***COORDINATES***

***Summary:***

***1. (i)*** *A pair of values written in the form* ***(x, y)*** *is called coordinates*

***(ii)*** *A point with given coordinates can be plotted on the* ***x−y*** *plane*

***2. (i)*** *The* ***x−y*** *plane is the same as the coordinate plane* ***or*** *the Cartesian plane*

***(ii)*** *On the* ***x−y*** *plane****,*** *the horizontal axis is called the* ***x−axis*** *and the vertical axis is called the* ***y−axis.***

***(iii)*** *The* ***x−axis*** *meets the* ***y−axis*** *at a point called the* ***origin.*** *The coordinates of the origin are* ***(0, 0)***

***(iv)*** *On the* ***x−axis,*** *values to the right of the origin are positive and those to the left are negative*

***(v)*** *On the* ***y−axis,*** *values above the origin are positive and those below are negative*

***(vi)*** *For each axis a suitable scale is chosen and then marked off at equal intervals*

***3.*** *In coordinate geometry****,*** *area is stated in terms of square units* ***(sq units)***

***EXAMPLES:***

***1.*** *On the same axes****,*** *plot the following points* ***A(4, 5 ), B(−2, −4), C(3, 0), D(0, 3), E(−3, 0)*** *and* ***F(0, −2)***

***2. (i)*** *On the same axes****,*** *plot the points* ***A(3, 2 ), B(7, 2)*** *and* ***C(7, 8)***

***(ii)*** *Join the points and name the formed figure* ***ABC.***

***(iii)*** *Calculate the area of the formed figure* ***ABC.***

***Soln:***

***(ii)*** *Figure* ***ABC*** *is a right angled triangle*

***(iii)******Area*** *=* 

***METHOD II***

***Area*** *=* 

***A(3, 2)***

***B(7, 2)***

***C(7, 8)***

***A(3, 2)***

***Area*** ***=*** *3(2) + 7(8) + 7(2)* ***= 76***

***Area*** ***=*** *2(7) + 2(7) + 8(3)* ***= 52***

***Required Area*** *=* 

***3. (i)*** *On the same axes****,*** *plot the points* ***P(−2, 3), Q(−8, 3), R(−8, 8)*** *and* ***S(−2, 8)***

***(ii)*** *Join the points and name the formed figure* ***PQRS.***

***(iii)*** *Calculate the area of the formed figure* ***PQRS.***

***Soln:***

***(ii)*** *Figure* ***PQRS*** *is a rectangle*

***(iii)******Area*** *=* 

***4. (i)*** *On the same axes****,*** *plot the points* ***A(3, 6 ), B(8, −5)*** *and* ***C(−4, −2)***

***(ii)*** *Join the points and name the formed figure* ***ABC.***

***(iii)*** *Calculate the area of the formed figure* ***ABC.***

***Soln:***

***(ii)*** *Figure* ***ABC*** *is a triangle*

***(iii)******Area*** *=* 

***A(3, 6)***

***B(8, −5)***

***C(−4, −2)***

***A(3, 6)***

***Area*** ***=*** *3(−5) + 8(−2) + −4(6)* ***= −55***

***Area*** ***=*** *8(6) + −5(−4) + −2(3)* ***= 62***

***Required Area*** *=* 

***METHOD II***

***Area*** *=* 

***5. (i)*** *On the same axes****,*** *plot the points* ***P(3, 4), Q(5, 4), R(6, 2)*** *and* ***S(2, 2)***

***(ii)*** *Join the points and name the formed figure* ***PQRS.***

***(iii)*** *Calculate the area of the formed figure* ***PQRS.***

***Soln:***

***(ii)*** *Figure* ***PQRS*** *is a trapezium*

***(iii)******Area*** *=* 

***6.*** *On the same axes****,*** *plot the following points* ***A(4, 10 ), B(−2, −40), C(3, 0),***

***D(0, 30), E(−3, 15)*** *and* ***F(0, −20). [****Use a scale of* ***1cm*** *to represent* ***1 unit*** *on the* ***x− axis*** *and* ***1cm*** *to represent* ***5 units*** *on the* ***y− axis]***

***7.*** *On the same axes****,*** *plot the following points* ***A(0⋅5, 1⋅5 ), B(3, −2⋅5), C(1⋅3, 3),***

***D(1⋅7, 2⋅2), E(−1⋅8, 0⋅6)*** *and* ***F(0, −1⋅6) [****Use a scale of* ***2cm*** *to represent* ***1 unit*** *on both axes****]***

***8.*** *Write down the coordinates of each of the following points shown on the graph below****:***

***EER:***

***1.*** *On the same axes****,*** *plot the following points* ***A(3, 2 ), B(−2, 3), C(−3, −2)*** *and* ***D(2, −3)***

***2.*** *On the same axes****,*** *plot the following points* ***A(0, 4 ), B(−3, 0), C(0, −2)*** *and* ***D(2, 0)***

***3.*** *Write down the coordinates of the points marked* ***A, B, C, D, E, F, G*** *and* ***H*** *on the graph below****:***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

*Write down the coordinates of the points marked* ***A, B, C, D, E, F, G*** *and* ***H***

***4.*** *A quadrilateral has vertices* ***A(1, 20), B(−3, 30), C(−2, −10)*** *and* ***D(2, −20).***

***(i)*** *Plot the points of the quadrilateral**and identify it.*

***(ii)*** *Find the coordinates of the point of intersection of the diagonals of the*

*Quadrilateral*

***5.*** *Find the area of the quadrilateral with vertices* ***A(−2, 2), B(3, 5), C(10, 5)*** *and*

***D(5, 2)***

***6. (i)*** *Find the area of a triangle with vertices* ***P(-2, -2) Q(2 , 4)*** *and* ***R(5 , 0).***

***(ii)*** *Construct a circle circumscribing triangle* ***PQ R.*** *Hence calculate the area of the segments cut off by triangle* ***PQ R.***

***7. (i)*** *Find the area of the quadrilateral with vertices* ***A(−2, 1), B(1, 3), C(4, 1)*** *and*

***D(1, −1)***

***(ii)*** *Find the coordinates of the point of intersection of the diagonals of the*

*quadrilateral*

***8.*** *A quadrilateral has vertices* ***A(−10, 0), B(−10, 25), C(15, 25)*** *and* ***D(25, −10).***

***(i)*** *Plot the points of the quadrilateral**and identify it.* ***[****Use a scale of* ***2cm*** *to*

*represent* ***10 units*** *on both axes****]***

***(ii)*** *Find the coordinates of the point of intersection of the diagonals of the*

*Quadrilateral*

***THE SLOPE OF A LINE (GRADIENT OF A LINE)***

***Summary:***

***1. (i)*** *The gradient of a line =*

***(ii)*** *A line joining two points is called a line segment*

***2.*** *The following relationships apply to a line segment with endpoints* 

*and* 

***(i)*** *Gradient of* ***AB*** *=*

***(ii)*** *Midpoint of* ***AB*** *=*

***(iii)*** *Length of* ***AB =*** 

***EXAMPLES:***

***1.*** *Find the gradient of a line passing through the points* ***P(1, 4)*** *and* ***Q(5, 12)***

***2.*** *Find the gradient of a line passing through the origin and the point* ***P(2, 10)***

***3.*** *Find the gradient of a line passing through the origin and the point* ***P(a, b)***

***4.*** *A line of gradient* ***−3*** *passes through the points* ***P(3, 8)*** *and* ***Q(k, 2).*** *Find the value of* ***k***

***5.*** *Find the midpoint of a line segment with end points* ***(3, −7)*** *and* ***(9, −1)***

***6.*** *Find the coordinates of the point that is halfway between* ***(−1, 4)*** *and* ***(3, 6)***

***7.*** *The vertices of a parallelogram are* ***A(2, 3), B(8, 1), C(11, 5)*** *and* ***D.*** *Find the coordinates of* ***D***

***Soln:***

***HINT:*** *The diagonals of a parallelogram bisect each other*

***A(2, 3)***

***B(8, 1)***

***C(11, 5)***

***D(x, y)***

***M***

***•***

*If D* ***= (x, y)***

*⇒* 

*⇒* 



***x = 5, y = 7***

***∴*** *Vertex* ***D*** *is* ***(5, 7)***

***8.*** *The vertices of a parallelogram are* ***P(4, 4), Q(5, 7), R(2, 5)*** *and* ***S.*** *Find the coordinates of* ***S***

***Soln:***

***HINT:*** *The diagonals of a parallelogram bisect each other*

***P(4, 4)***

***Q(5, 7)***

***R(2, 5)***

***S(x, y)***

***M***

***•***

*If S* ***= (x, y)***

*⇒* 

*⇒* 



***x = 1, y = 2***

***∴*** *Vertex* ***S*** *is* ***(1, 2)***

***9.*** *The midpoint of a line segment* ***PQ*** *is* ***(4, −1).*** *If the coordinates of* ***P*** *are* ***(−4, 3),*** *find the coordinates of* ***Q***

***Soln:***

*If Q* ***= (x, y)***

*⇒* 



***x = 12, y = −5***

***∴*** *The other end* ***= (12, −5)***

***10.*** *The midpoint of a line segment is* ***(6, 2).*** *If one endpoint of the line segment is (****3, −3),*** *find the coordinates of the other endpoint*

***11.*** *Point* ***M(1, 5)*** *is halfway between* ***(−1, 4)*** *and another point* ***Q.***  *Find the coordinates of* ***Q***

***12.*** *Find the distance between the points* ***P(−8, 2)*** *and* ***Q(4, 7 )***

***Soln:***

*|****PQ|*** *=* 

***13.*** *Find the length of a line segment with end points* ***(1, 9)*** *and* ***(−2, 5)***

***14.*** *Show that the points* ***A(8, 2), B(11, 13)*** *and* ***C(2, 6)*** *are vertices of an isosceles triangle.*

***Soln:***

***HINT:*** *The two sides of an isosceles triangle are equal*

***C(2, 6)***

***A(8, 2)***

***B(11, 13)***

*|****AB|*** *=* 

*|****BC|*** *=* 

*|****AC|*** *=* 

***∴*** *Since* ***AB = BC,*** *then the triangle is isosceles*

***15.*** *The distance of point* ***P(12, k)*** *from the origin is* ***13 units.*** *Find the possible values of* ***k***

***Soln:***

*If* 



***16.*** *The distance between the points* ***(4, 8)*** *and* ***(1, k)*** *is* ***5 units.*** *Find the possible values of* ***k***

***Soln:***

*If* 



***17.*** *Point* ***P(3, 0)*** *is equidistant from the points* ***A(5, k)*** *and* ***B(−4, 6).*** *Find the possible values of* ***k***

***Soln:***

*If distance* ***AP*** *= distance* ***BP***

***⇒***



***18.*** *The end points of the diameter of a circle are* ***(1, −2)*** *and* ***(7, 6).*** *Find the****:***

***(i)*** *coordinates of the centre of the circle*

***(ii)*** *radius of the circle*

***Soln:***

***Hint:*** *Centre is the midpoint of the diameter and radius is half the diameter*

***(i)******Centre*** *=*

***(ii)******Radius*** *=* 

***19.*** *Find the centre and radius of a circle that has a diameter with endpoints*

***(−11, 19)*** *and* ***(21, −5)***

***Soln:***

***Centre*** *=*

***Radius*** *=* 

***20.*** *One end of the diameter of a circle with centre* ***(−3, 4⋅5)*** *is* ***(−1, 3).*** *Find the****:***

***(i)*** *coordinates of the other end of the diameter*

***(ii)*** *radius of the circle*

***Soln:***

*If the other end* ***= (x, y)***

*⇒* 



***x = −5, y = 6***

***∴*** *The other end* ***= (−5, 6)***

***Radius*** *=* 

***EER:***

***1.*** *Find the gradient of a line joining the points* ***P(2, 10)*** *and* ***Q(−4, −8).***

***2.*** *Find the distance between the points* ***P(−8, 2)*** *and* ***Q(4, 7 )***

***3. (i)*** *Show that the points* ***A(−2, 3), B(−5, 4)*** *and* ***C(2, −1)*** *are vertices of an isosceles triangle.*

***(ii)*** *Find the area of the triangle*

***4.*** *Find the midpoint of a line segment with end points* ***(3, −1)*** *and* ***(9, 5)***

***5.*** *The vertices of a parallelogram are* ***P(2, 1), Q(4, 7), R(6, 5)*** *and* ***S.*** *Find the coordinates of* ***S***

***6.*** *The midpoint of a line segment* ***PQ*** *is* ***(4, 2).*** *If the coordinates of* ***P*** *are* ***(7, 6),*** *find the****:***

***(i)*** *coordinates of* ***Q***

***(ii)*** *length of the line segment* ***PQ***

***7.*** *The end points of the diameter of a circle are* ***(1, 6)*** *and* ***(7, −2).*** *Find the****:***

***(i)*** *coordinates of the centre of the circle*

***(ii)*** *radius of the circle*

***8.*** *The vertices of a parallelogram are* ***A(5, 2), B(2, 6), C(−8, −3)*** *and* ***D.*** *Find the coordinates of* ***D***

***9.*** *A line passes through the points* ***P(−1, 8)*** *and* ***Q(2, 12).*** *Find the****:***

***(i)*** *gradient of the line*

***(ii)*** *coordinates of the midpoint of the line segment* ***PQ***

***(ii)*** *length of the line segment* ***PQ***

***10.*** *A triangle has vertices* ***A(4, 2), B(8, 6)*** *and* ***C(5, 9).*** *Find the gradient of each side of the triangle*

***11.*** *The points* ***P(5, 2)*** *and* ***Q(2, 4)*** *are in the* ***x−y*** *plane****.*** *Find the****:***

***(i)*** *coordinates of* ***M,*** *the midpoint of* ***PQ***

***(ii) |OM|,*** *where* ***O*** *is the origin*

***12.*** *A line of gradient*  *passes through the points* ***P(5, 7)*** *and* ***Q(k, 13).*** *Find the value of* ***k***

***13.*** *Find the midpoint of a line segment with end points* ***(3a, b)*** *and* ***(a, c)***

***14.*** *Find the length of a line segment with end points* ***(8, −1)*** *and* ***(5, 3)***

***15.*** *Find the distance between the points* ***P(b, 0)*** *and* ***Q(0, a)***

***16.*** *Point* ***P(7, 6)*** *lies on a circle whose centre is* ***(4, 2).*** *Find the radius of the circle*

***17.*** *The distance of point* ***A(k, 4)*** *from the origin is* ***5 units.*** *Find the possible values of* ***k***

***18.*** *Find the distance between the points* ***P(8, −1)*** *and* ***Q(5, 3 )***

***19.*** *The vertices of a rectangle are* ***A(0, 2), B(4, 8), C(7, 6)*** *and* ***D(3, 0).*** *Show that its diagonals are equal in length*

***20.*** *The distance between the point* ***(16, k)*** *and the origin is* ***20 units.*** *Find the possible values of* ***k***

***21.*** *Point* ***P(0, −2)*** *is equidistant from the points* ***A(k, −2)*** *and* ***B(3, 2).*** *Find the possible values of* ***k***

***22.*** *The distance between the point* ***(0, −5)*** *and* ***(k, 0)*** *is* ***13 units.*** *Find the possible values of* ***k***

***23.*** *The distance between the point* ***(k, k+2)*** *and the origin is* ***10 units.*** *Find the possible values of* ***k***

***24.*** *The midpoint of a line segment* ***AB*** *is* ***(3, 6).*** *If the coordinates of* ***A*** *are* ***(−1, 1),*** *find the coordinates of* ***B***

***25.*** *Find the centre and radius of a circle that has a diameter with endpoints*

***(8, 6)*** *and* ***(−4, −3)***

***26.*** *One end of the diameter of a circle with centre* ***(2, 1⋅5)*** *is* ***(8, −3).*** *Find the****:***

***(i)*** *coordinates of the other end of the diameter*

***(ii)*** *radius of the circle*

***27.*** *One end of the diameter of a circle with centre* ***(5, 7)*** *is* ***(21, −5).*** *Find the****:***

***(i)*** *coordinates of the other end of the diameter*

***(ii)*** *radius of the circle*

***THE EQUATION OF A LINE***

***Summary:***

***(i) y = mx + c*** *is the equation of the line with gradient* ***m*** *and* ***y−****intercept* ***c***

***(ii)*** *In the above formula****, m*** *and* ***c*** *are constants to be determined*

***(iii)*** *The* ***y−****intercept of a line is a point where the line cuts the* ***y−axis***

***(iv)*** *If a point lies on a line, its coordinates must satisfy the equation of the line*

***(v)*** *Points that lie on a straight line are called* ***collinear points***

***(vi)*** *A line that divides a figure in to two equal parts is called* ***a line of symmetry***

***EXAMPLES:***

***1.*** *State the gradient and* ***y−****intercept of the following lines:*

***(i) y = 3x − 4 (ii) y − 5x − 9 = 0 (iii) 3y + x = 10 (iv) 3y + 2x = 12***

***(v) 20x − 4y − 3 = 0 (vi) 2y =***  ***+ 7 (vii)*** 

***Soln:***

***(i)*** *Since* ***y = 3x − 4*** *is comparable to* ***y = mx + c***

***⇒*** *Gradient* ***m = 3, y−****intercept* ***c = −4***

***(ii)*** *Express* ***y − 5x − 9 = 0*** *in the form* ***y = mx + c***

*If y − 5x − 9 = 0*

***⇒ y = 5x + 9***

***∴*** *Gradient* ***m = 5, y−****intercept* ***c = 9***

***(iii)*** *Express* ***3y + x = 10*** *in the form* ***y = mx + c***

*If 3y + x = 10*

***⇒ y =*** 

***∴*** *Gradient* ***m =*** ***, y−****intercept* ***c =*** 

***(iv)*** *Express* ***3y + 2x = 12*** *in the form* ***y = mx + c***

*If 3y + 2x = 12*

***⇒ y =*** 

***∴*** *Gradient* ***m =*** ***, y−****intercept* ***c = 4***

***(v)*** *Express* ***20x − 4y − 3 = 0*** *in the form* ***y = mx + c***

*If 20x − 4y − 3 = 0*

***⇒ y =*** 

***∴*** *Gradient* ***m = 5, y−****intercept* ***c =*** 

***(vi)*** *Express* ***2y =***  ***+ 7*** *in the form* ***y = mx + c***

*If 2y =*  *+ 7*

***⇒ y =*** 

***∴*** *Gradient* ***m =*** ***, y−****intercept* ***c =*** 

***2.*** *Find the equation of a line whose gradient is* ***3*** *and* ***y−****intercept* ***7.***

***Soln:***

*If* ***y = mx + c,*** *where* ***m = 3*** *and* ***c = 7***

***⇒ y = 3x + 7***

***3.*** *Find the equation of a line whose gradient is* ***2*** *and passes through the point* ***P(3, 1).***

***Soln:***

*If* ***y = mx + c,*** *where* ***m = 2***

***⇒ y = 2x + c***

*Substituting* ***x = 3*** *and* ***y = 1*** *gives*

*1 = 2(3) + c*

***c = −5***

***∴ y = 2x − 5***

***4.*** *Find the equation of a line whose* ***y−****intercept is* ***5*** *and passes through the point* ***P(−3, −7).***

***Soln:***

*If* ***y = mx + c,*** *where* ***c = 5***

***⇒ y = mx + 5***

*Substituting* ***x = −3*** *and* ***y = −7*** *gives*

*−7 = −3m + 5*

***m = 4***

***∴ y = 4x + 5***

***5.*** *Find the equation of a line passing through the points* ***P(3, 7)*** *and* ***Q(5, 11)***

***Soln:***

*If* ***y = mx + c,***

***⇒ m =*** 

***⇒ y = 2x + c***

*Substituting* ***x = 3*** *and* ***y = 7*** *gives*

*7 = 2(3) + c*

***c = 1***

***∴ y = 2x + 1***

***6.*** *Find the equation of a line passing through the points* ***A(−2, −2), B(2, 0), C(4, 1)*** *and* ***D(6, 2)***

***Soln:***

***Hint:******(i)*** *choose any two points on the line and work out its equation*

***(ii)*** *The gradient of a line must be the same between any two points*

*The chosen points are* ***(4, 1)*** *and* ***(6, 2)***

*If* ***y = mx + c,***

***⇒ m =*** 

***⇒ y =*** ***x + c***

*Substituting* ***x = 4*** *and* ***y = 1*** *gives*

*1 =*  *+ c*

***c = −1***

***∴ y =*** ***x − 1***

***7.*** *Find the equation of line* ***AB*** *shown on the graph below****:***

***x−axis***

***y−axis***

***3***

***6***

***0***

***B***

***A***

***Soln:***

***Hint:******(i)*** *choose any two points on the line and work out its equation*

***(ii)*** *The chosen points are* ***(3, 0)*** *and* ***(0, 6)***

*If* ***y = mx + c,***

***⇒ m =*** 

***⇒ y = −2x + c***

*Substituting* ***x = 3*** *and* ***y = 0*** *gives*

*0 = −2(3) + c*

***c = 6***

***∴ y = 6 − 2x***

***8.*** *Find the value of* ***k*** *for which the points* ***A(1, 3), B(2, 5)*** *and* ***C(k, 9)*** *are collinear*

***Soln:***

***Hint:*** *The gradient of a line must be the same between any two points*

*Gradient of* ***AB =*** 

*Gradient of* ***AC =*** 



***9.*** *Find the equation of a line passing through the origin and the point* ***P(3, 12)***

***Soln:***

*If* ***y = mx + c,***

***⇒ m =*** 

***⇒ y = 4x + c***

*Substituting* ***x = 3*** *and* ***y = 12*** *gives*

*12 = 4(3) + c*

***c = 0***

***∴ y = 4x***

***10.*** *Find the equation of a line passing through the points* ***P(0, 0)*** *and* ***Q(a, b)***

***11.*** *A quadrilateral has vertices* ***A(−2, 1 ), B(−1, 4), C(2, 3)*** *and* ***D(3, −4).***

***(i)*** *Plot the points of the quadrilateral**and identify it*

***(ii)*** *Draw the line of symmetry of the quadrilateral*

***(iii)*** *Find the equation of the line of symmetry*

***Soln:***

***Hint:******(i)*** *plot the points of the quadrilateral and identify it*

***(ii)*** *Use two points from the line of symmetry to find it equation*

*Quadrilateral* ***ABCD*** *is a kite*

*Using* ***B(−1, 4)*** *and* ***D(3, −4)***

*If* ***y = mx + c,***

***⇒ m =*** 

***⇒ y = 2x + c***

*Substituting* ***x = −1*** *and* ***y = 4*** *gives*

*4 = 2(−1) + c*

***c = 6***

***∴ y = 2x + 6***

***12.*** *A triangle has vertices* ***A(1, 2), B(6, 3)*** *and* ***C(4, 11).*** *Find the equation of the line passing through* ***A*** *and the midpoint of* ***BC***

***13.*** *A line whose equation is* ***2y = 3x − 8*** *passes through the points* ***P(k, 5)*** *and* ***Q(−2, h).*** *Find the values of* ***k*** *and* ***h***

***Soln:***

*If* ***2y = 3x − 8***

*Substituting* ***x = k*** *and* ***y = 5*** *gives*

*2(5) = 3(k) − 8*

***k = 6***

*Similarly, substituting* ***x = −2*** *and* ***y = h*** *gives*

*2(h) = 3(−2) − 8*

***h = −7***

***14.*** *Show that the points* ***A(3, 7), B(−1, −5)*** *and* ***C(2, 4)*** *lie on a straight line*

***Soln:***

***Hint:*** *If a point lies on a line, its coordinates must satisfy the equation of the line*

*Using* ***A(3, 7)*** *and* ***B(−1, −5)***

*If* ***y = mx + c,***

***⇒ m =*** 

***⇒ y = 3x + c***

*Substituting* ***x = 3*** *and* ***y = 7*** *gives*

*7 = 3(3) + c*

***c = −2***

***∴ y = 3x − 2***

*If a point* ***C(2, 4)*** *lies on the line* ***y = 3x − 2,*** *its coordinates must satisfy this equation*

*Thus when* ***x = 2,*** ***y =*** *3(2) − 2* ***= 4***

***∴*** *The three given points lie on a straight line*

***EER:***

***1.*** *Find the equation of the line joining the points* ***P(2, 7)*** *and* ***Q(5, 13)***

***2.*** *Find the equation of line* ***PQ*** *shown on the on the graph below****:***

***x−axis***

***y−axis***

***6***

***4***

***0***

***Q***

***P***

***3.*** *Find the equation of a line whose gradient is*  *and passes through the point* ***P(5, 4).***

***4.*** *Find the equation of a line with gradient* ***3*** *and* ***y−****intercept* ***−5.***

***5.*** *A triangle has vertices* ***A(4, 2), B(8, 6)*** *and* ***C(5, 9).*** *Find the equation of each of the lines* ***AB, BC*** *and* ***AC***

***6.*** *Find the equation of a line passing through the points* ***P(0, a)*** *and* ***Q(b, 0)***

***7.*** *A line whose equation is* ***y = 7x − 8*** *passes through the point* ***(k, 6).*** *Find the value of* ***k***

***8.*** *Find the equation of the line with gradient*  *and passing through the midpoint of the line joining* ***(−3, −4)*** *and* ***(−5, 6)***

***9.*** *Find the value of* ***k*** *for which the points* ***A(8, 2), B(−1, k)*** *and* ***C(4, 8)*** *are collinear*

***10.*** *Show that the points* ***A(1, 2), B(3, 6)*** *and* ***C(2, 4)*** *are collinear*

***11.*** *Show that the line joining the points* ***A(4, −3)*** *and* ***B(−8, 6)*** *passes through the origin*

***12.*** *Find the value of* ***k*** *for which the points* ***A(2, 2), B(−1, k)*** *and* ***C(1, 6)*** *are collinear*

***13.*** *A triangle has vertices* ***P(3, -1), Q(7,6)*** *and* ***R(0, 2).*** *Find the equation of its line of symmetry****.***

***14.*** *A quadrilateral has vertices* ***A(4, 3), B(4, 7), C(10, 1)*** *and* ***D(6, 1).***

***(i)*** *Plot the points of the quadrilateral**and identify it*

***(ii)*** *Draw the line of symmetry of the quadrilateral*

***(iii)*** *Find the equation of the line of symmetry*

***15.*** *Find the equation of the line of symmetry of a quadrilateral whose vertices are* ***A(−5, 7), B(2, 6), C(5, −3)*** *and* ***D(−4, 0).***

***16.*** *Find the equation of the line of symmetry of a geometrical figure whose vertices are* ***A(8, 11), B(8, 7), C(4, 3), D(0, 3), E(0, 7)*** *and* ***F(4, 11).***

***INTERCEPTS OF A LINE***

***Summary:***

***1. (i)*** *Intercepts are points where the line cuts the coordinate axes*

***(ii)*** *The* ***y−****intercept of a line is a point where the line cuts the* ***y−axis***

***(iii)*** *The* ***x−****intercept of a line is a point where the line cuts the* ***x−axis***

***2. (i)*** *The equation of the* ***x−axis*** *is* ***y = 0.*** *Thus across the* ***x−****axis****, y = 0***

***(ii)*** *The equation of the* ***y−axis*** *is* ***x = 0.*** *Thus across the* ***y−****axis****, x = 0***

***EXAMPLES:***

***1.*** *Find the intercepts of a line whose equation is given by* ***5y − 3x + 30 = 0***

***2.*** *A line is given by the equation* ***45 − 15x + 3y = 0.***  *Find the coordinates of****:***

***(i)*** *its* ***x−****intercept*

***(ii)*** *its* ***y−****intercept*

***3.*** *A line whose equation is* ***5y − 3x + 30 = 0*** *cuts the* ***x−axis*** *and* ***y−axis*** *at points* ***P*** *and* ***Q*** *respectively****.*** *Find the coordinates of* ***P*** *and* ***Q***

***4.*** *A line whose equation is* ***6y − 8x = 24*** *cuts the* ***x−axis*** *and* ***y−axis*** *at points* ***P*** *and* ***Q*** *respectively****.*** *Find the length of* ***PQ***

***5.*** *A line of gradient*  *passing through point* ***P(9, 4),*** *cuts the* ***y−axis*** *at point* ***Q.*** *Find the coordinates of* ***Q***

***6.*** *Find the equation of a line whose* ***x−****intercept is* ***5*** *and passes through point* ***P(3, 2).***

***Soln:***

***Hint:*** *This line meets the x−axis at point* ***(5, 0)***

***⇒*** *The line passes through* ***(5,0)*** *and* ***(3, 2)***

***7.*** *Find the equation of a line with gradient* ***5*** *and* ***x−****intercept* ***6.***

***8.*** *Find the equation of a line with* ***x−****intercept* ***2*** *and* ***y−****intercept* ***9.***

***EER:***

***1.*** *Find the* ***x*** *and* ***y−****intercepts of the line whose equation is given by* 

***2.******(i)*** *Find the gradient of a line whose equation is* ***2y + 3x − 8 = 0.***

***(ii)*** *Find the the coordinates of the point where the line in* ***(i)*** *above cuts the*

***y−axis.***

***3.*** *A line whose gradient is* ***3*** *and y−intercept* ***−12*** *cuts the* ***x−****axis at point* ***P.***

***(i)*** *State the equation of the line.*

***(ii)*** *Find the coordinates of* ***P.***

***4.*** *A line of gradient* ***3*** *passes through the point* ***(2, 1).*** *Find the****:***

***(i)*** *equation of the line*

***(ii)*** *coordinates of point* ***R*** *where it cuts the* ***y−axis.***

***5.*** *The linecuts the* ***x-****axis at point* ***D.*** *Find the equation of the line passing through point* ***D*** *and whose gradient is* 

***6.*** *A line of gradient* ***−1*** *passes through point* ***P(3, −2).*** *Find the****:***

***(i)*** *equation of the line*

***(ii)*** *coordinates of the point where the line cuts the* ***y−****axis*

***7.*** *A line of gradient*  *passing through point* ***P(3, 4),*** *cuts the* ***y−axis*** *at point* ***Q.*** *Find the coordinates of* ***Q***

***INTERSECTION OF TWO LINES***

***Summary:***

***1. (i)*** *Point of intersection of two lines is a point where the two lines meet.*

***(ii)*** *When the lines* ***y = mx +c*** *and* ***y = nx +d*** *intersect****,*** *they have the same* ***x*** *and* ***y*** *values at that point****.*** *Thus* ***mx +c = nx +d (****the two equations are equal****)***

***(iii)*** *The intersection point can also be obtained graphical ly*

***EXAMPLES:***

***1.*** *Find the coordinates of the point of intersection of the lines* ***y + 2x + 1 = 0*** *and*  ***x − 5y = 16***

***2.*** *Find the coordinates of the point of intersection of the lines* ***y = 2x + 3*** *and* ***y =*** 

***4.*** *Find the coordinates of the point of intersection of the line* ***y + 2x + 1 = 0*** *and the line joining the points* ***A(3, 4)*** *and* ***B(8, 5).***

***5.*** *The lines* ***5y + mx = 17*** *and* ***ny − x = 6*** *intersect at point* ***P(−4, 1).*** *Find the values of* ***m*** *and* ***n***

***7.*** *Find the equation of the line that passes through the point* ***(4, 3)*** *and the point of intersection of the lines* ***y + 2x = 8 a****nd* ***2y − x = 6***

***8.*** *Find the equation of a line with gradient*  *and passing through the point of intersection of the lines* ***y + 2x = 10*** *and* ***3y − x − 2 = 0***

***9.*** *Find the coordinates of the point of intersection of line* ***y − 5x + 9 = 0*** *and the curve* 

***EER:***

***1.*** *Find the points of intersection of the line* ***y = mx + c*** *with the axes*

***2.*** *Find the equation of the line whose y−intercept is* ***− 13*** *and passes through the point of intersection of the lines* ***y + x = 5*** *and* ***x − y = 1***

***3.*** *The lines* ***ax + 2y = 3*** *and* ***ax − by = 6*** *intersect at point* ***P(1, 2).*** *Find the values of* ***a*** *and* ***b***

***GRAPHING LINEAR EQUATIONS***

***Summary:***

***(i)*** *In graphing a line using its equation****,*** *assume two values of* ***x*** *and work out their* ***y*** *values*

***(ii)*** *Plot the two points and draw a line that connects them*

***EXAMPLES:***

***1.******(i)*** *Draw a line whose equation is* ***y = 3 − x*** *for values of* ***x*** *from* ***−3*** *to* ***3***

***(ii)*** *Find the coordinates of the intercepts of the line*

***(iii)*** *Calculate the area enclosed between the line and the coordinate axes*

***2.*** *On different axes****,*** *draw the lines with the following equations****:***

***(i) y = 2x + 1 (ii) y =***   ***(iii) 2x− 3y − 12 = 0 (vi) x − y = 0***

***(v) x + y = 0 (vi) y = 3 (vii) y = −2 (viii) x = 4 (ix) x = −3***

***Soln:***

***(ii) Hint:******(i)*** *since* ***y =***  *use two value of* ***x*** *that are divisible by* ***3*** *to get the points to be plotted*

|  |  |  |  |
| --- | --- | --- | --- |
| ***X*** | ***0*** | ***3*** | ***6*** |
| ***Y*** | ***4*** | ***8*** | ***12*** |

***3.******(i)*** *On the same axes****,*** *draw the lines with equations* ***y = 2x + 3*** *and* ***y =*** 

***(ii)*** *Find the coordinates of the point of intersection of the two lines*

***4.******(i)*** *On the same axes****,*** *draw the lines with equations* ***y = x − 2, y + x = 14*** *and* ***y = 7x − 26***

***(ii)*** *Find the coordinates of the vertices of the region enclosed by the three lines*

***(iii)*** *Calculate the area enclosed between the three lines*

***OTHER FORMS OF LINEAR EQUATIONS***

***Summary:***

***1. (i)*** *All points on a horizontal line have the same* ***y−****coordinate*

***(ii) y = 0*** *is the equation of the* ***x−****axis*

***(iii) y = b*** *is the equation of a horizontal line whose* ***y****−intercept is* ***b***

***2. (i)*** *All points on a vertical line have the same* ***x−****coordinate*

***(ii) x = 0*** *is the equation of the* ***y−****axis*

***(iii) x = a*** *is the equation of a vertical line whose* ***x****−intercept is* ***a***

***EXAMPLES:***

***1.*** *On the same axes****,*** *draw the graphs of the equations****:***

***(i) x = 2 (ii) x = 5 (iii) x = −2 (iv) x = −4***

***2.*** *On the same axes****,*** *draw the graphs of the equations****:***

***(i) y = 2 (ii) y = 5 (iii) y = −2 (iv) y = −4***

***3.*** *Write down the equation of each of the following lines* ***PQ*** *on the graphs below****:***

***7***

***y−axis***

***x−axis***

***0***

***Q***

***P***

***(i)***

***−54***

***y−axis***

***x−axis***

***0***

***Q***

***P***

***(ii)***

***y−axis***

***x−axis***

***0***

***P***

***Q***

***4***

***(iii)***

***(iv)***

***y−axis***

***x−axis***

***0***

***P***

***Q***

***−3***

***4.*** *Write down the equation of a horizontal line passing through* ***(2, −3)***

***Soln:***

***Hint:*** *The equation of the* ***x****−axis is* ***y = 0***

***∴*** *Required equation is* ***y = −3***

***5.*** *Write down the equation of a vertical line passing through* ***(4, 6)***

***Soln:***

***Hint:*** *The equation of the* ***y****−axis is* ***x = 0***

***∴*** *Required equation is* ***x = 4***

***6.*** *Find the coordinates of the point of intersection of the lines* ***y = 3*** *and* ***y = x − 1***

***7.*** *In the figure below****,******OPQR*** *is a trapezium formed by the* ***x−****axis****,*** *the lines* ***y = 6,******y = 24− 2x,*** *and* ***2y = 3x.***

***2y = 3x***

***y = 24 − 2x***

***y = 6***

***y−axis***

***x−axis***

***O***

***P***

***Q***

***R***

*Find the****:***

***(i)*** *coordinates of* ***P, Q*** *and* ***R***

***(ii)*** *area of**the trapezium*

***EER:***

***1.******(i)*** *Draw a line whose equation is* ***3y = 4x + 12***

***(ii)*** *Find the coordinates of the intercepts of the line*

***(iii)*** *Calculate the area enclosed between the line and the coordinate axes*

***2.*** *In the figure below****, OPQR*** *is a trapezium formed by the* ***x−****axis****,******y−****axis****,*** *the lines* ***y = 3x + 22*** *and* ***y = 6.***

***y = 3x+22***

***y***

***x***

***O***

***R***

***Q***

***P***

***y = 7***

*Find the****:***

***(i)*** *coordinates of* ***Q*** *and* ***R***

***(ii)*** *area of**the trapezium*

***3.*** *Two lines with gradients* ***0*** *and* ***3*** *each pass through point* ***P(8, 4).*** *Find the****:***

***(i)*** *equation of each line*

***(ii)*** *area enclosed between the two lines and the coordinate axes*

***4.******(i)*** *On the same axes****,*** *draw the lines with equations* ***y = 2x − 3*** *and* ***y = −x − 3***

***(ii)*** *Find the coordinates of the point of intersection of the two lines*

***(iii)*** *Calculate the area enclosed between the two lines and the* ***x−****axis*

***5.*** *Write down the equations of the lines forming rectangle* ***OABC*** *shown below****:***

***y−axis***

***x−axis***

***0***

***O***

***A***

***B***

***C***

***3***

***5***

***6.******(i)*** *On the same axes****,*** *draw the lines with equations* ***y = 3*** *and* ***y = x − 1***

***(ii)*** *Find the coordinates of the point of intersection of the two lines*

***(iii)*** *Calculate the area enclosed between the two lines and the* ***y−****axis*

***7.*** *In the figure below****,******OPQR*** *is a trapezium formed by the* ***x−****axis****,*** *the lines* ***y = 4,******y = 12− x,*** *and* ***y = x.***

***y = x***

***y = 12 − x***

***y = 4***

***y−axis***

***x−axis***

***O***

***P***

***Q***

***R***

*Find the****:***

***(i)*** *coordinates of* ***P, Q*** *and* ***R***

***(ii)*** *area of**the trapezium*

***8.******(i)*** *Use a graphical method to find the coordinates of the point of intersection of the lines* ***y = 2x − 3*** *and* ***y = −x − 3***

***(ii)*** *Calculate the area enclosed between the two lines and the* ***x−****axis*

***PARALLEL LINES***

***Summary:***

*Parallel lines have the same gradient. Thus if the lines* ***y = mx +c*** *and* ***y = nx +d*** *are parallel, then* ***m = n.***

***EXAMPLES:***

***1.*** *Find the gradient of the line that is parallel to the line with gradient* 

***2.*** *Find the gradient of a line that is parallel to the line whose equation is* ***3y + 2x = 0.***

***3.*** *Find the value of* ***k*** *for which the lines with gradients*  *and*  *are parallel to each other*

***4.*** *Find the equation of the line that is parallel to the line* ***3y − 2x = 6*** *and whose* ***y−****intercept is* ***−5***

***5.*** *Find the equation of the line that is parallel to the line* ***2x + y = 6*** *and passes through the point* ***(1, 10)***

***6.*** *Find the equation of the line that is parallel to the line*  *and passes through the origin*

***7.*** *Find the equation of the line passing through* ***(2, −4)*** *and parallel to the line joining the points* ***(2, 3)*** *and* ***(−4, 5)***

***8.*** *Find the equation of the line that is parallel to the line* ***12x − 3y = 2*** *and passes through the point of intersection of the lines* ***y + x = 5*** *and* ***x − y = 1***

***9.*** *A line passing through the points* ***A(3, k)*** *and* ***B(2,7)*** *is parallel to the line through the points* ***P(−1, 4)*** *and* ***Q(0, 6).*** *Find the value of* ***k***

***10.*** *A line passing through the points* ***A(−1, 3k)*** *and* ***B(k,3)*** *is parallel to the line whose equation is* ***2y − 3x = 9.*** *Find the coordinates of* ***A*** *and* ***B***

***11.*** *Show that the line passing through the points* ***A(6,4)*** *and* ***B(7, 11)*** *is parallel to the line through the points* ***P(0,0)*** *and* ***Q(2, 14).***

***Soln:***

*Gradient of* ***AB =*** 

*Gradient of* ***PQ =*** 

*Since Gradient of* ***AB =*** *Gradient of* ***PQ,*** *then the lines are parallel*

***EER:***

***1.*** *Find the equation of the line that is parallel to the line* ***2y + x = 3*** *and passes through the point* ***(2, 3)***

***2.*** *Find the equation of the line passing through* ***(−2, 4)*** *and parallel to the line joining the points* ***(2, −5)*** *and* ***(4, 1)***

***2.*** *Find the equation of the line that is parallel to the line* ***3y + 2x = 1*** *and passes through the midpoint of the line joining* ***(−2, 8)*** *and* ***(−4, 6)***

***9.*** *Find the equation of a line parallel to the* ***x−****axis and passing through the point of intersection of the lines* ***y + 2x = 10*** *and* ***3y − x − 2 = 0.***

***19.*** *Line* ****** *passes through point* ***P(−4, 1)*** *and is parallel to the line joining the*

*points* ***A(1, 3)*** *and* ***B(−1, 5).*** *Find the****:***

***(i)*** *equation of line* ******

***(ii)*** *coordinates of the point of intersection of line******* *and the line* ***y = 2x − 3***

***(iii)*** *area enclosed between the two lines in* ***(ii)*** *above and the* ***x−****axis*

***3.*** *Line* ****** *passes through point* ***P(−2, −5)*** *and is parallel to the line joining the points* ***A(6, 6)*** *and* ***B(−6, −10).*** *Find the****:***

***(i)*** *equation of line* ******

***(ii)*** *coordinates of the point of intersection* ***Q*** *of line******* *and the line* ***x − 2y + 2 = 0***

***(iii)*** *length of the line segment* ***PQ***

***PERPENDICULAR LINES***

***Summary:***

*Two lines are perpendicular if the product of their gradients is equal to−1. Thus if the lines* ***y = mx +c*** *and* ***y = nx +d*** *are perpendicular****,*** *then* ***mn = −1.***

***EXAMPLES:***

***1.*** *Find the value of* ***k*** *for which the lines with gradients*  *and*  *are perpendicular to each other*

***2.*** *Find the value of* ***m*** *for which the lines* ***3x + my + 7 = 0*** *and* ***9x − 2y + 5 = 0*** *are perpendicular to each other*

***3.*** *Find the gradient of the line that is perpendicular to the line whose equation is* ***6x + 9y + 4 = 0***

***4.*** *Find the equation of the line that is perpendicular to the line* ***2y + 3x = 6*** *and whose* ***y−****intercept is* ***−4***

***5.*** *Find the equation of the line that is perpendicular to the line* ***6y − 2x = 7*** *and passes through* ***(1, 2)***

***6.*** *Find the equation of the line that is perpendicular to the line* *and passes through the origin*

***7.*** *Find the equation of the line passing through* ***(2, 0)*** *and perpendicular to the line joining the points* ***A(4, 9)*** *and* ***B(1, 3)***

***8.*** *Find the equation of the line that is perpendicular to the line* ***12y + 4x = 9*** *and passes through the point of intersection of the lines* ***y = 2x − 5*** *and* ***x + y = 1***

***9.*** *A line passing through the points* ***A(2, k)*** *and* ***B(4,6)*** *is perpendicular to the line through the points* ***P(−1, 7)*** *and* ***Q(2, 1).*** *Find the value of* ***k***

***10.*** *Two perpendicular lines intersect at* ***(3, 5).*** *If one of the lines passes through* ***(2, 3),*** *find the equation of the other line*

***11.*** *Two perpendicular lines intersect at* ***(−2, 0).*** *If one of the lines is* ***15y + mx = 6,*** *find the****:***

***(i)*** *value of* ***m***

***(ii)*** *equation of the other line*

***12.*** *The line* ***y = 3x − 4*** *is perpendicular to the line passing through* ***(6, 4).*** *Find the coordinates of their point of intersection*

***13.*** *Show that the line passing through the points* ***A(6, 0)*** *and* ***B(0, 12)*** *is perpendicular to the line through the points* ***P(8, 10)*** *and* ***Q(4, 8).***

***Soln:***

*Gradient of* ***AB =*** 

*Gradient of* ***PQ =*** 

*Gradient of* ***AB ×*** *Gradient of* ***PQ =*** 

***Hence the lines are perpendicular***

***14.*** *A line* ****** *passes through the point of intersection of the lines* ***x − y − 2 = 0*** *and* ***3x + 4y + 15 = 0*** *and is perpendicular to the line passing through the points* ***P(2, 3)*** *and* ***Q(1, 1).*** *Find the equation of line* ******

***15. (i)*** *Show that the points* ***A(−2, −4), B(2, −1)*** *and* ***C(5, −5)*** *are vertices of a right triangle*

***(ii)*** *Find the area of the triangle*

***Soln:***

***Hint:*** *This could be done using gradient method* ***or*** *Pythagoras theorem*

*Gradient of* ***AB =*** 

*Gradient of* ***BC =*** 

*Since*  *then* ***AB*** *is perpendicular* ***BC.*** *Thus**the triangle is right angled since* ***∠B = 90°***

***EER:***

***1.*** *Find the gradient of the line that is perpendicular to the line with gradient* 

***2.*** *Find the gradient of the line that is perpendicular to the line whose equation is* ***3y + 2x = 6***

***3.*** *Find the equation of the line that is perpendicular to the line* ***2y − 4x = 7*** *and whose* ***y−****intercept is* ***5***

***4.*** *Find the equation of the line perpendicular to the line* ***2y + 3x = 7*** *and passing through* ***(1, 3)***

***5.*** *The line joining the points* ***A(k, 2)*** *and* ***B(−4, 4)*** *is perpendicular to the line* ***2y + 3x − 8 = 0.*** *Find the value of* ***k***

***6.*** *Find the gradient of the line that is perpendicular to the line joining the points* ***(a, 3a)*** *and* ***(2a, −a)***

***7.*** *Find the equation of the line perpendicular to the line* ***2y − 4x = 7*** *and passing through* ***(1, 2)***

***8.*** *Find the equation of the line that is perpendicular to the line*  *and passes through* ***(4, −5)***

***9.*** *State with a reason whether the lines* ***3y − 4x + 10 = 0*** *and* ***12y + 9x − 8 = 0*** *are parallel* ***or*** *perpendicular*

***10.*** *State with a reason whether the lines* ***2y + 8x + 1 = 0*** *and* ***3y + 12x − 7 = 0*** *are parallel* ***or*** *perpendicular*

***11.*** *Find the equation of the line that is perpendicular to the line* ***6y + 9x − 7 = 0*** *and passes through* ***(−3, 2)***

***12.*** *Find the equation of the line that is perpendicular to the line* ***3x − y − 6 = 0*** *and passes through* ***(6, 5)***

***13.*** *Find the equation of the line that is perpendicular to the line* ***2y + x = 5*** *and passes through* ***(3, −2)***

***14.***  *Line* ****** *is perpendicular to the line* ***2y + 8x − 10 = 0*** *and intersect at point* ***P(−3, k).*** *Find the****:***

***(i)*** *value of* ***k***

***(ii)*** *equation of line* ******

***15.***  *Line* ****** *is perpendicular to the line* ***3y + 2x = 7*** *and passes through the points* ***A(2, 2)*** *and* ***B(4, k).*** *Find the****:***

***(i)*** *value of* ***k***

***(ii)*** *equation of line* ******

***(i)*** *coordinates of the point where lines* ****** *cuts the* ***x−****axis*

***16.*** *The end points of a line segment are* ***P(1, 6)*** *and* ***Q(7, −2).*** *Find the****:***

***(i)*** *coordinates of* ***M,*** *the midpoint of* ***PQ***

***(ii)*** *gradient of the line perpendicular to line segment* ***PQ***

***(iii)*** *equation of the line through* ***M*** *and perpendicular to line segment* ***PQ***

***17.*** *A line* ****** *passes through the points* ***A(2, 1)*** *and* ***B(6, 5).*** *Another line* ****** *is perpendicular to line* ****** *and passes through point* ***P(−1, 8).*** *Find the****:***

***(i)*** *equation of line* ****** *and* ******

***(ii)*** *coordinates of the point of intersection of the lines* ****** *and* ******

***18.***  *Line* ****** *is parallel to the line* ***2y − 6x = 8*** *and passes through point* ***P(4, 5).*** *Another line* ****** *is perpendicular to the line* ***5y + x − 10 = 0*** *and passes through point* ***Q(0, −9).*** *Find the****:***

***(i)*** *equation of line* ****** *and* ******

***(ii)*** *coordinates of the point of intersection of the lines* ****** *and* ******

***(iii)*** *coordinates of the point of intersection of line* ****** *and the curve* 

***19.*** *Line* ****** *is perpendicular to the line* ***2x + 5y − 15 = 0*** *and passes through point* ***P(6, 10).*** *Find the coordinates of the point of intersection of line* ****** *and the line* ***y − x = 1***

***20.*** *The line* ***y = x + 1*** *is perpendicular to the line passing through* ***(3, 0).*** *Find the coordinates of their point of intersection*

***21. (i)*** *Show that the points* ***A(−4, −2), B(4, 2)*** *and* ***C(2, 6)*** *are vertices of a right triangle*

***(ii)*** *Find the area of the triangle*

***22.*** *Show that the points* ***A(4, −1), B(5, 6)*** *and* ***C(1, 3)*** *are vertices of an isosceles right triangle.*

***24. (i)*** *The vertices of a triangle are* ***A(0, 6), B(−6, 2)*** *and* ***C(2, −10).*** *Show that angle* ***ABC*** *is* ***90°***

***(ii)*** *Find the area of the triangle*

***A PERPENDICULAR BISECTOR***

***Summary:***

*A**perpendicular bisector**is a line that cuts the line segment at its midpoint and at right angles*

***EXAMPLES:***

***1.*** *Find the equation of the perpendicular bisector of the line segment with endpoints* ***P(6, 4)*** *and* ***Q(2, 8).***

***2.*** *Find the equation of the perpendicular bisector of the line segment with endpoints* ***P(0, 4)*** *and* ***Q(6, 0).***

***3.*** *A perpendicular bisector of the line segment with endpoints* ***P(−7, 3)*** *and* ***Q(−3, −1)*** *cuts the* ***x−axis*** *and* ***y−axis*** *at points* ***P*** *and* ***Q*** *respectively****.*** *Find the coordinates of* ***P*** *and* ***Q***

***4.*** *Show that point* ***P(7, 1)*** *lies on a perpendicular bisector of the line segment with endpoints* ***A(4, 6)*** *and* ***B(2, 4)***

***EER:***

***1.*** *Find the equation of the perpendicular bisector of the line segment with endpoints* ***P(−7, 3)*** *and* ***Q(−3, −1)***

***2.*** *A line segment has endpoints* ***P(2, 3)*** *and* ***Q(1, 1).*** *Find the equation of its perpendicular bisector*

***3.*** *A perpendicular bisector of the line segment with endpoints* ***P(−7, 3)*** *and* ***Q(−3, −1)*** *cuts the* ***x−axis*** *and* ***y−axis*** *at points* ***P*** *and* ***Q*** *respectively****.*** *Find the coordinates of* ***P*** *and* ***Q***

***4.*** *Find the equation of the perpendicular bisector of the line segment with endpoints* ***P(1, 2)*** *and* ***Q(3, 6).***

***5.*** *Find the equation of the perpendicular bisector of the line segment with endpoints* ***P(4, 6)*** *and* ***Q(12, 10)***

***6.*** *Show that point* ***P(−4, 1)*** *lies on a perpendicular bisector of the line segment with endpoints* ***A(1, 2)*** *and* ***B(3, 6)***

***x−axis***

***y−axis***