Exercise 16A

Question 13:
Let A(1, -1), B(5, 2) and C(9, 5) are the given points. Then

$$AB = \sqrt{(5-1)^2 + (2+1)^2} = \sqrt{(4)^2 + (3)^2}$$
$$= \sqrt{16+9} = \sqrt{25} = 5 \text{ units}$$
$$BC = \sqrt{(9-5)^2 + (5-2)^2} = \sqrt{(4)^2 + (3)^2}$$
$$= \sqrt{16+9} = \sqrt{25} = 5 \text{ units}$$
$$AC = \sqrt{(9-1)^2 + (5+1)^2} - \sqrt{(8)^2 + (6)^2}$$
$$= \sqrt{64+36} = \sqrt{100} = 10 \text{ units}$$
$$AB + BC = (5+5)\text{units} = 10\text{units} = AC$$
$$\text{thus, } AB + BC = AC$$

Hence the given points A, B, C are collinear.

Question 14:
(i) Let A (6,9), B(0,1) and C(-6, -7) be the given points. Then

$$AB = \sqrt{(0-6)^2 + (1-9)^2} = \sqrt{(-6)^2 + (-8)^2} = \sqrt{36+64}$$
$$= \sqrt{100} = 10 \text{ units}$$
$$BC = \sqrt{(-6-0)^2 + (-7-1)^2} = \sqrt{34+64} = \sqrt{100} = 10 \text{ units}$$
$$AC = \sqrt{(-6-6)^2 + (-7-9)^2} = \sqrt{(-12)^2 + (-16)^2} = \sqrt{144+256}$$
$$= \sqrt{400} = 20 \text{ units}$$
$$\therefore AB + BC = (10+10)\text{units} = 20\text{units} = AC$$
$$\therefore AB + BC = AC$$

Hence the given A, B, C are collinear.
(ii) Let A(-1, -1), B(2,3) and C(8,11) be the given points. Then

$$AB = \sqrt{(2+1)^2 + (3+1)^2} = \sqrt{(3)^2 + (4)^2} = \sqrt{9+16} = \sqrt{25} = 5\text{units}$$
$$BC = \sqrt{(8-2)^2 + (11-3)^2} = \sqrt{(6)^2 + (8)^2} = \sqrt{36+64} = \sqrt{100} = 10\text{units}$$
$$AC = \sqrt{(8+1)^2 + (11+1)^2} = \sqrt{(9)^2 + (12)^2} = \sqrt{81+144} = \sqrt{225}$$
$$= 15 \text{ units}$$
$$\therefore AB + BC = (5\text{units} + 10\text{units})$$
$$= 15\text{units} = AC$$
$$\therefore AB + BC = AC$$

Hence the given A, B, C are collinear.
(iii) Let P(1,1), Q(-2,7) and R(3, -3) be the given points, then

$$PQ = \sqrt{(-2-1)^2 + (7-1)^2} = \sqrt{(-3)^2 + (6)^2}$$
$$= \sqrt{9+36} = \sqrt{45}$$
$$= 3\sqrt{5} \text{ units}$$
$$QR = \sqrt{(3+2)^2 + (-3-7)^2} = \sqrt{(5)^2 + (-10)^2}$$
$$= \sqrt{125} = 5\sqrt{5} \text{ units}$$
$$PR = \sqrt{(3-1)^2 + (-3-1)^2} = \sqrt{2^2 + (-4)^2} = \sqrt{20} = 2\sqrt{5} \text{ units}$$

$\therefore PQ + PR = \left(3\sqrt{5} + 2\sqrt{5}\right) = 5\sqrt{5}$ units $= QR$

Thus, $PQ + PR = QR$

Hence, the given points P, Q, R are collinear

(iv) Let P(2,0), Q(11,6) and R(-4,-4) be the given points
Then,

$$PQ = \sqrt{(11-2)^2 + (6-0)^2} = \sqrt{(9)^2 + (6)^2} = \sqrt{117} = 3\sqrt{13} \text{ units}$$
$$QR = \sqrt{(-4-11)^2 + (-4-6)^2} = \sqrt{(-15)^2 + (-10)^2} = \sqrt{325} = 5\sqrt{13} \text{ units}$$
$$PR = \sqrt{(-4-2)^2 + (-4-0)^2} = \sqrt{(-6)^2 + (-4)^2} = \sqrt{52} = 2\sqrt{13} \text{ units}$$

$$PQ + PR = \left(3\sqrt{13} + 2\sqrt{13}\right) \text{units} = 5\sqrt{13} \text{ unit} = QR$$

$\therefore PQ + PR = QR$

Hence the given P, Q, R are collinear.

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