S.3 Mathematics
Chapter 08 – Coordinate Geometry – Note

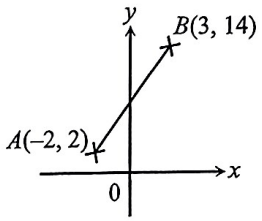
Name:_____ Class:_____( ) Date:_____

Distance Formula

The distance between any two points $A(x_1, y_1)$ and $B(x_2, y_2)$ on a rectangular coordinate plane is give by

$$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

1. In the figure, the coordinates of A and B are (–2, 2) and (3, 14) respectively. Find the distance between A and B.

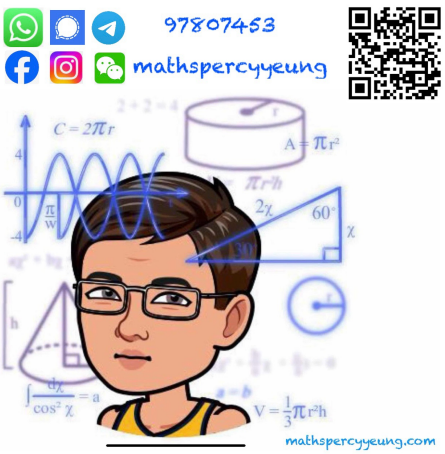


2. In each of the following, find the distance between the given points.
(Leave the answers in surd form if necessary.)

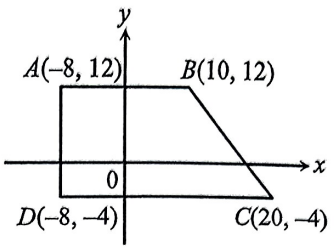
(a) $A(11, 3), B(8, -1)$

(b) $C(3, -2), D(-1, 6)$

(c) $E(-4, 13), F(5, 7)$



3. In the figure, $A(-8, 12)$, $B(10, 12)$, $C(20, -4)$ and $D(-8, -4)$ are the vertices of trapezium $ABCD$. Find the perimeter of trapezium $ABCD$, correct to 3 significant figures.



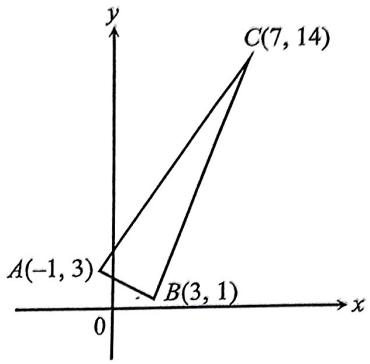
4. In the figure, $A(-4, -1)$, $B(3, 4)$ and $C(1, -1)$ are the vertices of $\triangle ABC$. Find the perimeter of $\triangle ABC$, correct to 3 significant figures.

5. It is given that $P(3, 8)$, $Q(-4, -3)$ and $R(5, 2)$ are vertices of $\triangle PQR$. Find the perimeter of $\triangle PQR$, correct to 3 significant figures.

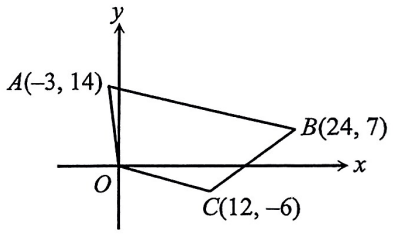
S.3 Mathematics
Chapter 08 – Coordinate Geometry – Note

Name:_____ Class:_____( ) Date:_____

1. In the figure, $A(-1, 3)$, $B(3, 1)$ and $C(7, 14)$ are vertices of $\triangle ABC$. Show that $\triangle ABC$ is an isosceles triangle.



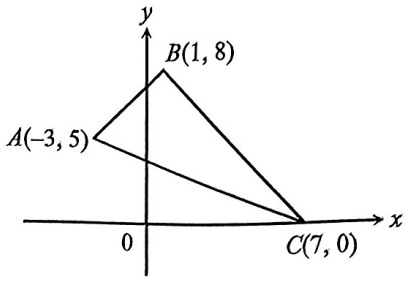
2. In the figure, $OABC$ is a quadrilateral, where O is the origin. The coordinates of A, B and C are $(-3, 14)$, $(24, 7)$ and $(12, -6)$ respectively. Determine whether the diagonals OB and AC are equal.



3. In the figure, $A(-3, 5)$, $B(1, 8)$ and $C(7, 0)$ are vertices of $\triangle ABC$.

(a) Show that $\triangle ABC$ is a right-angled triangle.

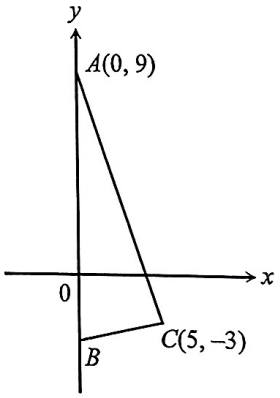
(b) Using the result of **(a)**, find the area of $\triangle ABC$.



4. In the figure, A and B lie on the y-axis and $AB = AC$. The coordinates of A and C are $(0, 9)$ and $(5, -3)$ respectively.

(a) Find the coordinates of B.

(b) Find the area of $\triangle ABC$.



S.3 Mathematics
Chapter 08 – Coordinate Geometry – Note

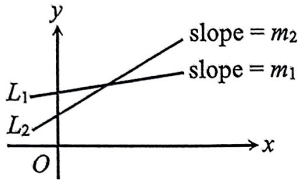
Name:_____ Class:_____( ) Date:_____

Slope Formula

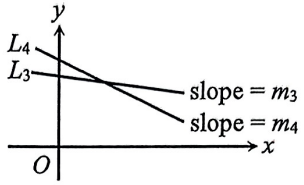
1. Consider a straight line L passing through the points $A(x_1, y_1)$ and $B(x_2, y_2)$, where $x_1 \neq x_2$.
Then the slope m of L is given by

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

2. **(a)** If $m_2 > m_1 > 0$, then L_2 is steeper L_1.



(b) If $0 > m_3 > m_4$, then L_4 is steeper L_3.



1. In each of the following, find the slope of the straight line passing through the given points.

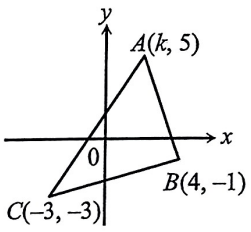
(a) $A(-3, 6)$, $B(9, 2)$

(b) $C(14, 8)$, $D(-10, -16)$

2. In the figure, $A(k, 5)$, $B(4, -1)$ and $C(-3, -3)$ are the vertices of $\triangle ABC$. It is given that the slope of AB is -3.

(a) Find the value of k.

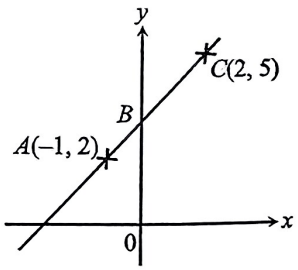
(b) Find the slope of AC.



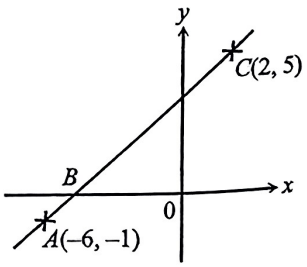
3. Determine whether $A(-2, 3)$, $B(3, 6)$ and $C(8, 9)$ are collinear.

4. Determine whether $A(8, 3)$, $B(5, -1)$ and $C(2, -4)$ are collinear.

5. The line passing through $A(-1, 2)$ and $C(2, 5)$ cuts the y-axis at B. Find the coordinates of B.



6. The line passing through $A(-6, -1)$ and $C(2, 5)$ cuts the x-axis at B. Find the coordinates of B.



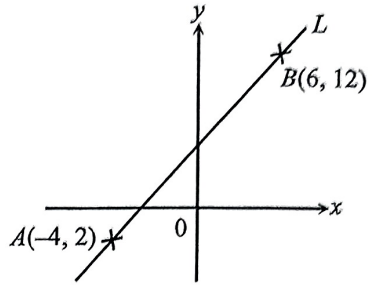
S.3 Mathematics
Chapter 08 – Coordinate Geometry – Note

Name:_____ Class:_____( ) Date:_____

1. In the figure, L is a straight line passing through the points $A(-4, 2)$ and $B(6, 12)$.

(a) Find the slope of L.

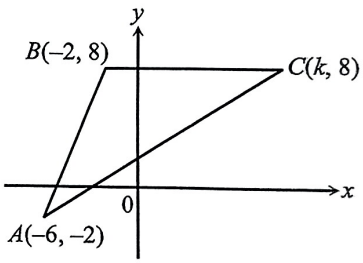
(b) Find the inclination of L.



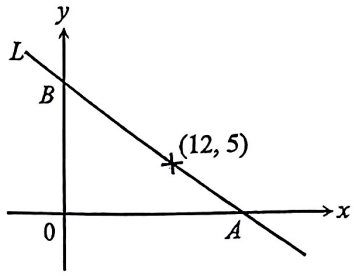
2. $A(-6, -2)$, $B(-2, 8)$ and $C(k, 8)$ are the vertices of $\triangle ABC$. It is given that the slope of AC is $\frac{2}{3}$.

(a) Find the value of k.

(b) Find the area of $\triangle ABC$.



3. In the figure, a straight line L passes through the point (12, 5) and cuts the x-axis and the y-axis at A and B respectively. If the slope of L is –0.8, find the coordinates of A and B.



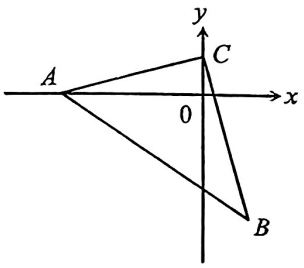
4. It is given that $A(a, 3)$, $B(-1, b)$, $C(-5, 9)$ and $D(3, 15)$ are collinear. Find the values of a and b.

5. In the figure, the coordinates of A and B are (–15, 0) and (3, –12) respectively. C is a point lying on the y-axis. It is given that the slope of AC is 0.2.

(a) Find the inclination of AC, correct to 3 significant figures.

(b) Find the coordinates of C.

(c) Is ABC a right-angled triangle? Explain your answer.



S.3 Mathematics
Chapter 08 – Coordinate Geometry – Note

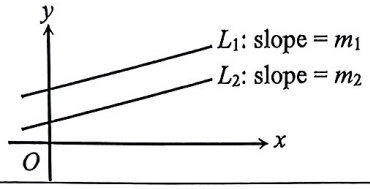
Name:_____ Class:_____( ) Date:_____

Problems Related to Parallel Lines

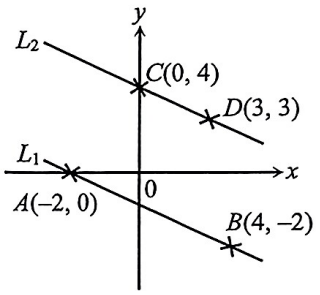
Consider two non-vertical straight lines L_1 and L_2 with slopes m_1 and m_2 respectviely.

(1) If $L_1 // L_2$, then $m_1 = m_2$.

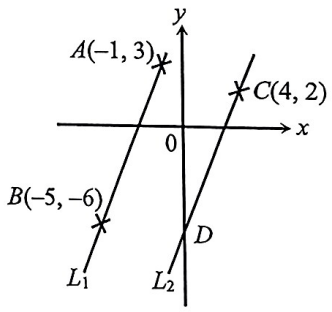
(2) If $m_1 = m_2$, then $L_1 // L_2$.



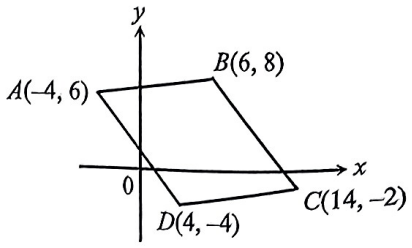
1. In the figure, L_1 is a straight line passing through the points $A(-2, 0)$ and $B(4, -2)$ while L_2 is a straight line passing through the points $C(0, 4)$ and $D(3, 3)$. Show that $L_1 // L_2$.



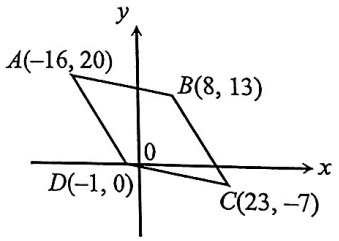
2. In the figure, L_1 is a straight line passing through the points $A(-1, 3)$ and $B(-5,-6)$. A straight line L_2 passes through the point $C(4, 2)$ and cuts the y-axis at D. If $L_1 // L_2$, find the coordinates of D.



3. In the figure, $A(-4, 6)$, $B(6, 8)$, $C(14, -2)$ and $D(4, -4)$ are the vertices of a quadrilateral $ABCD$. Show that $ABCD$ is a parallelogram.



4. In the figure, $A(-16, 20)$, $B(8, 13)$, $C(23, -7)$ and $D(-1, 0)$ are the vertices of a quadrilateral $ABCD$. Show that $ABCD$ is a rhombus.



S.3 Mathematics
Chapter 08 – Coordinate Geometry – Note

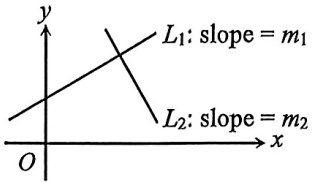
Name:_____ Class:_____( ) Date:_____

Problems Related to Perpendicular Lines

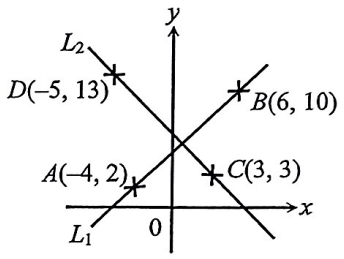
Consider two straight lines L_1 and L_2 with slopes m_1 and m_2 respectviely, where $m_1, m_2 \neq 0$.

(1) If $L_1 \perp L_2$, then $m_1 \times m_2 = -1$.

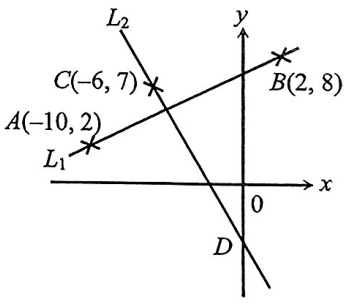
(2) If $m_1 \times m_2 = -1$, then $L_1 \perp L_2$.



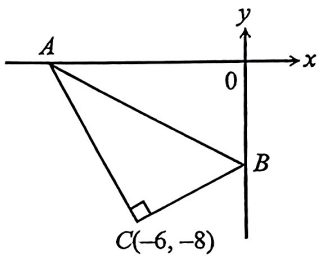
1. In the figure, L_1 is a straight line passing through the points $A(-4, 2)$ and $B(6, 10)$ while L_2 is a straight line passing through the points $C(3, 3)$ and $D(-5, 13)$. Show that $L_1 \perp L_2$.



2. In the figure, L_1 is a straight line passing through the points $A(-10, 2)$ and $B(2, 8)$. A straight line L_2 passing through the points $C(-6, 7)$ cuts the y-axis at D. If $L_1 \perp L_2$, find the coordinates of D.



3. In the figure, $\triangle ABC$ is right-angled at C. A and B are points lying on the x-axis and the y-axis respectively. The coordinates of C are $(-6, -8)$. The slope of AC is $-\frac{3}{2}$.



(a) Find the slope of BC.

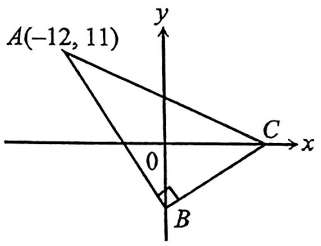
(b) Find the coordinates of B.

4. In the figure, $\triangle ABC$ is right-angled at B. B and C are points lying on the y-axis and the x-axis respectively. The coordinates of A are $(-12, 11)$. The slope of AB is -1.25.

(a) Find the slope of BC.

(b) Find the coordinates of B and C.

(c) Find the area of $\triangle ABC$.



S.3 Mathematics
Chapter 08 – Coordinate Geometry – Note

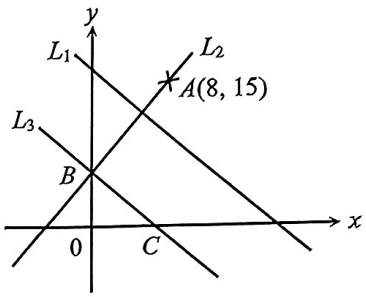
Name:_____ Class:_____( ) Date:_____

Parallel Lines and Perpendicular Lines

1. In the figure, L_1 is a straight line with slope –0.8 while L_2 is a straight line passing through $A(8, 15)$ and cut the y-axis at B. L_3 is a straight line passing through B and cut the x-axis at C. It is given that $L_1 \perp L_2$ and $L_1 // L_3$.

(a) Find the slope of L_2.

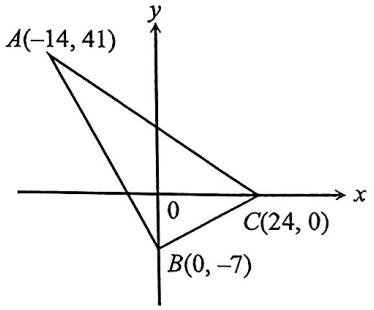
(b) Find the coordinates of B and C.



2. In the figure, $A(-14, 41)$, $B(0, -7)$ and $C(24, 0)$ are vertices of $\triangle ABC$.

(a) Show that $\triangle ABC$ is a right-angled triangle.

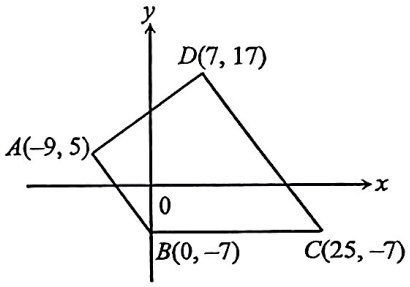
(b) Find the area of $\triangle ABC$.



3. In the figure, $A(-9, 5)$, $B(0, -7)$, $C(25, -7)$ and $D(7, 17)$ are vertices of a quadrilateral $ABCD$.

(a) Show that $AB \parallel DC$.

(b) Show that $ABCD$ is a right-angled trapezium.



4. In the figure, $ABCD$ is a rectangle. The coordinates of A, B and D are $(-5, 0)$, $(-2, -6)$ and (p, q) respectively. C lies on the x-axis.

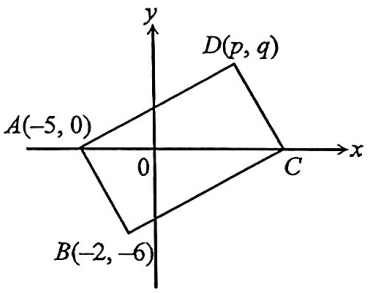
(a) Find the slope of AB and the slope of BC.

(b) Find the coordinates of C.

(c) **(i)** Express the slope of AD in terms of p and q.

(ii) Express the slope of CD in terms of p and q.

(d) Find the values of p and q.



S.3 Mathematics
Chapter 08 – Coordinate Geometry – Note

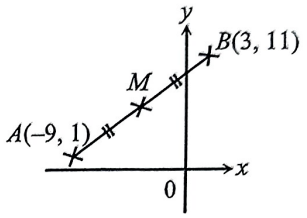
Name:_____ Class:_____( ) Date:_____

Mid-Point Formula

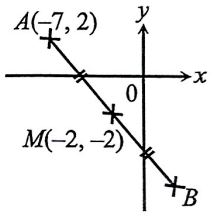
If $M(x, y)$ is the mid-point of the line segment joining the points $A(x_1, y_1)$ and $B(x_2, y_2)$, then

$$x = \frac{x_1 + x_2}{2} \text{ and } y = \frac{y_1 + y_2}{2}$$

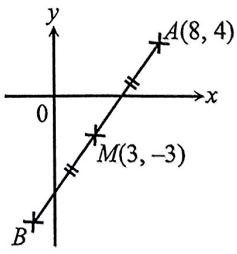
1. In the figure, M is the mid-point of the line segment joining $A(-9, 1)$ and $B(3, 11)$. Find the coordinates of M.



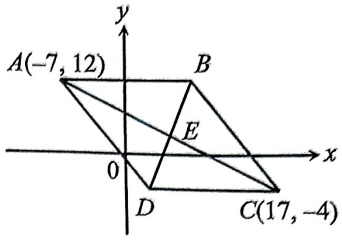
2. In the figure, M is the mid-point of the line segment AB. The coordinates of A and M are $(-7, 2)$ and $(-2, -2)$ respectively. Find the coordinates of B.



3. In the figure, M is the mid-point of the line segment AB. The coordinates of A and M are $(8, 4)$ and $(3, -3)$ respectively. Find the coordinates of B.



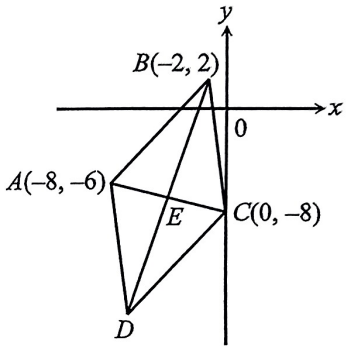
4. In the figure, $ABCD$ is a parallelogram. The diagonals AC and BD intersect at E. The coordinates of A and C are $(-7, 12)$ and $(17, -4)$ respectively. Find the coordinates of E.



5. In the figure, $ABCD$ is a parallelogram. The diagonals AC and BD intersect at E. The coordinates of A, B and C are $(-8, -6)$, $(-2, 2)$ and $(0, -8)$ respectively.

(a) Find the coordinates of E.

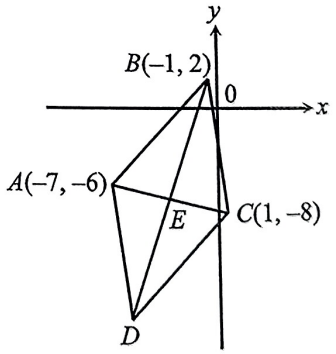
(b) Using the result of **(a)**, find the coordinates of D.



6. In the figure, $ABCD$ is a parallelogram. The diagonals AC and BD intersect at E. The coordinates of A, B and C are $(-7, -6)$, $(-1, 2)$ and $(1, -8)$ respectively.

(a) Find the coordinates of E.

(b) Using the result of **(a)**, find the coordinates of D.



S.3 Mathematics
Chapter 08 – Coordinate Geometry – Note

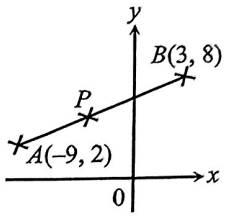
Name:_____ Class:_____( ) Date:_____

Section Formula

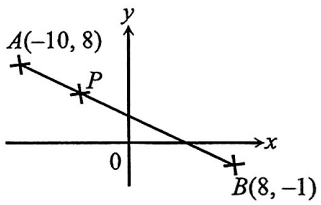
If $P(x, y)$ is a point lying on the line segment joining the points $A(x_1, y_1)$ and $B(x_2, y_2)$ such that $AP : PB = r : s$, then

$$x = \frac{sx_1 + rx_2}{r+s} \quad \text{and} \quad y = \frac{sy_1 + ry_2}{r+s}$$

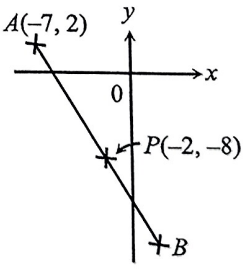
1. In the figure, P is a point lying on the line segment joining $A(-9, 2)$ and $B(3, 8)$ such that $AP : PB = 1 : 2$. Find the coordinates of P.



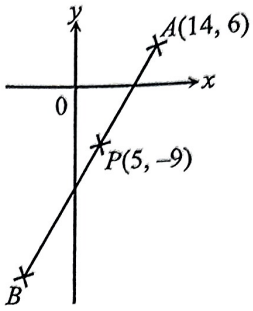
2. In the figure, P is a point lying on the line segment joining $A(-10, 8)$ and $B(8, -1)$ such that $AP : PB = 2 : 7$. Find the coordinates of P.



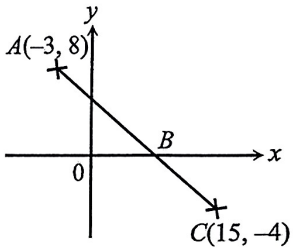
3. In the figure, P is a point lying on the line segment AB such that $AP : PB = 5 : 4$. The coordinates of A and P are $(-7, 2)$ and $(-2, -8)$ respectively. Find the coordinates of B.



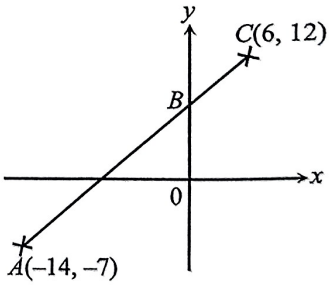
4. In the figure, P is a point lying on the line segment AB such that $AP : PB = 3 : 4$. The coordinates of A and P are (14, 6) and (5, –9) respectively. Find the coordinates of B.



5. In the figure, the line segment AC cuts the x-axis at B. The coordinates of A and C are (–3, 8) and (15, –4) respectively. Find $AB : BC$.



6. In the figure, the line segment AC cuts the y-axis at B. The coordinates of A and C are (–14, –7) and (6, 12) respectively. Find $AB : BC$.



S.3 Mathematics
Chapter 08 – Coordinate Geometry – Note

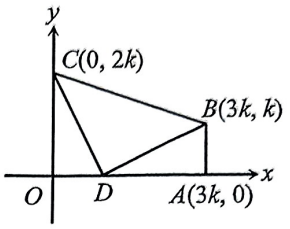
Name:_____ Class:_____( ) Date:_____

Prove Geometric Properties by Analytic Approach

1. In the figure, $OABC$ is a trapezium with AB // OC. O is the origin. The coordinates of A, B and C are $(3k, 0)$, $(3k, k)$ and $(0, 2k)$ respectively. D is a point lying on OA such that $OD : DA = 1 : 2$.

(a) Express the coordinates of D in terms of k.

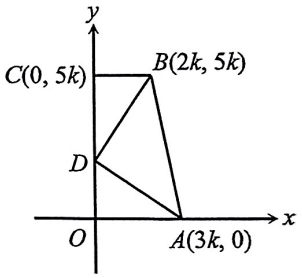
(b) Prove that $BD \perp CD$.



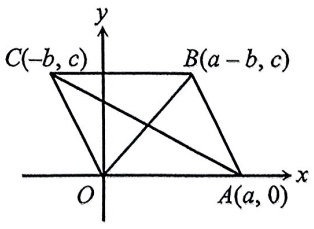
2. In the figure, $OABC$ is a trapezium with OA // CB. O is the origin. The coordinates of A, B and C are $(3k, 0)$, $(2k, 5k)$ and $(0, 5k)$ respectively. D is a point lying on OC such that $OD : DC = 2 : 3$.

(a) Express the coordinates of D in terms of k.

(b) Prove that $AD \perp BD$.



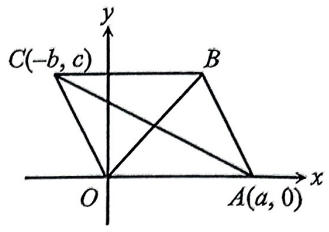
3. In the figure, $OABC$ is a parallelogram and O is the origin. The coordinates of A, B and C are $(a, 0)$, $(a - b, c)$ and $(-b, c)$ respectively. Prove that the diagonals AC and OB bisect each other.



4. In the figure, $OABC$ is a parallelogram and O is the origin. The coordinates of A and C are $(a, 0)$ and $(-b, c)$ respectively.

(a) Show that the coordinates of B are $(a - b, c)$.

(b) Prove that the diagonals AC and OB bisect each other.



5. In the figure, $OABC$ is a parallelogram and O is the origin. The coordinates of A, B and C are $(4a, 0)$, $(5a, b)$ and (a, b) respectively. P, Q, R and S are the mid-points of OA, AB, BC and OC respectively.

(a) Express the coordinates of P, Q, R and S in terms of a and b.

(b) Prove that $PQRS$ is a parallelogram.