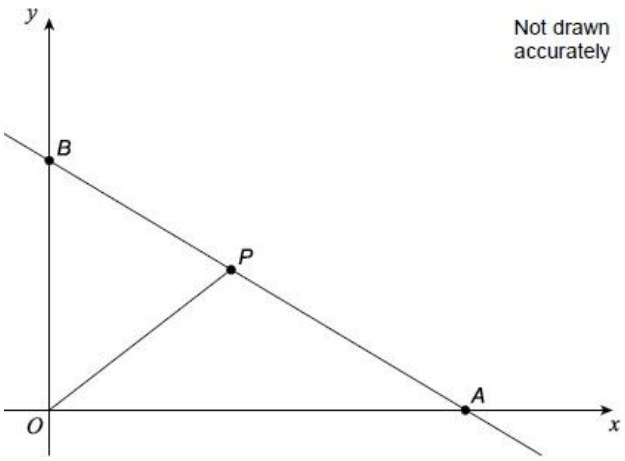
3 COORDINATE GEOMETRY – Further Maths

Section 3.1 – 3.6

Q1. The point (–6, –4) lies on a straight line with gradient $\frac{3}{2}$

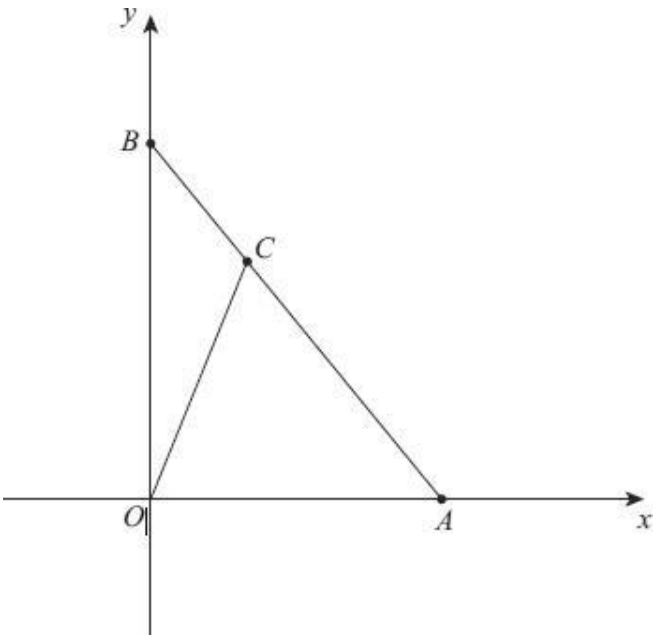
Work out the coordinates of the point where the line crosses the *y*-axis. **(2 marks)**

Q2. The equation of the line through *B*, *P* and *A* is $4x + 5y = 40$ $BP : PA = 2 : 3$



Work out the area of triangle *OBP*. **(4 marks)**

Q3. The equation of line AB is $y = 12 - 2x$ The area of triangle OCA is 24 square units.



Work out the coordinates of C. **(5 marks)**

Q4. *P* (–3, –10) and *Q* (a, b) are points on a straight line with gradient 12
Work out one possible pair of integer values for a and b. **(2 marks)**

Q5. L is a straight line with equation $ax + by = c$ where a, b and c are non-zero integers.

(a) At which point does L intersect the *x*-axis? Circle your answer.

$\left(\frac{a}{c}, 0\right)$ $\left(\frac{c}{a}, 0\right)$ $\left(\frac{b}{c}, 0\right)$ $\left(\frac{c}{b}, 0\right)$

(1 mark)

(b) What is the gradient of a line parallel to L? Circle your answer.

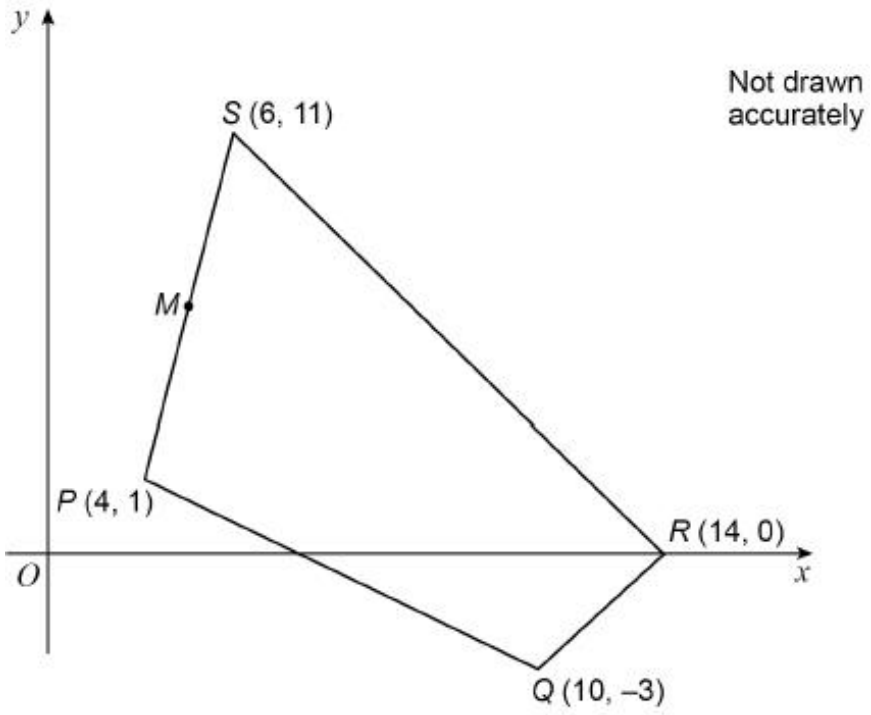
$-\frac{b}{a}$ $\frac{b}{a}$ $-\frac{a}{b}$ $\frac{a}{b}$

(1 mark)

Q6. A straight line passes through the points (−4, 7), (6, −5) and (8, *t*)

Use an algebraic method to work out the value of *t*.
You **must** show your working. **(3 marks)**

Q7. Here is a sketch of quadrilateral *PQRS*.
M is the midpoint of *PS*.



Use gradients to show that *MR* is parallel to *PQ*. **(3 marks)**

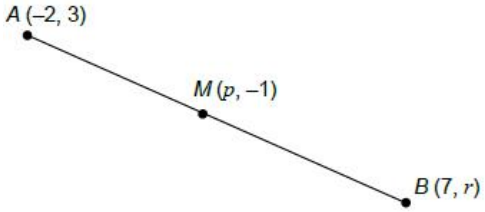
Q8. Line A has equation $y + 4x = 6$

Line B is parallel to line A and passes through the point (2, 1)

The point $(d, 2d)$ lies on line B. Work out the value of d. **(4 marks)**

Q9. Work out the equation of the straight line that is
parallel to the line $2y = x$
and
intersects the x-axis at (4, 0) **(3 marks)**

Q10. M is the midpoint of the line AB.



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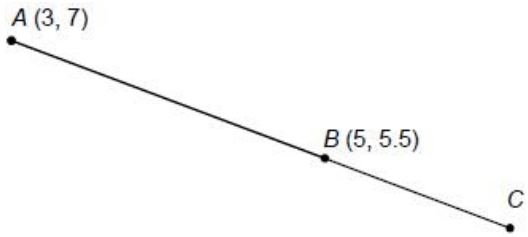
Work out the values of p and r. **(2 marks)**

Q11. ABC is a straight line with $AB : BC = 5 : 2$



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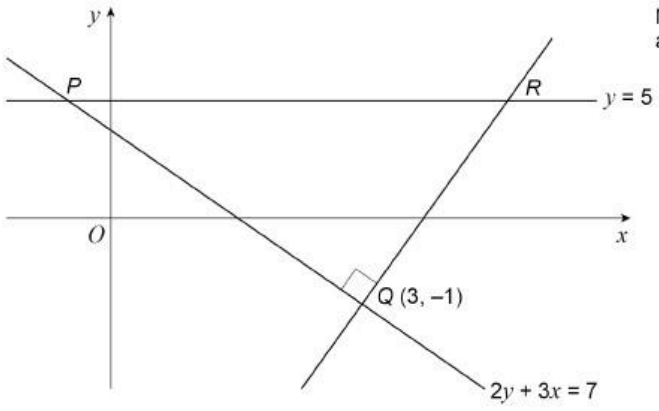
Work out the coordinates of C. **(4 marks)**

Q12. Triangle PQR is bounded by the lines shown. Angle $PQR = 90°$



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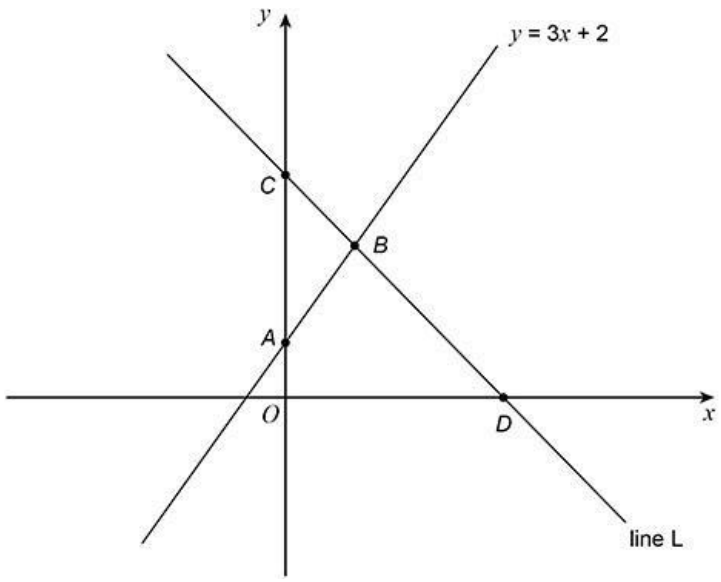
Work out the x-coordinate of R. **(5 marks)**

Q13. *A* and *B* are points on the line $y = 3x + 2$

B, *C* and *D* (5, 0) are points on the line L. $OA : AC = 1 : 4$



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Work out the *x*-coordinate of *B*. **(5 marks)**

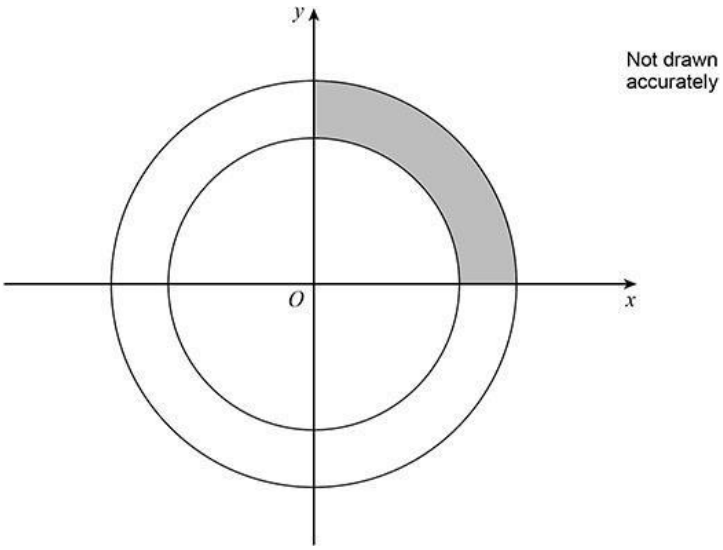
Section 3.7 – 3.8

Q1. *A* (–2, 5) and *B* (4, 13) are points on a circle. *AB* is a diameter.

Work out the equation of the circle.

Give your answer in the form $(x - a)^2 + (y - b)^2 = c$ where a, b and c are integers. **(3 marks)**

Q2. The equations of the two circles shown are $x^2 + y^2 = 100$ and $x^2 + y^2 = 36$



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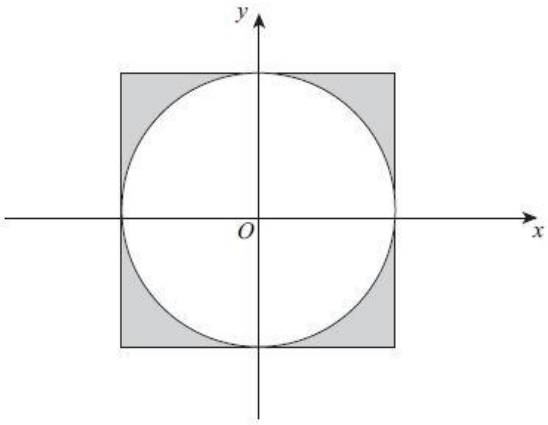
Work out the shaded area. Give your answer as an integer multiple of π. **(3 marks)**

Q3. The circle $x^2 + y^2 = 25$ touches each side of the square as shown.



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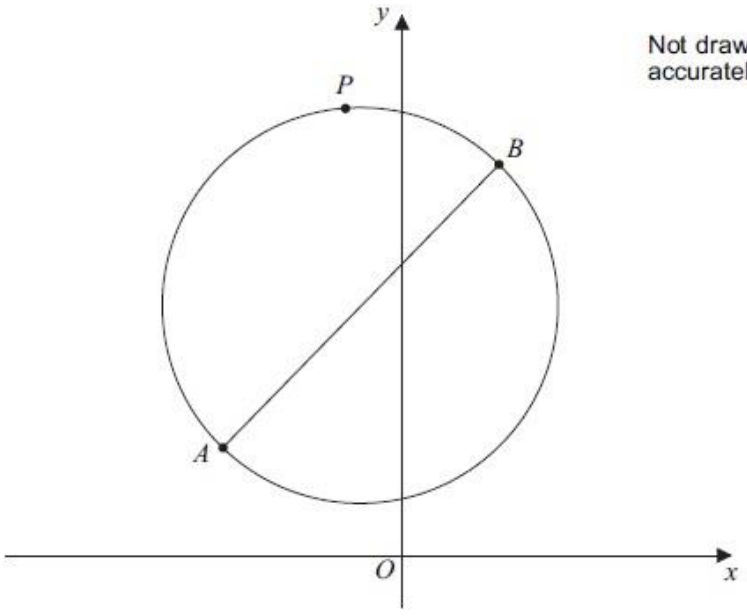
Work out the total shaded area. **(3 marks)**

Q4. $x^2 - 2x + y^2 - 6y = 0$ is the equation of a circle.

By writing the equation in the form $(x - a)^2 + (y - b)^2 = r^2$
work out the centre and radius of the circle. **(5 marks)**

Q5. A circle, centre (0, 0) has circumference 20π Work out the equation of the circle. **(2 marks)**

Q6. A is (−4, 3) and B is (2, 11) AB is a diameter of the circle.



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(a) Work out the coordinates of the centre of the circle. **(2 marks)**
(b) Work out the radius of the circle. **(2 marks)**
(c) Write down the equation of the circle. **(1 mark)**
(d) P is another point on the circle. The gradient of the line AP is 2.
Write down the gradient of the line PB. **(1 mark)**

Q7. Two circles, each with centre O, are shown. The equations of the circles are

$$x^2 + y^2 = 289 \quad \text{and} \quad x^2 + y^2 = 121$$

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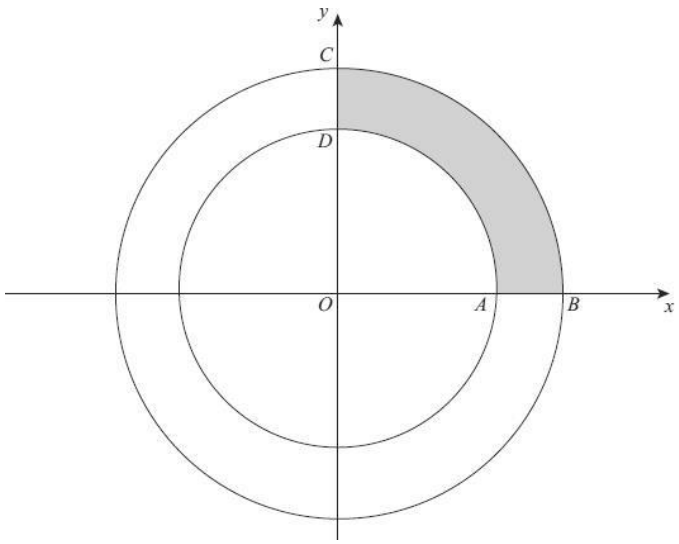


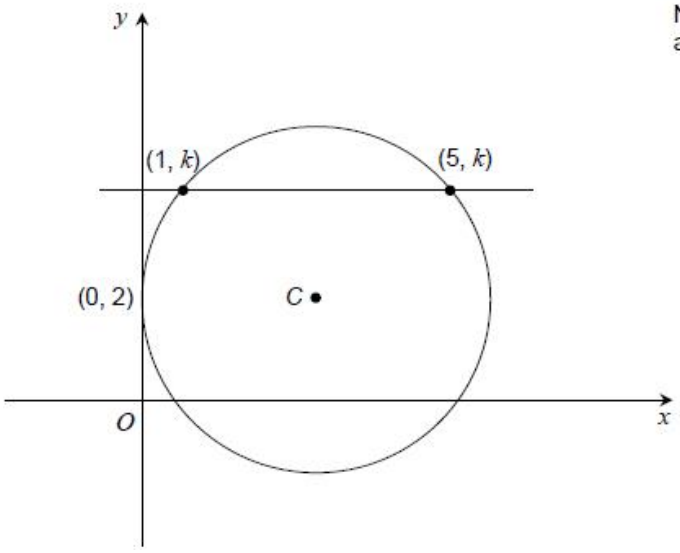
Work out the **perimeter** of the shaded section *ABCD*. **(5 marks)**

Q8. *O* is the point (0, 0) and *P* is the point (2, 3) *OP* is a radius of a circle.

Work out the equations of the **two** possible circles. **(3 marks)**

Q9. A circle, centre *C*, touches the *y*-axis at the point (0, 2)

The line $y = k$ intersects the circle at the points (1, k) and (5, k)



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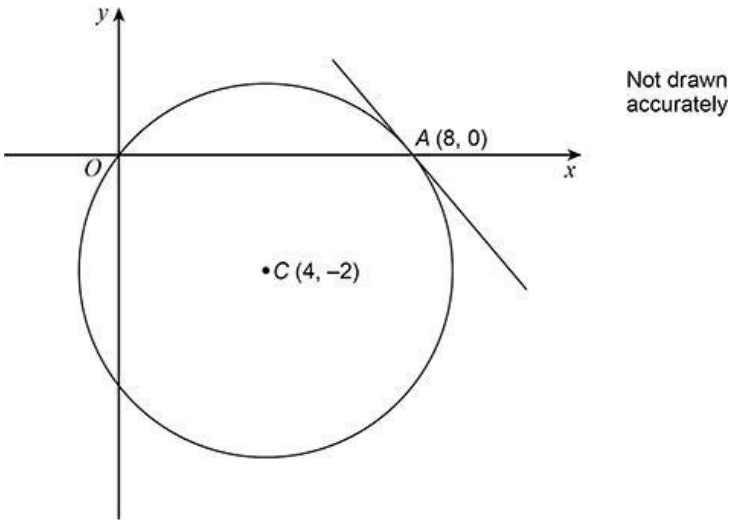
Work out the equation of the circle.

(3 marks)

Section 3.9

Q1. A circle, centre C (4, –2), passes through the origin and point A (8, 0) on the x-axis.

The tangent at A is shown.



(a) Work out the equation of the circle. **(2 marks)**

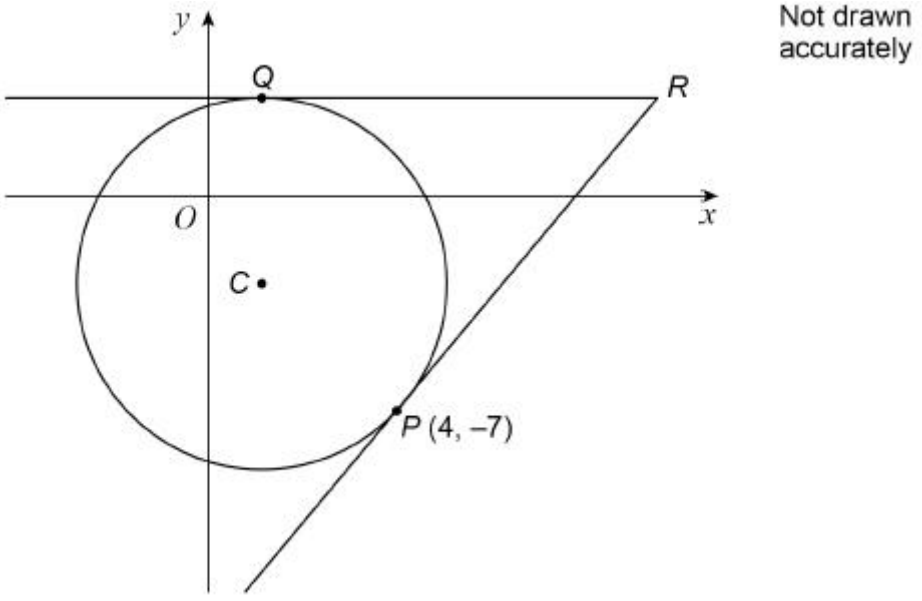
(b) Work out the equation of the tangent to the circle at A. **(3 marks)**

Q2. A circle has centre C and equation $(x - 1)^2 + (y + 3)^2 = 25$

P (4, −7) and Q are points on the circle.

The tangent at Q is parallel to the x-axis.

The tangents at P and Q intersect at point R.



(a) Write down the coordinates of C. **(1 mark)**

(b) Show that the equation of the tangent at Q is $y = 2$ **(1 mark)**

(c) Work out the x-coordinate of R. **(4 marks)**

Q3. A circle has equation $x^2 + y^2 = 29$

P is the point $(-5, 2)$

(a) Show that P is on the circle.

(1 mark)

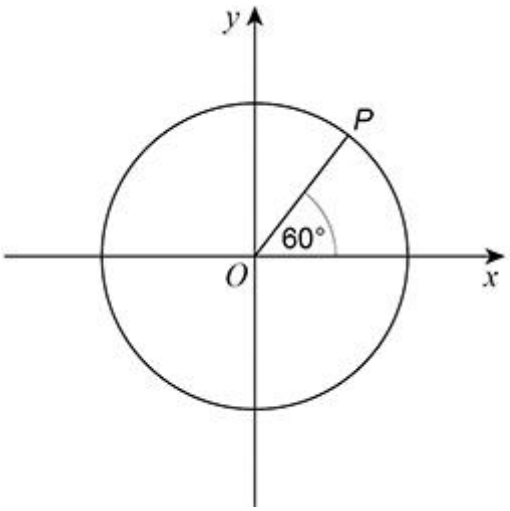
(b) The tangent to the circle at P intersects the x-axis at point Q.

Work out the x-coordinate of Q.
You **must** show your working.

(4 marks)

Q4. The point P lies on the circle $x^2 + y^2 = 16$

The line OP is at an angle of 60° to the positive x-axis.



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(a) Show that the coordinates of point P are $(2, 2\sqrt{3})$

(2 marks)

(b) Work out the equation of the tangent to the circle at P.

Write your answer in the form $x + ay = b$ where a and b are constants.

(4 marks)