



eClassroom

INTERNATIONAL A LEVEL MATHEMATICS • PURE 2

# Pure Mathematics 2

Exam Questions by Topic

Pearson Edexcel International Advanced Level (WMA12/01) • Calculator allowed

Multi-step exam questions at the difficulty of the real WMA12 paper, with a full mark scheme

| Chapters (tap a chapter to jump to it)                                                                                                                       | Qs | Marks | Page    | My score |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|---------|----------|
| <b>1 Algebraic Methods</b><br>Algebraic fractions, the factor and remainder theorems, proof                                                                  | 10 | 66    | own PDF |          |
| <b>2 Coordinate Geometry in the (x, y) Plane</b><br>Equations of circles, tangents, chords and intersections                                                 | 10 | 68    | 2       |          |
| <b>3 Exponentials and Logarithms</b><br>Laws of logarithms, exponential equations, modelling                                                                 | 10 | 68    | own PDF |          |
| <b>4 The Binomial Expansion</b><br>Expanding $(a + bx)^n$ , coefficients and approximations                                                                  | 10 | 65    | own PDF |          |
| <b>5 Sequences and Series</b><br>Arithmetic and geometric series, sigma notation, recurrence                                                                 | 10 | 69    | own PDF |          |
| <b>6 Trigonometric Identities and Equations</b><br>$\tan \theta = \frac{\sin \theta}{\cos \theta}$ , $\sin^2 \theta + \cos^2 \theta = 1$ , solving equations | 10 | 66    | own PDF |          |
| <b>7 Differentiation</b><br>Increasing and decreasing functions, stationary points, optimisation                                                             | 10 | 67    | own PDF |          |
| <b>8 Integration</b><br>Definite integrals, areas under curves, the trapezium rule                                                                           | 10 | 67    | own PDF |          |

[Full mark scheme](#)

[Free courses](#)

[More worksheets](#)

Name .....

Class .....

Date .....



Join students already acing their exams.

Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

## CHAPTER 2 • KEY SKILLS

## 2

## Coordinate Geometry in the (x, y) Plane

Specification P2: Circles • 10 questions • 68 marks • about 80 minutes

**1 Equation of a circle**Centre  $(a, b)$ , radius  $r$ :

$$(x - a)^2 + (y - b)^2 = r^2$$

**2 Centre and radius**Complete the square in  $x$  and in  $y$ .

e.g.  $x^2 + y^2 - 4x + 2y = 4$  is

$$(x - 2)^2 + (y + 1)^2 = 9$$
: centre  $(2, -1)$ ,

$$r = 3$$

**3 Midpoints and distances**The centre is the midpoint of a diameter.  $r$  is the distance from the centre to any point on the circle.**4 Tangents**

A tangent is perpendicular to the radius at the point of contact: gradient

$$= -\frac{1}{m_{\text{radius}}}$$

**5 Chords**

The perpendicular bisector of any chord passes through the centre.

**6 Angle in a semicircle**If angle  $ACB = 90^\circ$ , then  $AB$  is a diameter of the circle through  $A$ ,  $B$  and  $C$ .**7 Lines meeting circles**

Substitute the line into the circle.

$$b^2 - 4ac > 0$$
: two points;  $= 0$ : tangent;

$$< 0$$
: no points.

**8 Two circles**Compare the distance  $d$  between the centres with  $r_1 + r_2$  (and  $|r_1 - r_2|$ ).

Draw a sketch.

**9 Tangents from a point**Tangent length<sup>2</sup> = (distance to centre)<sup>2</sup> -  $r^2$ , by Pythagoras.**Skills map** every skill above is tested at least once; interleaved skills come from GCSE or other chapters

| Skill                                                        | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|--------------------------------------------------------------|----|----|----|----|----|----|----|----|----|-----|
| Marks                                                        | 4  | 5  | 6  | 5  | 5  | 8  | 8  | 8  | 9  | 10  |
| 1 Equation of a circle                                       | •  |    | •  |    | •  |    |    | •  |    |     |
| 2 Centre and radius                                          |    | •  |    |    |    | •  |    |    | •  |     |
| 3 Midpoints and distances                                    | •  |    | •  | •  | •  | •  |    | •  |    | •   |
| 4 Tangents                                                   |    | •  | •  |    |    |    | •  |    |    | •   |
| 5 Chords                                                     |    |    |    |    | •  |    |    |    | •  |     |
| 6 Angle in a semicircle                                      |    |    |    |    |    |    |    | •  |    |     |
| 7 Lines meeting circles                                      |    |    |    | •  |    |    | •  |    | •  |     |
| 8 Two circles                                                |    |    |    |    |    | •  |    |    |    |     |
| 9 Tangents from a point                                      |    |    |    |    |    |    |    |    |    | •   |
| Interleaved: straight lines and perpendicular gradients (P1) |    |    | •  |    | •  |    |    | •  | •  |     |
| Interleaved: quadratics and the discriminant (P1)            |    |    |    | •  |    |    | •  |    | •  |     |
| Interleaved: radians: sectors and segments (P1)              |    |    |    |    |    |    |    |    | •  | •   |

**Exam difficulty.** Questions 1 to 5 check each skill on its own. Questions 6 to 10 are multi-step questions built like the last questions on a real WMA12 paper, where one part leads into the next and skills from different topics are combined.

**Must learn.** Watch the signs:  $(x + 2)^2$  means the centre has  $x = -2$ . The radius is  $\sqrt{r^2}$ . When comparing distances, write the values and a conclusion.



Join students already acing their exams.

Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

1. The points  $A(-1, 4)$  and  $B(5, -4)$  are the ends of a diameter of the circle  $C$ .  
Find an equation for  $C$ .

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 1 is 4 marks)



Join students already acing their exams.

Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

2. The circle  $C$  has equation

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

- (a) Find the coordinates of the centre of  $C$  and the radius of  $C$ .

(3)

- (b) Show that  $C$  touches the  $x$ -axis, and state the coordinates of the point where it does so.

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



## Question 2 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 2 is 5 marks)



Join students already acing their exams.

Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

3. A circle  $C$  has centre  $(-1, 3)$ . The point  $P(3, 0)$  lies on  $C$ .

(a) (i) Find the radius of  $C$ .

(1)

(ii) Find an equation for  $C$ .

(2)

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

(3)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



**Question 3 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**(Total for Question 3 is 6 marks)****Join students already acing their exams.**Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

**4. In this question you must show all stages of your working.****Solutions relying on calculator technology are not acceptable.**The circle  $C$  has equation  $x^2 + y^2 = 25$  and the line  $l$  has equation  $y = x + 1$ The line  $l$  meets  $C$  at the points  $A$  and  $B$ .**(a)** Using algebra, find the coordinates of  $A$  and  $B$ .**(4)****(b)** Find the exact length of the chord  $AB$ .**(1)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



## Question 4 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 4 is 5 marks)



Join students already acing their exams.

Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

5. The points  $A(-2, 1)$  and  $B(4, 5)$  lie on the circle  $C$ .

(a) Find an equation of the perpendicular bisector of  $AB$ .

(3)

Given that the centre of  $C$  lies on the  $x$ -axis,

(b) find an equation for  $C$ .

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



## Question 5 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 5 is 5 marks)



Join students already acing their exams.

Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

6. The circle  $C_1$  has equation  $x^2 + y^2 - 4x + 6y - 12 = 0$   
The circle  $C_2$  has equation  $x^2 + y^2 - 20x - 18y + 145 = 0$

(a) Find the centre and the radius of  $C_1$ .

(3)

(b) Find the centre and the radius of  $C_2$ .

(2)

(c) Show that  $C_1$  and  $C_2$  do not meet.

(3)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



## Question 6 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 6 is 8 marks)



Join students already acing their exams.

Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

**Solutions relying on calculator technology are not acceptable.**

The line  $l$  has equation  $y = 2x + k$ , where  $k$  is a constant.

$$5x^2 + (4k - 10)x + k^2 - 2k - 10 = 0$$

**(3)**

(b) find the two possible values of  $k$ .

**(3)**

**(c)** For the positive value of  $k$ , find the coordinates of the point where  $l$  touches  $C$ .

(2)

**Question 7 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**(Total for Question 7 is 8 marks)****Join students already acing their exams.**Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

8. The points  $A$ ,  $B$  and  $C$  have coordinates  $(-1, 2)$ ,  $(7, 6)$  and  $(5, 0)$  respectively.

(a) Show that angle  $ACB = 90^\circ$

(3)

(b) Hence find an equation of the circle that passes through  $A$ ,  $B$  and  $C$ .

(3)

The point  $D$  lies on the circle and  $CD$  is a diameter.

(c) Find the coordinates of  $D$ .

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



## Question 8 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 8 is 8 marks)



Join students already acing their exams.

Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

9.

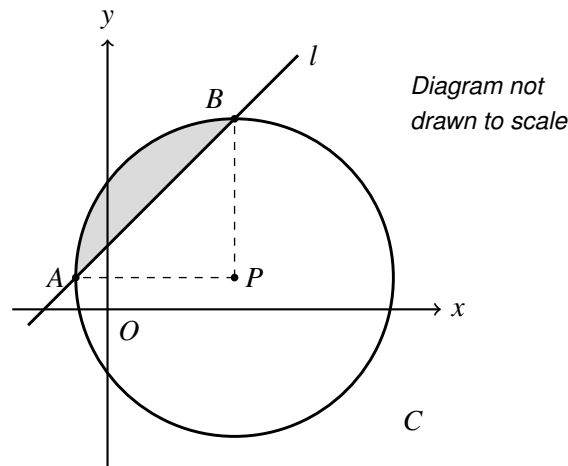


Figure 1

Figure 1 shows the circle  $C$  with equation

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

and centre  $P$ . The line  $l$  with equation  $y = x + 2$  meets  $C$  at the points  $A$  and  $B$ .

(a) Find the coordinates of  $P$  and the radius of  $C$ .

(2)

(b) Using algebra, find the coordinates of  $A$  and  $B$ .

(3)

(c) Show that angle  $APB = \frac{\pi}{2}$  radians.

(2)

The minor segment cut off by the chord  $AB$  is shown shaded in Figure 1.

(d) Find the exact area of the shaded segment.

(2)



Join students already acing their exams.

Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

## Question 9 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**Join students already acing their exams.**Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

## Question 9 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 9 is 9 marks)



Join students already acing their exams.

Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

10.

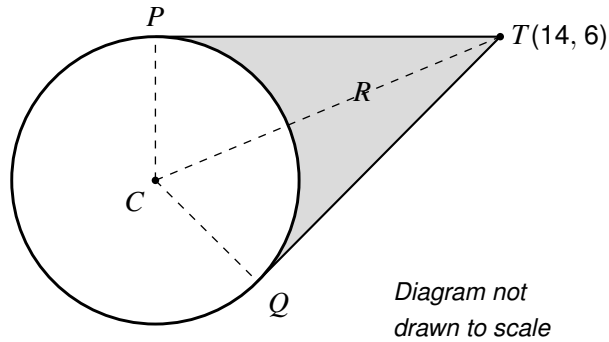


Figure 2

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

The point  $T$  has coordinates  $(14, 6)$ . The lines  $TP$  and  $TQ$  are tangents to the circle at  $P$  and  $Q$ , as shown in Figure 2.

- (a) Show that the length of the tangent  $TP$  is 12 (3)
- (b) Find the area of the quadrilateral  $CPTQ$ . (2)
- (c) Find the size of angle  $PCQ$ , in radians, to 3 significant figures. (2)

The region  $R$ , shown shaded in Figure 2, is bounded by the tangents  $TP$  and  $TQ$  and the minor arc  $PQ$ .

- (d) Find the area of  $R$ , giving your answer to 3 significant figures. (3)



## Question 10 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**Join students already acing their exams.**Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)

**Question 10 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**(Total for Question 10 is 10 marks)****TOTAL FOR CHAPTER 2 IS 68 MARKS****Join students already acing their exams.**Book your FREE lesson at [www.eclassroom.org.uk](http://www.eclassroom.org.uk)