Case Study Class 10 Maths Chapter 7 Coordinate Geometry

Case Study 5: Designing a Garden Layout

A landscape architect is designing a garden on a 10×10 coordinate grid where each unit equals 1 metre. A fountain is placed at F(0, 0), a rose bed at R(4, 6), a tulip section at T(−3, 5), a herb garden at H(5, −4), and a bench at B(−2, −6). The architect wants to calculate walking distances and find optimal placement for a water tap.

Questions:

(i) Find the distance from the fountain to the rose bed.

(ii) A water tap is placed at the midpoint between the rose bed and the herb garden. Find its location.

(iii) Find the distance between the tulip section and the herb garden.

(iv) Find the distance from the bench to the fountain.

(v) Is the distance from the rose bed to the fountain greater than the distance from the tulip section to the fountain? Compare with calculations.

Solution:

(i) F(0,0), R(4,6): $d = \sqrt{[16+36]} = \sqrt{52} = 2\sqrt{13} \approx 7.21$ metres.

(ii) Midpoint of R(4,6) and H(5,−4): $= ((4+5)/2, (6+(-4))/2) = (9/2, 1) = (4.5, 1)$. The water tap sits roughly 4.5 m east and 1 m north of the fountain.

(iii) T(−3,5), H(5,−4): $d = \sqrt{[(5-(-3))^2 + (-4-5)^2]} = \sqrt{[64+81]} = \sqrt{145} \approx 12.04$ metres.

(iv) B(−2,−6), F(0,0): $d = \sqrt{[4+36]} = \sqrt{40} = 2\sqrt{10} \approx 6.32$ metres.

(v) Rose bed to fountain = $2\sqrt{13} \approx 7.21$ m. Tulip to fountain: T(−3,5), F(0,0): $d = \sqrt{[9+25]} = \sqrt{34} \approx 5.83$ m. Yes, the rose bed (7.21 m) is farther from the fountain than the tulip section (5.83 m).

Case Study 6: Mapping Tourist Attractions

A tourist map of a heritage town uses a coordinate system where each unit represents 500 metres. The Central Museum is at M(2, 5), the Old Fort is at F(−4, 2), the Lake Garden is at L(3, −3), and the Craft Market is at C(−1, −4). A tourist bus starts from the Railway Station at S(0, 0) and needs to plan an efficient route.

Questions:

(i) Find the distance from the Railway Station to the Central Museum.

(ii) Find the distance from the Old Fort to the Lake Garden.

(iii) A rest point is set up at the midpoint between the Museum and the Craft Market. Find its coordinates.

(iv). Which attraction is closest to the Railway Station?

(v) The bus driver claims the Old Fort and the Lake Garden are more than 8 units apart. Verify this claim.

Solution:

(i) S(0,0), M(2,5): $d = \sqrt{[4+25]} = \sqrt{29} \approx 5.39$ units ≈ 2.69 km.

(ii) F(−4,2), L(3,−3): $d = \sqrt{[(3-(-4))^2 + (-3-2)^2]} = \sqrt{[49+25]} = \sqrt{74} \approx 8.60$ units ≈ 4.3 km.

(iii) Midpoint of M(2,5) and C(−1,−4): = ((2+(−1))/2, (5+(−4))/2) = (1/2, 1/2) = (0.5, 0.5) very close to the Railway Station.

(iv) S to M: $\sqrt{29} \approx 5.39$. S to F: $\sqrt{[16+4]} = \sqrt{20} \approx 4.47$. S to L: $\sqrt{[9+9]} = \sqrt{18} \approx 4.24$. S to C: $\sqrt{[1+16]} = \sqrt{17} \approx 4.12$. Craft Market C is closest to the Railway Station at ≈ 4.12 units.

(v) Fort F(−4,2) to Lake L(3,−3): $d = \sqrt{74} \approx 8.60 > 8$. The claim is correct the Old Fort and Lake Garden are more than 8 units (4 km) apart.

Case Study 7: Coordinate Based Data Analysis

A data analyst is plotting monthly revenue data for a small business on a coordinate plane. January revenue is represented at J(1, 40), March at M(3, 52), June at N(6, 70), September at P(9, 85), and December at D(12, 100). The x-axis shows the month number and the y-axis shows revenue in thousands of rupees. The analyst wants to study the rate and pattern of growth.

Questions:

(i) Find the distance between the January and December revenue points.

(ii) Find the midpoint between the March and September data points. What does this midpoint represent?

(iii) Find the slope of the line segment from January to December (rise over run).

(iv) The analyst wants to estimate July's revenue using the midpoint of June and September data. Find this estimate.

(v) What is the average monthly revenue increase from January to December?

Solution:

(i) J(1,40), D(12,100): $d = \sqrt{[(12-1)^2 + (100-40)^2]} = \sqrt{[121+3600]} = \sqrt{3721} = 61$ units.

(ii) Midpoint of M(3,52) and P(9,85): = ((3+9)/2, (52+85)/2) = (6, 68.5) = (6, 68.5). This represents an estimated revenue of ₹68,500 in June the middle month between March and September.

(iii) Slope from J to D = (100−40)/(12−1) = 60/11 ≈ 5.45. This means revenue increases by approximately ₹5,450 per month on average.

(iv) Midpoint of N(6,70) and P(9,85): = ((6+9)/2, (70+85)/2) = (7.5, 77.5). This estimates July's revenue at approximately ₹77,500 (the midpoint month 7.5 is between June and September).

(v) Total increase = 100 − 40 = ₹60,000 over 11 months (from January = month 1 to December = month 12). Average monthly increase = 60,000 / 11 ≈ ₹5,454.55 per month.