CLASSIFIED

International Examinations Papers

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MODULAR
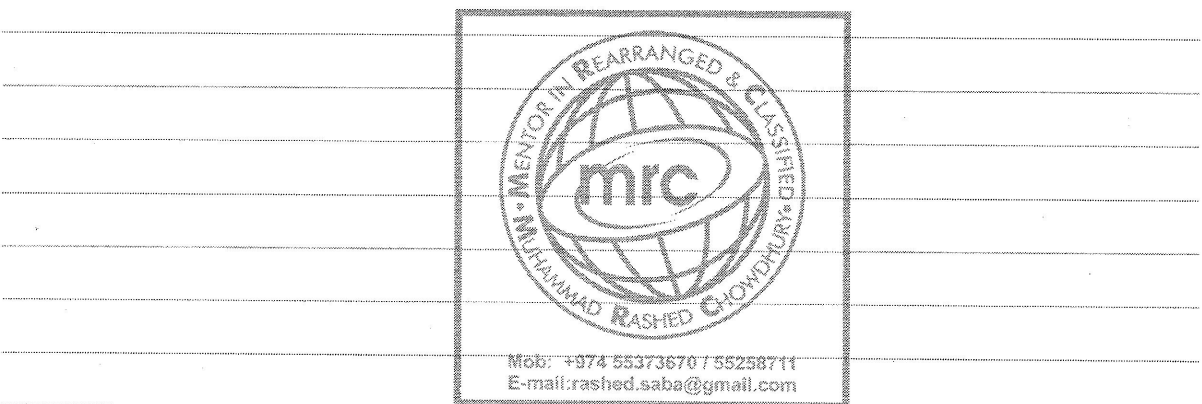# MATHEMATICS/CORE-1
TOPIC-Coordinate geometry(x,y)

4. The point A (–6, 4) and the point B (8, –3) lie on the line L.

(a) Find an equation for L in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

(b) Find the distance AB, giving your answer in the form $k\sqrt{5}$, where k is an integer.

(3)

Q4

(Total 7 marks)

3. The line l_1 has equation $3x + 5y - 2 = 0$

(a) Find the gradient of l_1.

(2)

The line l_2 is perpendicular to l_1 and passes through the point (3, 1).

(b) Find the equation of l_2 in the form $y = mx + c$, where m and c are constants.
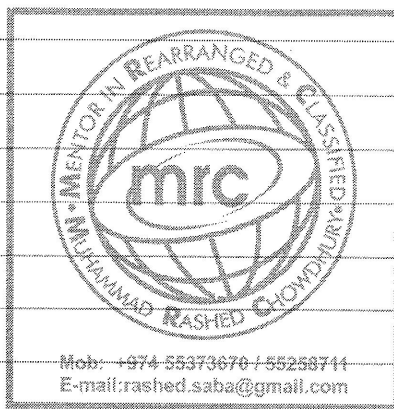
(3)

$Jan-10$

3. The points P and Q have coordinates $(-1, 6)$ and $(9, 0)$ respectively.

The line l is perpendicular to PQ and passes through the mid-point of PQ.

Find an equation for l, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

Jn-11

3. The line L has equation $y = 5 - 2x$.

(a) Show that the point P (3, –1) lies on L.

(1)

(b) Find an equation of the line perpendicular to L, which passes through P. Give your answer in the form $ax + by + c = 0$, where a, b and c are integers.

Ja-06

(4)

(Total 5 marks)

4

6. The straight line L_1 passes through the points $(-1, 3)$ and $(11, 12)$.   Jn-13

(a) Find an equation for L_1 in the form $ax + by + c = 0$,

where a, b and c are integers.

(4)

The line L_2 has equation $3y + 4x - 30 = 0$.

(b) Find the coordinates of the point of intersection of L_1 and L_2.

(3)

10. The curve C has equation $y = \frac{1}{3}x^3 - 4x^2 + 8x + 3$.

The point P has coordinates $(3, 0)$.

(a) Show that P lies on C.

(1)

(b) Find the equation of the tangent to C at P, giving your answer in the form $y = mx + c$, where m and c are constants.

(5)

Another point Q also lies on C. The tangent to C at Q is parallel to the tangent to C at P.

(c) Find the coordinates of Q.

(5)

9. The line L_1 has equation $2y - 3x - k = 0$, where k is a constant.

Given that the point A (1,4) lies on L_1, find

(a) the value of k,
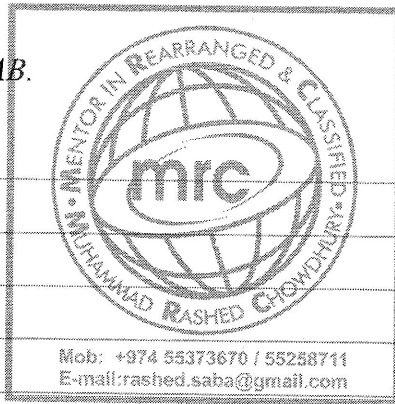
(1)

(b) the gradient of L_1.

(2)

The line L_2 passes through A and is perpendicular to L_1.

(c) Find an equation of L_2 giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

The line L_2 crosses the x-axis at the point B.

(d) Find the coordinates of B.

(2)

(e) Find the exact length of AB.

(2)

10. The line l_1 passes through the point A (2, 5) and has gradient $-\dfrac{1}{2}$.

(a) Find an equation of l_1, giving your answer in the form $y = mx + c$.

(3)

The point B has coordinates (−2, 7).

(b) Show that B lies on l_1.

(1)

(c) Find the length of AB, giving your answer in the form $k\sqrt{5}$, where k is an integer.

(3)

The point C lies on l_1 and has x-coordinate equal to p.

The length of AC is 5 units.

Ja-09

(d) Show that p satisfies

$$p^2 - 4p - 16 = 0.$$

(4)

11. The curve C has equation

$$y = x^3 - 2x^2 - x + 9, \quad x > 0$$

The point P has coordinates $(2, 7)$.

(a) Show that P lies on C.

(1)

(b) Find the equation of the tangent to C at P, giving your answer in the form $y = mx + c$, where m and c are constants.

$7x - 9$ **(5)**

The point Q also lies on C.

Given that the tangent to C at Q is perpendicular to the tangent to C at P,

(c) show that the x-coordinate of Q is $\dfrac{1}{3}\left(2 + \sqrt{6}\right)$.

(5)

11. The curve C has equation

$$y = 9 - 4x - \frac{8}{x}, \qquad x > 0.$$

Jan-09

The point P on C has x-coordinate equal to 2.

(a) Show that the equation of the tangent to C at the point P is $y = 1 - 2x$.

(6)

(b) Find an equation of the normal to C at the point P.

(3)

The tangent at P meets the x-axis at A and the normal at P meets the x-axis at B.

(c) Find the area of triangle APB.

(4)

5. The line l_1 has equation $y = -2x + 3$

The line l_2 is perpendicular to l_1 and passes through the point $(5, 6)$.

(a) Find an equation for l_2 in the form $ax + by + c = 0$, where a, b and c are integers.

(3)

The line l_2 crosses the x-axis at the point A and the y-axis at the point B.

(b) Find the x-coordinate of A and the y-coordinate of B.

(2)

Given that O is the origin,

(c) find the area of the triangle OAB.

(2)

8. (a) Find an equation of the line joining $A(7, 4)$ and $B(2, 0)$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(3)

(b) Find the length of AB, leaving your answer in surd form.

(2)

The point C has coordinates $(2, t)$, where $t > 0$, and $AC = AB$.

Jn-10

(c) Find the value of t.

(1)

(d) Find the area of triangle ABC.

(2)

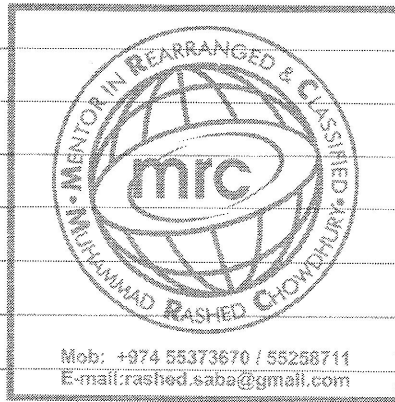**8.** The line l_1 passes through the point $(9, -4)$ and has gradient $\frac{1}{3}$.

(a) Find an equation for l_1 in the form $ax + by + c = 0$, where a, b and c are integers.

(3)

The line l_2 passes through the origin O and has gradient -2. The lines l_1 and l_2 intersect at the point P.

(b) Calculate the coordinates of P.

(4)

Given that l_1 crosses the y-axis at the point C,

(c) calculate the exact area of $\triangle OCP$.

(3)

11. The line l_1 passes through the points $P(-1, 2)$ and $Q(11, 8)$.

(a) Find an equation for l_1 in the form $y = mx + c$, where m and c are constants.

(4)

The line l_2 passes through the point $R(10, 0)$ and is perpendicular to l_1. The lines l_1 and l_2 intersect at the point S.

(b) Calculate the coordinates of S.

(5)

(c) Show that the length of RS is $3\sqrt{5}$.

(2)

(d) Hence, or otherwise, find the exact area of triangle PQR.

(4)

9. The line L_1 has equation $4y + 3 = 2x$

    The point A $(p, 4)$ lies on L_1

    (a) Find the value of the constant p.

    (1)

    The line L_2 passes through the point C $(2, 4)$ and is perpendicular to L_1

    (b) Find an equation for L_2 giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

    (5)

    The line L_1 and the line L_2 intersect at the point D.

    (c) Find the coordinates of the point D.

    (3)

    (d) Show that the length of CD is $\dfrac{3}{2}\sqrt{5}$
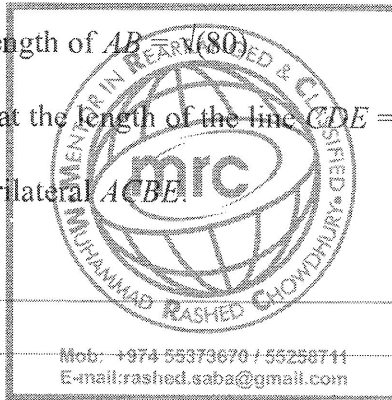
    (3)

    A point B lies on L_1 and the length of $AB = \sqrt{(80)}$

    The point E lies on L_2 such that the length of the line $CDE = 3$ times the length of CD.

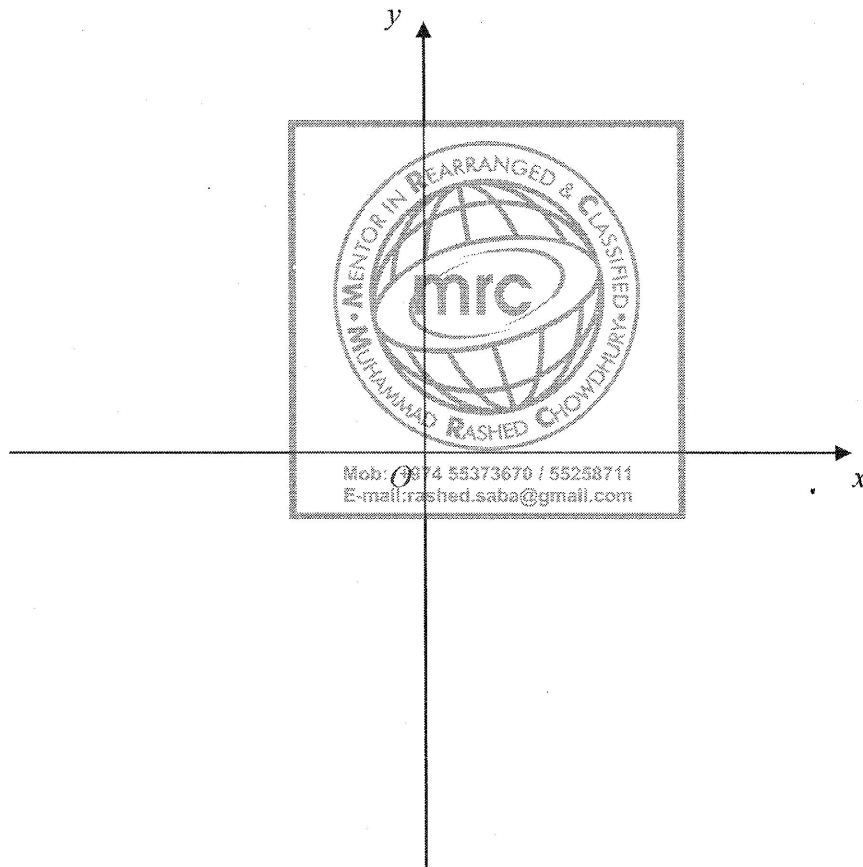   (e) Find the area of the quadrilateral $ACBE$.

    (3)

6. The curve C has equation $y = \dfrac{3}{x}$ and the line l has equation $y = 2x + 5$.

   (a) On the axes below, sketch the graphs of C and l, indicating clearly the coordinates of any intersections with the axes.

(3)

   (b) Find the coordinates of the points of intersection of C and l.
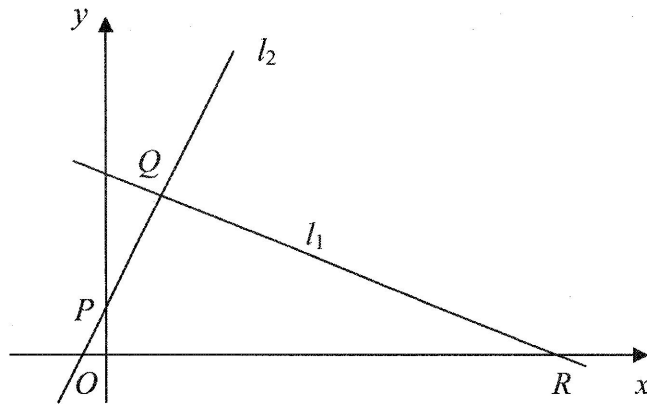
(6)

10.

Figure 2

The points $Q(1, 3)$ and $R(7, 0)$ lie on the line l_1, as shown in Figure 2.

The length of QR is $a\sqrt{5}$.

(a) Find the value of a.

(3)

The line l_2 is perpendicular to l_1, passes through Q and crosses the y-axis at the point P, as shown in Figure 2.

Find

(b) an equation for l_2,

(5)

(c) the coordinates of P,

(1)

(d) the area of $\triangle PQR$.

(4)

10.

Figure 2

The points P (0, 2) and Q (3, 7) lie on the line l_1, as shown in Figure 2.

The line l_2 is perpendicular to l_1, passes through Q and crosses the x-axis at the point R, as shown in Figure 2.
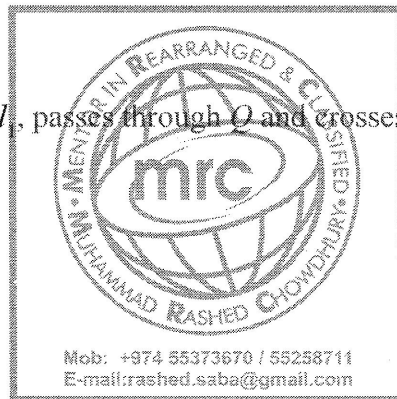
Find

(a) an equation for l_2, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers,

(5)

(b) the exact coordinates of R,

(2)

(c) the exact area of the quadrilateral $ORQP$, where O is the origin.
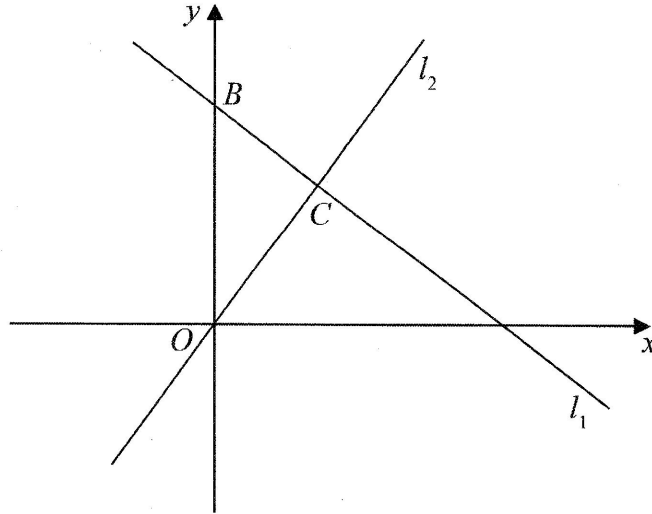
(5)

9.

Figure 2

The line l_1, shown in Figure 2 has equation $2x + 3y = 26$

The line l_2 passes through the origin O and is perpendicular to l_1

(a) Find an equation for the line l_2

(4)

The line l_2 intersects the line l_1 at the point C.

Line l_1 crosses the y-axis at the point B as shown in Figure 2.

(b) Find the area of triangle OBC.

Give your answer in the form $\dfrac{a}{b}$, where a and b are integers to be determined.
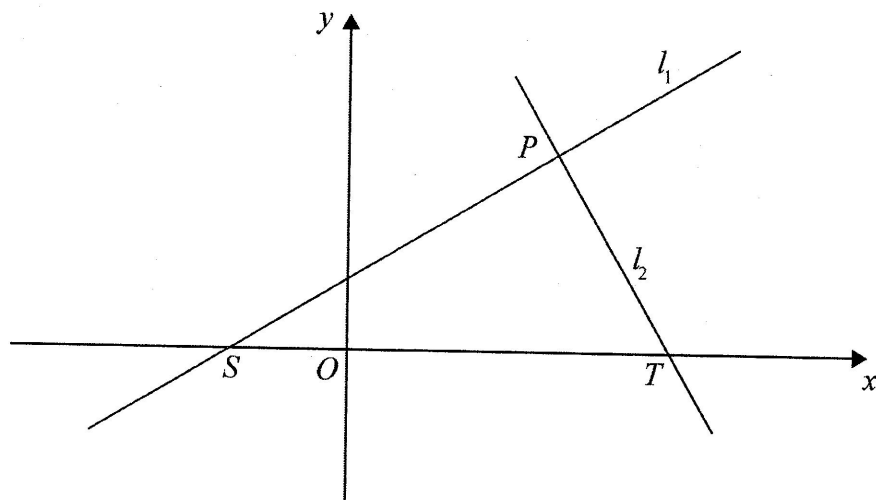
(6)

8.

Figure 1

Not to scale

J_N-17

The straight line l_1, shown in Figure 1, has equation $5y = 4x + 10$

The point P with x coordinate 5 lies on l_1

The straight line l_2 is perpendicular to l_1 and passes through P.

(a) Find an equation for l_2, writing your answer in the form $ax + by + c = 0$ where a, b and c are integers.

(4)

The lines l_1 and l_2 cut the x-axis at the points S and T respectively, as shown in Figure 1.

(b) Calculate the area of triangle SPT.

(4)

6.

Figure 1

The line l_1 has equation $2x - 3y + 12 = 0$

(a) Find the gradient of l_1.

(1)

The line l_1 crosses the x-axis at the point A and the y-axis at the point B, as shown in Figure 1.

The line l_2 is perpendicular to l_1 and passes through B.

(b) Find an equation of l_2.

(3)

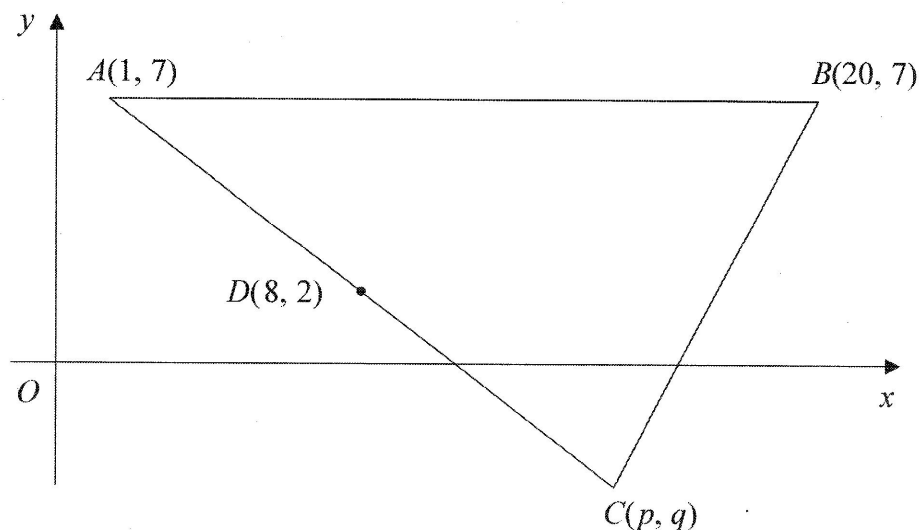The line l_2 crosses the x-axis at the point C.

(c) Find the area of triangle ABC.

(4)

8.

Figure 2

The points $A(1, 7)$, $B(20, 7)$ and $C(p, q)$ form the vertices of a triangle ABC, as shown in Figure 2. The point $D(8, 2)$ is the mid-point of AC.
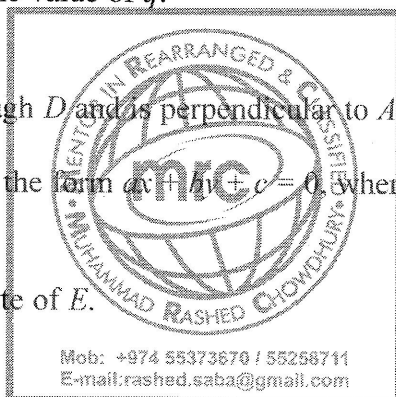
(a) Find the value of p and the value of q.

(2)

The line l, which passes through D and is perpendicular to AC, intersects AB at E.

(b) Find an equation for l, in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

(c) Find the exact x-coordinate of E.
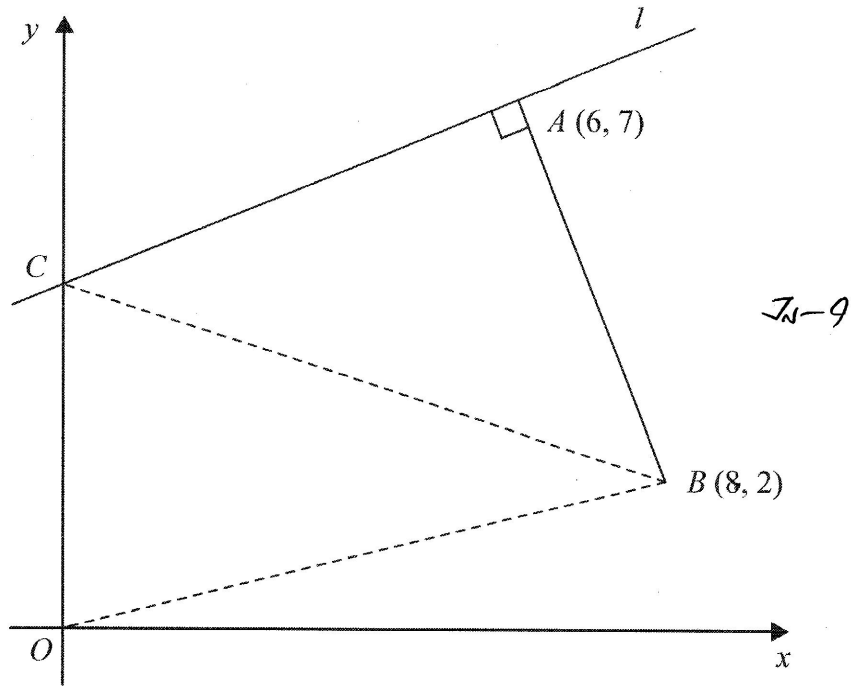
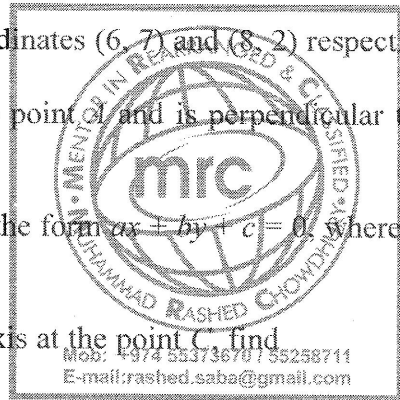**(2)**

8.

Figure 1

The points A and B have coordinates $(6, 7)$ and $(8, 2)$ respectively.

The line l passes through the point A and is perpendicular to the line AB, as shown in Figure 1.

(a) Find an equation for l in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

Given that l intersects the y-axis at the point C, find

(b) the coordinates of C,

(2)

(c) the area of $\triangle OCB$, where O is the origin.

(2)

10. (a) On the same axes sketch the graphs of the curves with equations

(i) $y = x^2(x-2)$,

(3)

(ii) $y = x(6-x)$,

$In-07$

(3)

and indicate on your sketches the coordinates of all the points where the curves cross the x-axis.

(b) Use algebra to find the coordinates of the points where the graphs intersect.

(7)

5. The curve C has equation $y = x(5 - x)$ and the line L has equation $2y = 5x + 4$

(a) Use algebra to show that C and L do not intersect.

(4)

(b) In the space on page 11, sketch C and L on the same diagram, showing the coordinates of the points at which C and L meet the axes.

(4)

Ja-12

3. Given that $f(x) = \dfrac{1}{x}, \quad x \neq 0,$

(a) sketch the graph of $y = f(x) + 3$ and state the equations of the asymptotes.

(4)

(b) Find the coordinates of the point where $y = f(x) + 3$ crosses a coordinate axis.

Ja-07

(2)

10. The curve C has equation

$$y = (x+3)(x-1)^2.$$

(a) Sketch C showing clearly the coordinates of the points where the curve meets the coordinate axes.

(4)

(b) Show that the equation of C can be written in the form

$$y = x^3 + x^2 - 5x + k,$$

where k is a positive integer, and state the value of k.

(2)

There are two points on C where the gradient of the tangent to C is equal to 3.

(c) Find the x-coordinates of these two points.

(6)

9. (a) Factorise completely $x^3 - 4x$

(3)

(b) Sketch the curve C with equation

$$y = x^3 - 4x,$$

showing the coordinates of the points at which the curve meets the x-axis.

(3)

The point A with x-coordinate -1 and the point B with x-coordinate 3 lie on the curve C.

(c) Find an equation of the line which passes through A and B, giving your answer in the form $y = mx + c$, where m and c are constants.

(5)

(d) Show that the length of AB is $k\sqrt{10}$, where k is a constant to be found.

(2)

10. (a) On the axes below sketch the graphs of

(i) $y = x(4-x)$

(ii) $y = x^2(7-x)$

showing clearly the coordinates of the points where the curves cross the coordinate axes.

(5)

(b) Show that the x-coordinates of the points of intersection of

$$y = x(4-x) \quad \text{and} \quad y = x^2(7-x)$$

are given by the solutions to the equation $x(x^2 - 8x + 4) = 0$

(3)

The point A lies on both of the curves and the x and y coordinates of A are both positive.

(c) Find the exact coordinates of A, leaving your answer in the form $(p + q\sqrt{3}, r + s\sqrt{3})$, where p, q, r and s are integers.

(7)

y

x