Write your name here

Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Mathematics

Year 11 to Year 12 Transition Paper

Circles

You must have:
Mathematical Formulae and Statistical Tables, calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer cross it out and put your new answer and any working out underneath.

Turn over ▶

Pearson

You may use a calculator to answer these questions.

1. The equation of circle **C** is $x^2 + y^2 = 16$

The circle **C** is translated by the vector $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$ to give circle **B**.

Draw a sketch of circle **B**.

Label with coordinates the centre of circle **B** and any points of intersection with the
x-axis.

(Total for Question 1 is 3 marks)

2.

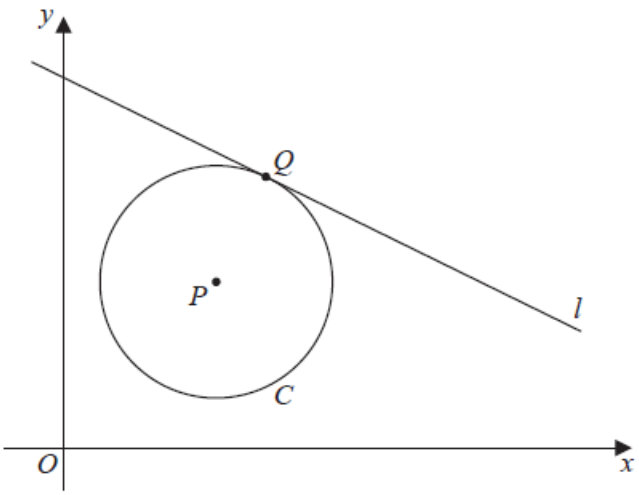

Diagram not drawn to scale

Figure 1

The circle C has centre $P(7, 8)$ and passes through the point $Q(10, 13)$, as shown in Figure 1.

(a) Find the length PQ, giving your answer as an exact value.

(2)

(b) Hence write down an equation for C.

(2)

The line l is a tangent to C at the point Q, as shown in Figure 2.

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

(4)

(Total for Question 2 is 8 marks)

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3. The circle C has equation

$$x^2 + y^2 - 2x + 14y = 0$$

Find

(a) the coordinates of the centre of C,

(2)

(b) the exact value of the radius of C,

(2)

(c) the y coordinates of the points where the circle C crosses the y-axis.

(2)

(d) Find an equation of the tangent to C at the point (2, 0), giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

(Total for Question 3 is 10 marks)

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4. The circle C has equation

$$x^2 + y^2 - 10x + 6y + 30 = 0$$

Find

(a) the coordinates of the centre of C,

(2)

(b) the radius of C,

(2)

(c) the y coordinates of the points where the circle C crosses the line with equation $x = 4$,
giving your answers as simplified surds.

(3)

(Total for Question 4 is 7 marks)

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5. A circle C has centre $(-1, 7)$ and passes through the point $(0, 0)$.

Find an equation for C.

(Total for Question 5 is 4 marks)

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6. A circle C with centre at the point $(2, -1)$ passes through the point A at $(4, -5)$.

(a) Find an equation for the circle C.

(3)

(b) Find an equation of the tangent to the circle C at the point A, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

(Total for Question 6 is 7 marks)

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7. The circle C has equation

$$x^2 + y^2 - 20x - 24y + 195 = 0.$$

The centre of C is at the point M.

(a) Find

(i) the coordinates of the point M,

(ii) the radius of the circle C.

(5)

N is the point with coordinates $(25, 32)$.

(b) Find the length of the line MN.

(2)

The tangent to C at a point P on the circle passes through point N.

(c) Find the length of the line NP.

(2)

(Total for Question 7 is 9 marks)

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8. The points A and B have coordinates $(-2, 11)$ and $(8, 1)$ respectively.

Given that AB is a diameter of the circle C,

(a) show that the centre of C has coordinates $(3, 6)$,

(1)

(i) find an equation for C.

(4)

(c) Verify that the point $(10, 7)$ lies on C.

(1)

(d) Find an equation of the tangent to C at the point $(10, 7)$, giving your answer in the form $y = mx + c$, where m and c are constants.

(4)

(Total for Question 7 is 10 marks)

9.

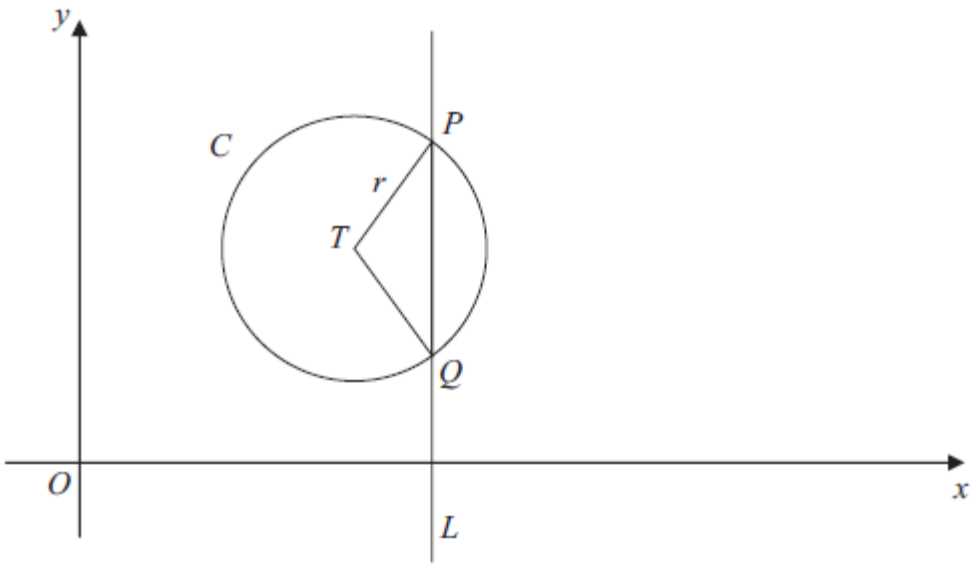

Figure 2

The circle C with centre T and radius r has equation

$$x^2 + y^2 - 20x - 16y + 139 = 0.$$

(a) Find the coordinates of the centre of C.

(3)

(b) Show that $r = 5$

(2)

The line L has equation $x = 13$ and crosses C at the points P and Q as shown in Figure 1.

(c) Find the y coordinate of P and the y coordinate of Q.

(3)

(Total for Question 9 is 8 marks)

10. A circle C has equation

$$x^2 + y^2 - 4x + 8y - 8 = 0$$

(a) Find

(i) the coordinates of the centre of C,

(ii) the exact radius of C.

(3)

The straight line with equation $x = k$, where k is a constant, is a tangent to C.

(b) Find the possible values for k.

(2)

(Total for Question 10 is 5 marks)

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11. The circle C has equation

$$x^2 + y^2 + 4x - 2y - 11 = 0.$$

Find

(a) the coordinates of the centre of C,

(2)

(b) the radius of C,

(2)

(c) the coordinates of the points where C crosses the y-axis, giving your answers as simplified surds.

(4)

(Total for Question 11 is 8 marks)

12.

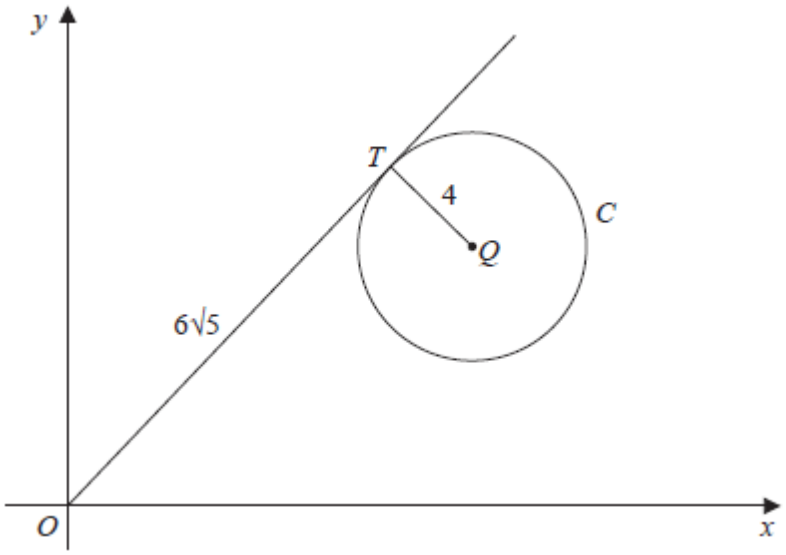

Figure 3

Figure 3 shows a circle C with centre Q and radius 4 and the point T which lies on C. The tangent to C at the point T passes through the origin O and $OT = 6\sqrt{5}$.

Given that the coordinates of Q are $(11, k)$, where k is a positive constant,

(a) *find the exact value of k,*

(3)

(*b*) find an equation for C.

(2)

(Total for Question 12 is 5 marks)

13.

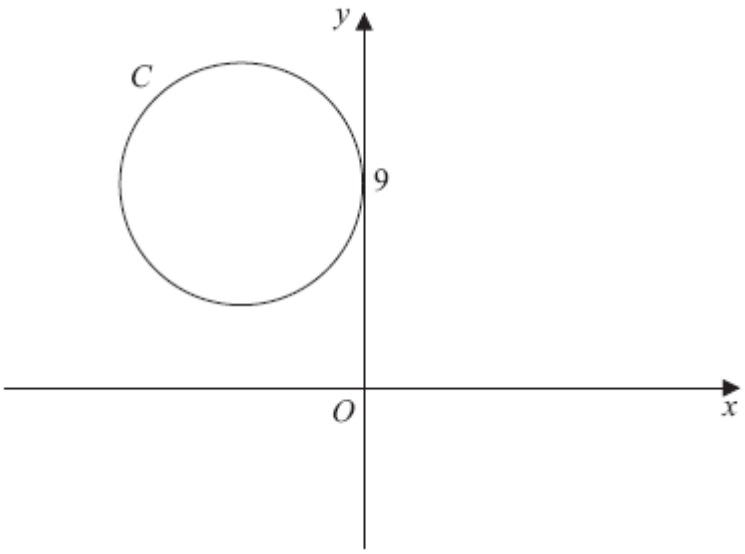

Figure 4

The circle C has radius 5 and touches the y-axis at the point (0, 9), as shown in Figure 4.

(a) Write down an equation for the circle C, that is shown in Figure 4.

(3)

A line through the point $P(8, -7)$ is a tangent to the circle C at the point T.

(b) Find the length of PT.

(3)

(Total for Question 13 is 6 marks)

14. A circle C with centre at (–2, 6) passes through the point (10, 11).

(*a*) Show that the circle *C* also passes through the point (10, 1).

(3)

The tangent to the circle C at the point (10, 11) meets the *y*-axis at the point *P* and the tangent to the circle *C* at the point (10, 1) meets the *y*-axis at the point *Q*.

(*b*) Show that the distance *PQ* is 58, explaining your method clearly.

(7)

(Total for Question 14 is 10 marks)

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15. A circle *C* has centre (2, 5). Given that the point *P*(–2, 3) lies on *C*.

(*a*) find an equation for *C*.

(3)

The line *l* is the tangent to *C* at the point *P*. The point *Q*(2, *k*) lies on *l*.

(*b*) Find the value of *k*.

(5)

(Total for Question 15 is 8 marks)

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16. The circle *C* has equation

$$x^2 + y^2 - 6x + 10y + 9 = 0.$$

(*a*) Find

(i) the coordinates of the centre of *C*,

(ii) the radius of *C*.

(3)

The line with equation $y = kx$, where k is a constant, cuts *C* at two distinct points.

(*b*) Find the range of values for *k*.

(6)

(Total for Question 16 is 9 marks)
