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TUTGATHER PRACTICE PAPER

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2027

Candidate Number

MATHEMATICS Compulsory Part
PAPER 1

Question-Answer Book

TUTGATHER
PRACTICE PAPER · NOT AN OFFICIAL HKEAA PAPER

1 hour 5 minutes

This paper must be answered in English

Topic practice: Equations of Circles

INSTRUCTIONS

(1) This paper consists of THREE sections, A(1), A(2) and B.

(2) Attempt ALL questions in this paper. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins.

(3) Unless otherwise specified, all working must be clearly shown.

(4) Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.

(5) The diagrams in this paper are not necessarily drawn to scale.

(6) Calculators and mathematical drawing instruments may be used.

(7) The marks for each question are shown in brackets.

(8) No extra time will be given after the 'Time is up' announcement.

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SECTION A(1) (16 marks)

1. Find the equation of the circle with centre $(-2, 3)$ which passes through the point $(4, -5)$. Express your answer in the form $x^2 + y^2 + Dx + Ey + F = 0$. **(3 marks)**

2. The equation of a circle is $2x^2 + 2y^2 - 12x + 8y - 6 = 0$. Find its centre and its radius. **(3 marks)**

3. The line $y = x + 1$ cuts the circle $x^2 + y^2 = 25$ at the points A and B. Find the coordinates of A and B. **(4 marks)**

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4. The points $A(-1, 2)$ and $B(7, 10)$ are the ends of a diameter of a circle C. **(6 marks)**

(a) Find the centre and the radius of C.

(b) Find the equation of C.

(c) Show that the point $P(7, 2)$ lies on C, and hence find the area of $\triangle APB$.

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SECTION A(2) (24 marks)

5. A circle C passes through the points $A(1, 0)$, $B(5, 0)$ and $D(3, 6)$. **(7 marks)**

(a) Explain why the centre of C lies on the line $x = 3$.

(b) Find the equation of C.

(c) The circle C is translated 4 units to the left and 1 unit downwards to give a circle C'. Find the equation of C'.

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6. The circle C has equation $x^2 + y^2 - 8x + 6y + 16 = 0$. **(8 marks)**

(a) Find the centre G and the radius r of C.

(b) The point $P(8, 1)$ is outside C. Let T be a point on C such that PT is a tangent to C.

(i) Find the length of PT.

(ii) Find the equation of the tangent PT.

(c) Find the shortest distance from P to the circle C.

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7. The circle C has equation $x^2 + y^2 - 4x + 2y - 20 = 0$ and the line L has equation $y = mx + 6$. **(9 marks)**

(a) Find the centre and radius of C.

(b) Show that the x-coordinates of the intersection points of L and C satisfy

$$(1 + m^2)x^2 + (8m - 4)x + 28 = 0.$$

(c) Find the range of values of m for which L intersects C at two distinct points.

(d) When $m = 1$, find the length of the chord cut off by L on C.

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SECTION B (10 marks)

8. The circle C_1 has equation $x^2 + y^2 - 6x - 8y + 16 = 0$. A second circle C_2 has centre $Q(11, 4)$ and passes through the point $R(6, 4)$. **(10 marks)**

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

(b) Find the equation of C_2.

(c) Show that C_1 and C_2 touch externally, and find the coordinates of the point of contact.

(d) A common tangent to the two circles touches C_1 at A and C_2 at B, with $A \neq$ the point of contact in (c). Find the length AB.

END OF PAPER

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