Exercise 14(B) Page No: 190

1. Find the slope of the line whose inclination is:
(i) 0^o (ii) 30^o
(iii) 72^o 30' (iv) 46^o
Solution:

We know that, the slope of a line is given by the tan of its inclination.
(i) Slope = tan 0^o = 0
(ii) Slope = tan 30^o = 1/ √3
(iii) Slope = tan 72^o 30' = 3.1716
(iv) Slope = tan 46^o = 1.0355

2. Find the inclination of the line whose slope is:
(i) 0 (ii) √3
(iii) 0.7646 (iv) 1.0875
Solution:

(i) Slope = tan θ = 0
⇒ θ = 0^o
(ii) Slope = tan θ = √3
⇒ θ = 60^o
(iii) Slope = tan θ = 0.7646
⇒ θ = 37^o 24'
(iv) Slope = tan θ = 1.0875
⇒ θ = 47^o 24'

3. Find the slope of the line passing through the following pairs of points:
(i) (-2, -3) and (1, 2)
(ii) (-4, 0) and origin
(iii) (a, -b) and (b, -a)
Solution:

We know that,
Slope = $(y_2 - y_1)/ (x_2 - x_1)$
(i) Slope = (2 + 3)/ (1 + 2) = 5/3
(ii) Slope = (0 - 0)/ (0 + 4) = 0
(iii) Slope = (-a + b)/ (b - a) = 1

4. Find the slope of the line parallel to AB if:
(i) A = (-2, 4) and B = (0, 6)
(ii) A = (0, -3) and B = (-2, 5)
Solution:

(i) Slope of AB = (6 - 4)/ (0 + 2) = 2/2 = 1
Hence, slope of the line parallel to AB = Slope of AB = 1

(ii) Slope of AB = (5 + 3)/ (-2 - 0) = 8/-2 = -4
Hence, slope of the line parallel to AB = Slope of AB = -4

5. Find the slope of the line perpendicular to AB if:
(i) A = (0, -5) and B = (-2, 4)
(ii) A = (3, -2) and B = (-1, 2)
Solution:

(i) Slope of AB = (4 + 5)/ (-2 - 0) = -9/2
Slope of the line perpendicular to AB = -1/Slope of AB = -1/(-9/2) = 2/9
(ii) Slope of AB = (2 + 2)/ (-1 - 3) = 4/-4 = -1
Slope of the line perpendicular to AB = -1/slope of AB = -1/-1 = 1

6. The line passing through (0, 2) and (-3, -1) is parallel to the line passing through (-1, 5) and (4, a). Find a.
Solution:

Slope of the line passing through (0, 2) and (-3, -1) = (-1 - 2)/ (-3 - 0) = -3/-3 = 1
Slope of the line passing through (-1, 5) and (4, a) = (a - 5)/ (4 + 1) = (a -5)/ 5
As, the lines are parallel.
The slopes must be equal.
1 = (a - 5)/ 5
a – 5 = 5
a = 10

7. The line passing through (-4, -2) and (2, -3) is perpendicular to the line passing through (a, 5) and (2, -1). Find a.
Solution:
Slope of the line passing through (-4, -2) and (2, -3) = (-3 + 2)/ (2 + 4) = -1/6
Slope of the line passing through (a, 5) and (2, -1) = (-1 – 5)/ (2 - a) = -6/ (2 –a)
As, the lines are perpendicular we have
-1/6 = -1/(-6/ 2 – a)
-1/6 = (2 - a)/6
2 – a = -1
a = 3

8. Without using the distance formula, show that the points A (4, -2), B (-4, 4) and C (10, 6) are the vertices of a right-angled triangle.
Solution:

Given points are A (4, -2), B (-4, 4) and C (10, 6).
Calculating the slopes, we have
Slope of AB = (4 + 2)/ (-4 - 4) = 6/ -8 = -3/4
Slope of BC = (6 – 4)/ (10 + 4) = 2/ 14 = 1/7
Slope of AC = (6 + 2)/ (10 - 4) = 8/ 6 = 4/3
It’s clearly seen that,

Slope of AB = -1/ Slope of AC
Thus, AB ⊥ AC.
Therefore, the given points are the vertices of a right-angled triangle.

9. Without using the distance formula, show that the points A (4, 5), B (1, 2), C (4, 3) and D (7, 6) are the vertices of a parallelogram.
Solution:

Given points are A (4, 5), B (1, 2), C (4, 3) and D (7, 6).
Slope of AB = (2 - 5)/ (1 - 4) = -3/ -3 = 1
Slope of CD = (6 - 3)/ (7 - 4) = 3/3 = 1
As the slope of AB = slope of CD
So, we can conclude AB || CD
Now,
Slope of BC = (3 - 2)/ (4 - 1) = 1/3
Slope of DA = (6 – 5)/ (7 - 4) = 1/3
As, slope of BC = slope of DA
Hence, we can say BC || DA
Therefore, ABCD is a parallelogram.

10. (-2, 4), (4, 8), (10, 7) and (11, -5) are the vertices of a quadrilateral. Show that the quadrilateral, obtained on joining the mid-points of its sides, is a parallelogram.
Solution:

Let the given points be A (-2, 4), B (4, 8), C (10, 7) and D (11, -5).
And, let P, Q, R and S be the mid-points of AB, BC, CD and DA respectively.
So,
Co-ordinates of P are

$$\left(\frac{-2+4}{2}, \frac{4+8}{2}\right) = (1, 6)$$

Co-ordinates of Q are

$$\left(\frac{4+10}{2}, \frac{8+7}{2}\right) = \left(7, \frac{15}{2}\right)$$

Co-ordinates of R are

$$\left(\frac{10+11}{2}, \frac{7-5}{2}\right) = \left(\frac{21}{2}, 1\right)$$

Co-ordinates of S are

$$\left(\frac{11-2}{2}, \frac{-5+4}{2}\right) = \left(\frac{9}{2}, \frac{-1}{2}\right)$$

$$Slope\ of\ PQ = \frac{\frac{15}{2} - 6}{7 - 1} = \frac{\frac{15 - 12}{2}}{6} = \frac{3}{12} = \frac{1}{4}$$

$$Slope\ of\ RS = \frac{\frac{-1}{2} - 1}{\frac{9}{2} - \frac{21}{2}} = \frac{\frac{-1-2}{2}}{\frac{9-21}{2}} = \frac{-3}{-12} = \frac{1}{4}$$

As, slope of PQ = Slope of RS, we can say PQ || RS.
Now,

$$Slope\ of\ QR = \frac{1 - \frac{15}{2}}{\frac{21}{2} - 7} = \frac{\frac{2-15}{2}}{\frac{21-14}{2}} = \frac{-13}{7}$$

$$Slope\ of\ SP = \frac{\frac{-1}{2} - 6}{\frac{9}{2} - 1} = \frac{\frac{-1-12}{2}}{\frac{9-2}{2}} = \frac{-1-12}{7} = \frac{-13}{7}$$

As, slope of QR = Slope of SP, we can say QR || SP.
Therefore, PQRS is a parallelogram.

11. Show that the points P (a, b + c), Q (b, c + a) and R (c, a + b) are collinear.
Solution:

We know that,
The points P, Q, R will be collinear if the slopes of PQ and QR are the same.
Calculating for the slopes, we get
Slope of PQ = (c + a – b – c)/ (b – a) = (a - b)/ (b - a) = -1
Slope of QR = (a + b – c - a)/ (c - b) = (b – c)/ (c - b) = -1
Therefore, the points P, Q, and R are collinear.