclist II travelled the distance of 10 km when he met cyclist I

(e) When cyclist II reached town B, cyclist I was 10 km far away from town A.

Question 17 – The following table gives the distances travelled by a car at various time-intervals. Study the table and draw a linear graph for the same.

Time	**6 a.m.**	**7 a.m.**	**8 a.m.**	**9 a.m.**
Distance (in km)	**40**	**80**	**120**	**160**

From your graph, answer the questions given below:

(a) How much distance did the car cover during the period from 7.30 a.m. to 8 a.m.?

(b) What was the time when the car had covered a distance of 100 km, since its start?

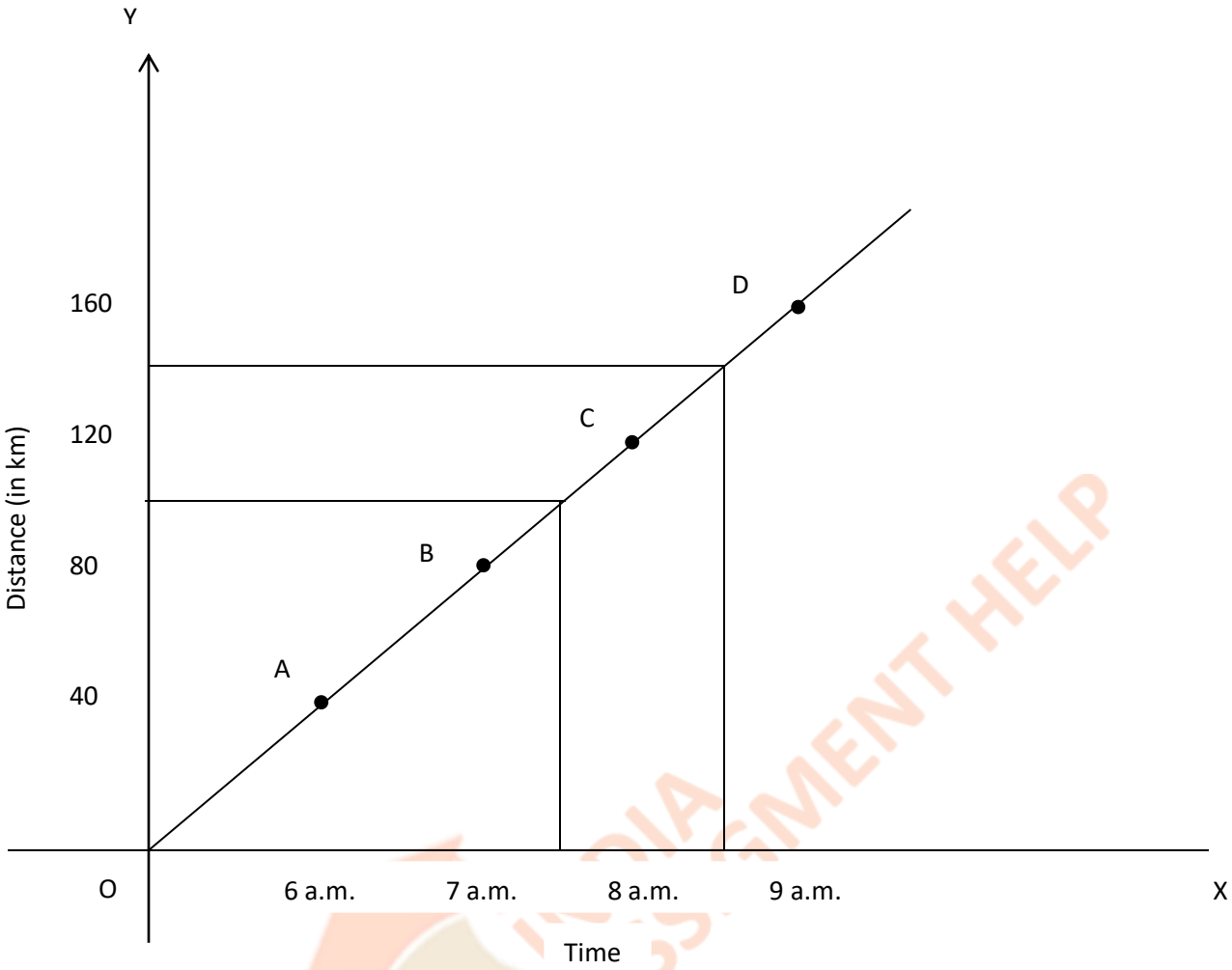
(c) How much distance had the car covered by 8.30 a.m.?

Solution – We will first make a graph using the above data:

Let OX and OY be the x-axis and y-axis respectively. O is the origin.

We take time along the x-axis and distance (in km) along the y-axis.

We get the required graph by plotting the points (6 a.m., 40), (7 a.m., 80), (8 a.m., 120) and (9 a.m., 160) as follows:



(a) During the period from 7.30 a.m. to 8 a.m., the distance covered by car was 20 km

(b) When the car had covered a distance of 100 km, since its start, the time was 7.30 a.m.

(c) The car had covered the distance of 140 km by 8.30 a.m.

Question 18 – Study the table given below and draw a line graph for it.

Side of the square (in cm)	**2**	**3**	**3.5**	**5**	**6**
Perimeter (in cm)	**8**	**12**	**14**	**20**	**24**

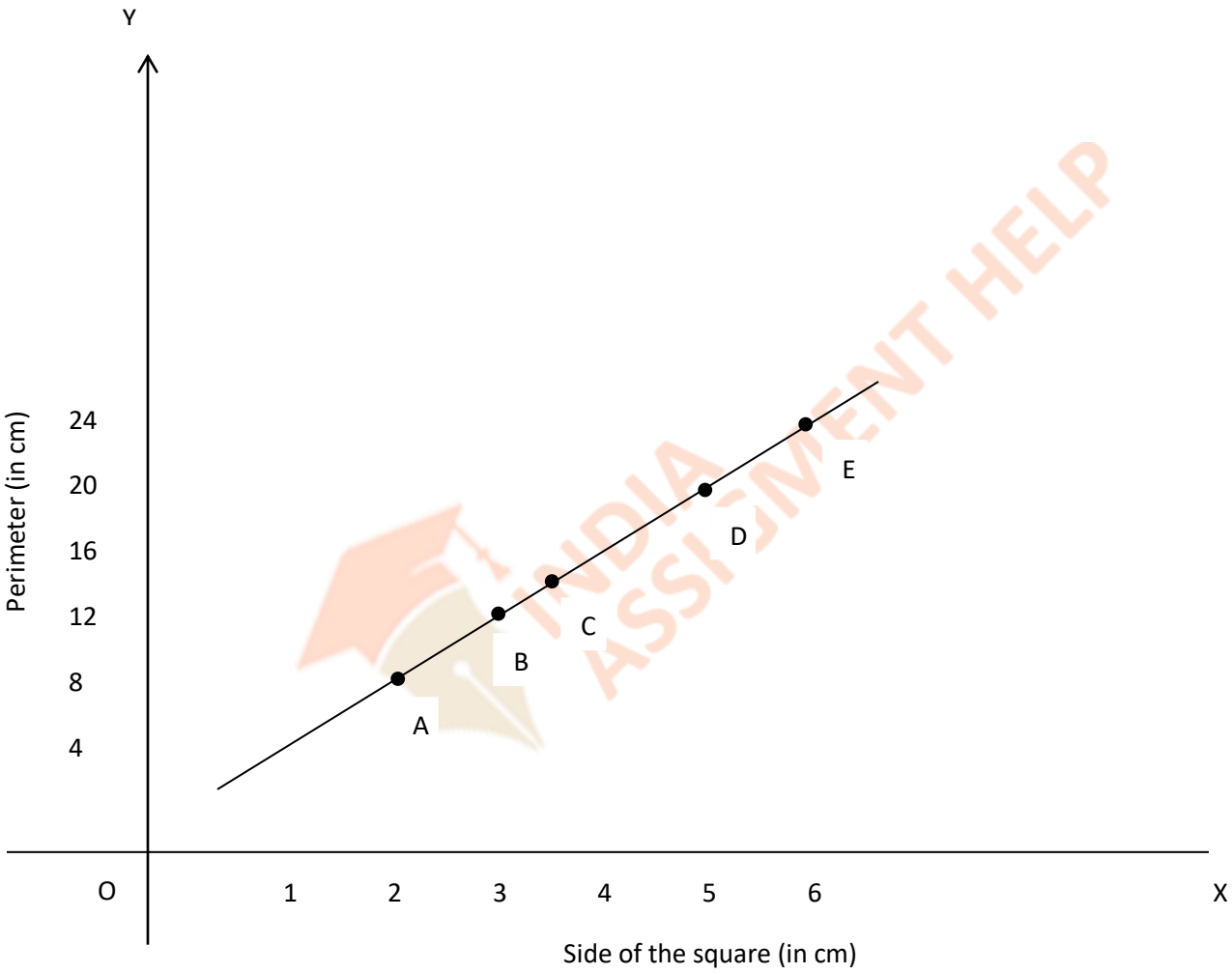
Is the graph drawn, a linear graph?

Solution - We will first make a graph using the above data:

Let OX and OY be the x-axis and y-axis respectively. O is the origin.

We take side of square (in cm) along the x-axis and perimeter (in cm) along the y-axis.

We get the required graph by plotting the points (2, 8), (3, 12), (3.5, 14), (5, 20) and (6, 24) as follows:



We can see that the above graph is a linear graph.

Question 19 – Study the table given below and draw a line graph for it.

Side of square (in cm)	**2**	**3**	**4**	**5**	**6**
Area (in sq. cm)	**4**	**9**	**16**	**25**	**36**

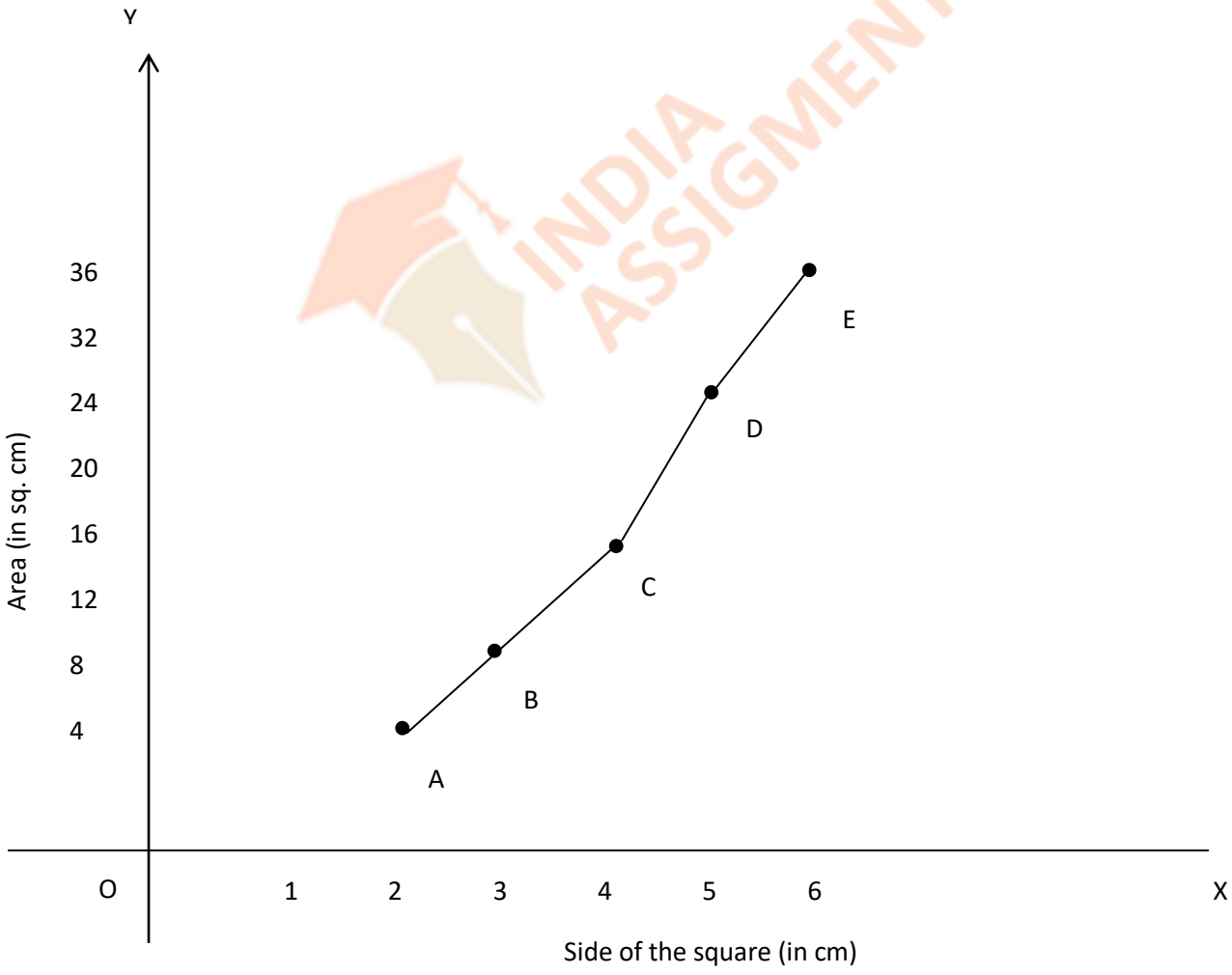
Is the graph drawn, a linear graph?

Solution - We will first make a graph using the above data:

Let OX and OY be the x-axis and y-axis respectively. O is the origin.

We take side of square (in cm) along the x-axis area (in sq. cm) along the y-axis.

We get the required graph by plotting the points (2, 4), (3, 9), (4, 16), (5, 25) and (6, 36) as follows:



We can see that the above graph is not a linear graph.

Question 20 – Plot a line graph for the variables p and q, where p is four times q, i.e., the equation is p = 4q.

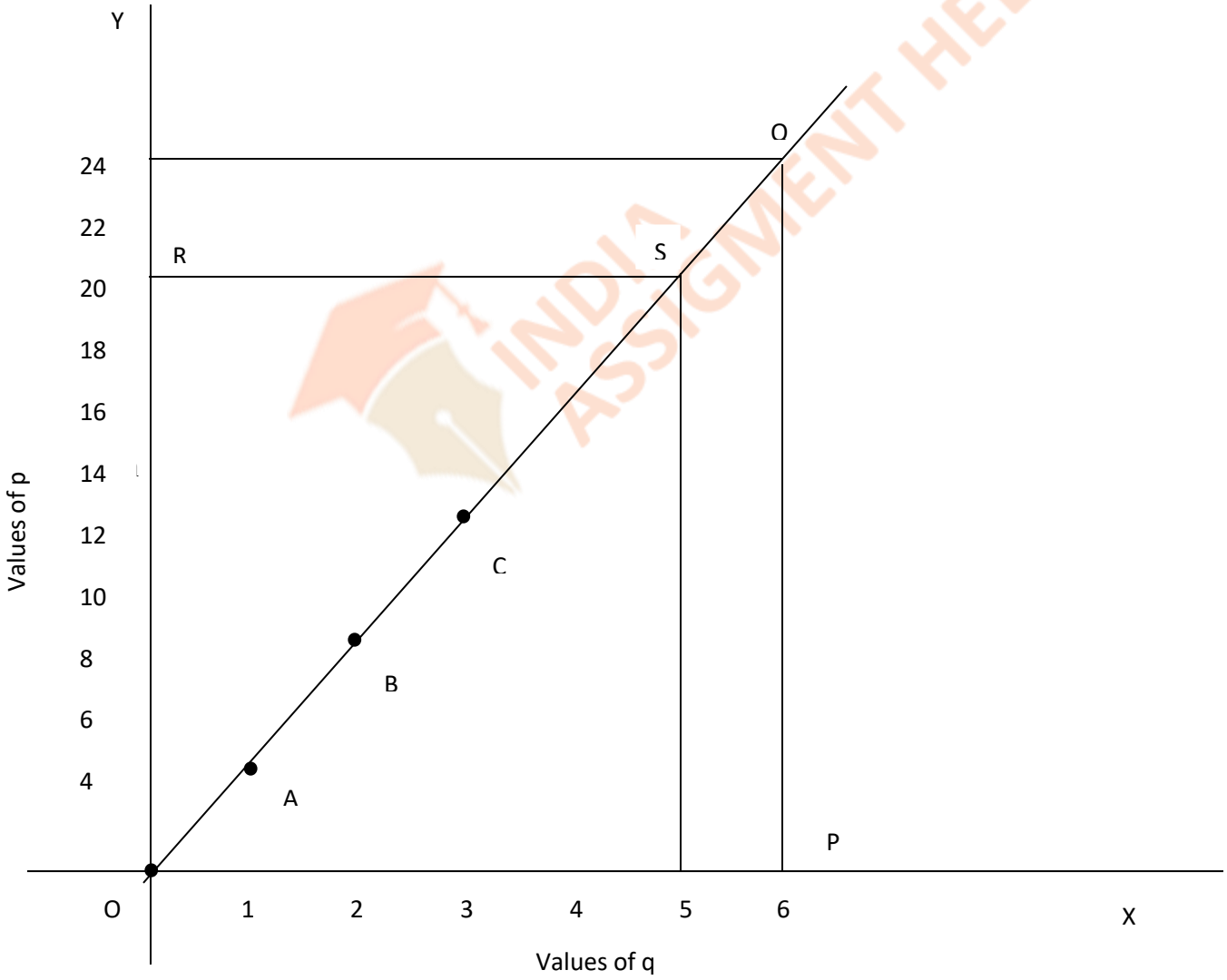
Using the graph, find the value of p, when q =6 and q, when p = 20

Solution – The equation is given to be p = 4q

We draw a table for the values of p and q as follows:

p	0	4	8	12
q	0	1	2	3

Using these values, we plot the points O (0, 0), A (1, 4), B (2, 8) and C (3, 12) on the graph as follows:



(a) When q = 6, p =?

We take point ‘P’ at q = 6 and draw PQ parallel to y-axis, we get p = 24

(b) When p = 20, q =?

We take point ‘R’ at p = 20 and draw RS parallel to x-axis, we get q = 5.

Question 21 – Plot a line graph for the variables x and y, where y = 2x + 1.

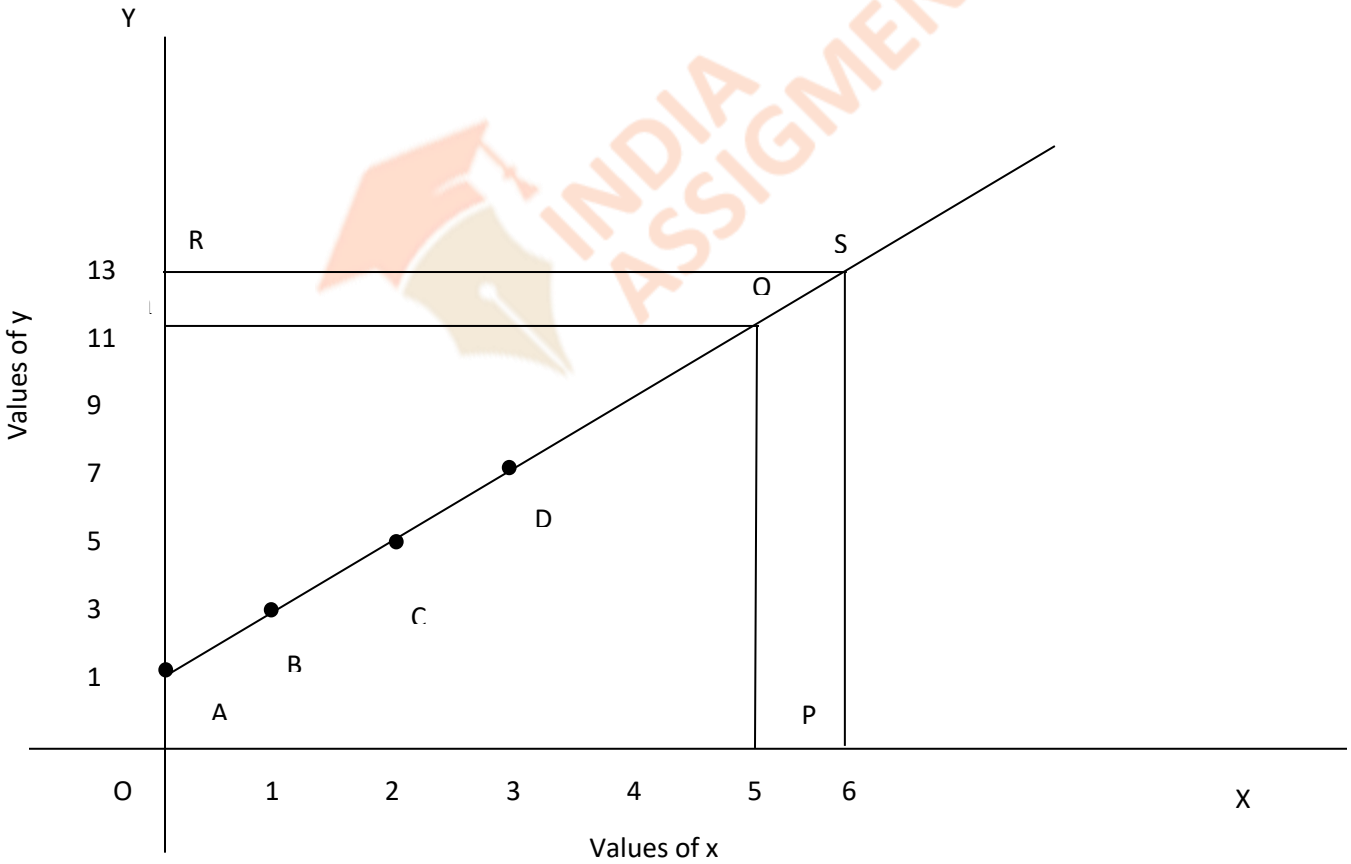
Using the graph, find the value of y, when x = 5 and x, when y = 13.

Solution – The equation is given to be y = 2x + 1

We draw a table for the values of x and y as follows:

x	0	1	2	3
y	1	3	5	7

Using these values, we plot the points A (0, 1), B (1, 3), C (2, 5) and D (3, 7) on the graph as follows:



(a) When x = 5, y =?

We take point ‘P’ at x =5 and draw PQ parallel to y-axis, we get y = 11

(b) When y = 13, x =?

We take point ‘R’ at y = 13 and draw RS parallel to x-axis, we get x = 6

Question 22 – A bank gives 10% simple interest on deposits by senior citizens. Draw a line graph to illustrate the relation between the sum deposited and the simple interest earned.

Find from the graph:

(a) The annual interest obtainable for an investment of Rs 250.

(b) The investment one has to make in order to get an annual simple interest of Rs 70

Solution – We know that SI = (P×R×T)/100

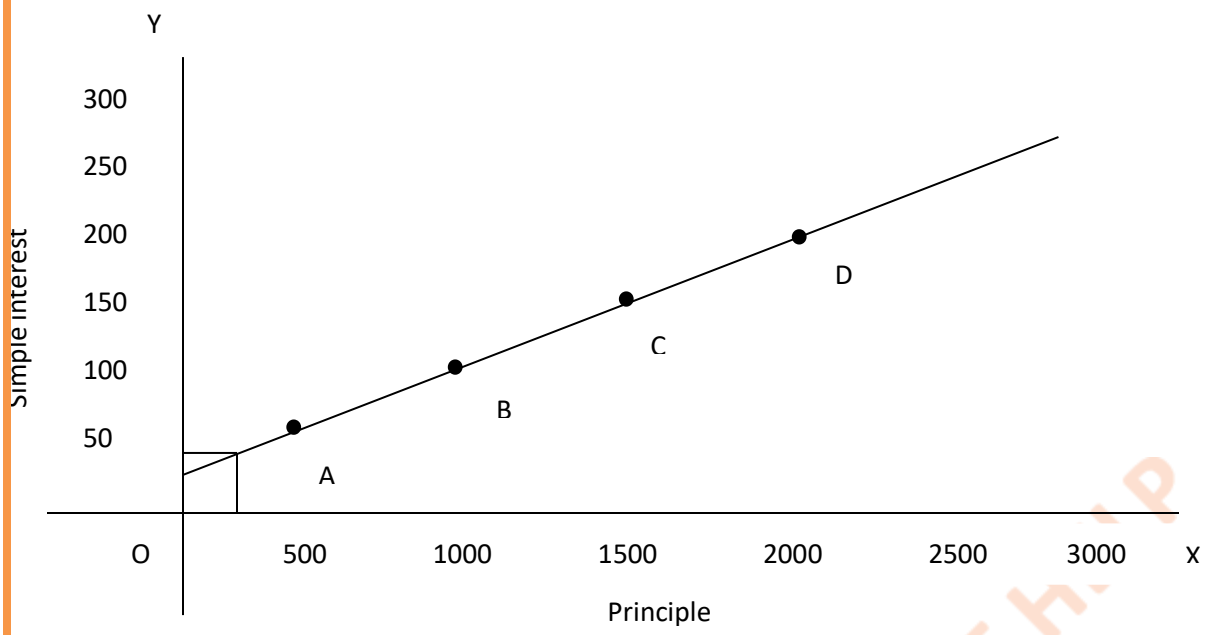
Where, SI = Simple interest, P = Principle, R = Rate, T = Time

Rate = 10% and T = 1 year

Thus, we can make a table to show the data as follows:

Principle (P)	500	1000	1500	2000
Simple Interest	50	100	150	200

Using these values, we plot the points A (500, 50), B (1000, 100), C (1500, 150) and D (2000, 200) on the graph as follows:



(a) It is given that P = Rs 250

SI =?

Since, SI = (P×R×T)/100

SI = 250 × 10% ×1 = Rs 25

(b) Given that SI = Rs 70

P =?

Since, SI = (P×R×T)/100

70 = (P × 10 × 1)/100

7000 = P× 10

P = Rs 700

Question 23 – Sajal can ride a scooter constantly at a speed of 30 km/hr. Draw a distance-time graph for this situation.

Use the graph drawn to find:

(a) The time taken by Sajal to ride 75 km

(b) The distance covered by Sajal in 3 ½ hours.

Solution – We know that speed = Distance / time

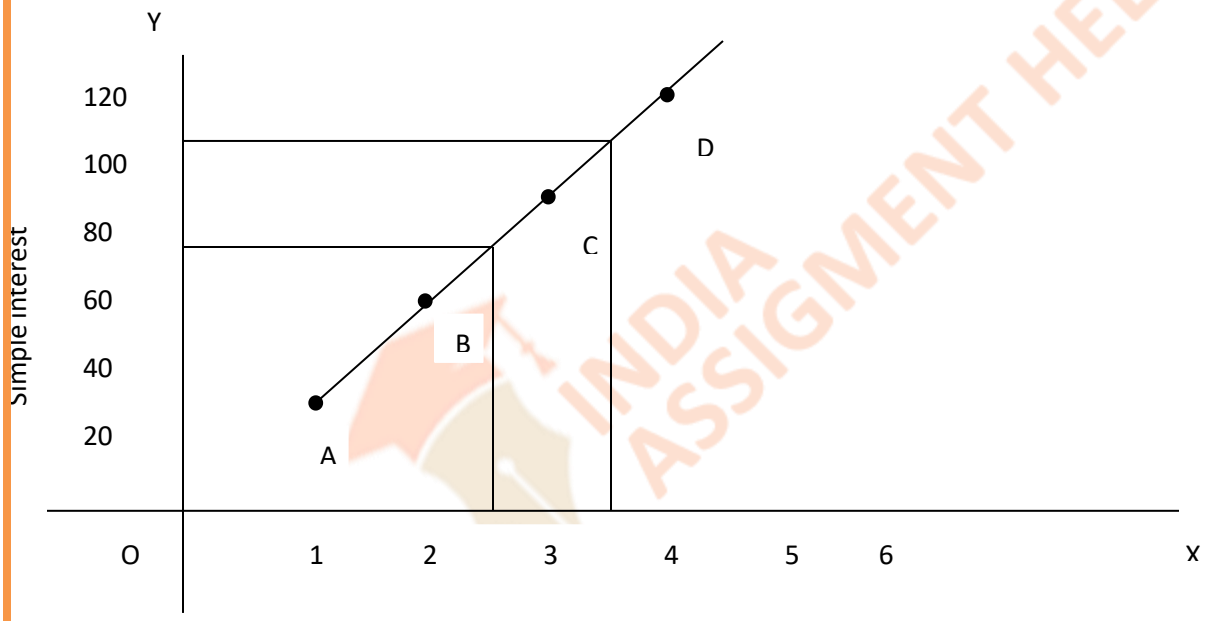
Distance = speed × time

Speed = 30 km/hr.

Thus, we can make a table to show the data as follows:

Time	1	2	3	4
Distance	30	60	90	120

Using these values, we plot the points A (1, 30), B (2, 60), C (3, 90) and D (4, 120) on the graph as follows:



(a) Given that distance = 75 km

Time =?

Time = Distance / speed = 75/30 = 2.5 hrs.

Also, from the graph we can see that the time taken by sajal to ride 75 km is 2.5 hr.

(b) Given the time = 3 ½ hours = 7/2 hrs. = 3.5 hrs.

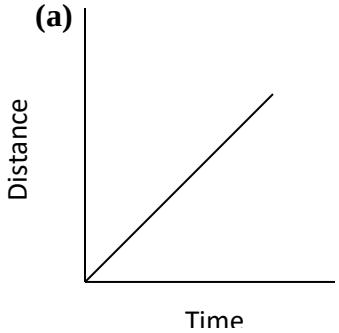
Distance =?

Distance = Speed × time = 30 × 3.5 = 105 km

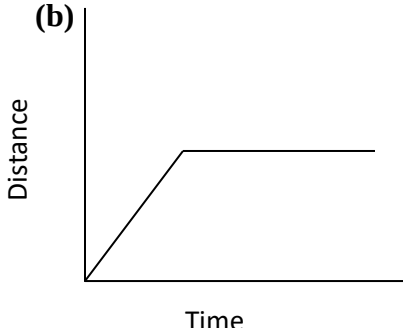
Also, from the graph we see that the distance covered by sajal in 3.5 hrs. = 105 km

Question 24 – Explain the situations represented by the following distance-time graphs:

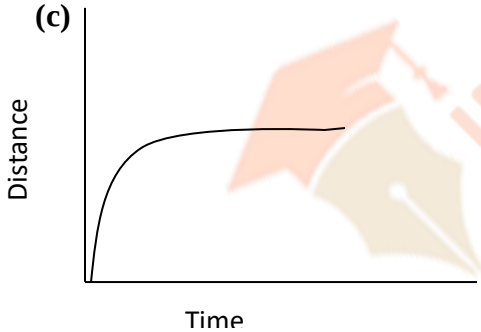
(a)



(b)



(c)



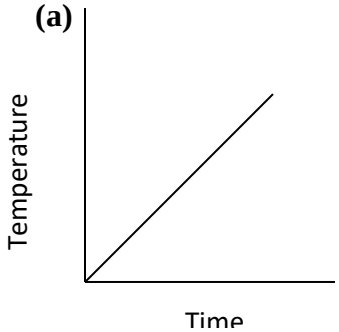
Solution – (a) We know that the distance-time graph shows the speed. Thus in the given graph, it shows the uniform speed.

(b) The second figure shows that the graph moves with uniform speed and then it comes to rest.

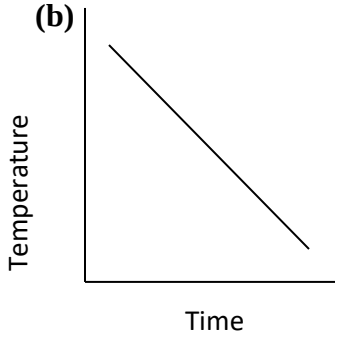
(c) The third figure shows that the graph moves with the non-uniform speed and then slowly comes to rest.

Question 25 – Can there be a temperature-time graph as follows? Justift your answer.

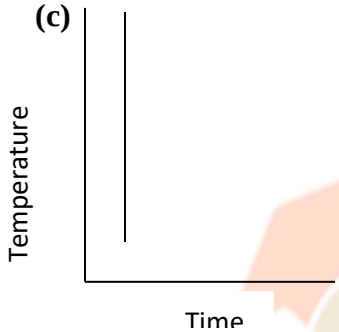
(a)



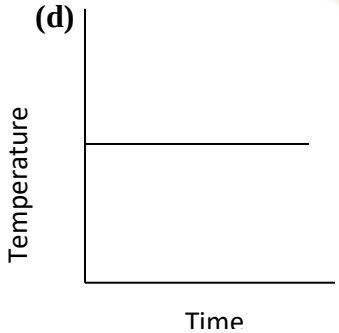
(b)



(c)



(d)



Solution - (a) Yes, the first figure can be a temperature-time graph as it shows that temperature is directly proportional with the time. It shows that with the increase in time, temperature is also increasing.

(b) Yes, the second figure can be a temperature-time graph since there is inverse relationship between time and temperature. It shows that with the increase in time, temperature is declining.

(c) No, the third figure cannot be a temperature-time graph since there cannot be different temperatures at the same time.

(d) Yes, the forth figure can be a temperature-time graph since it shows that the temperature remains constant as the time increases.