Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname ____________________

Forename(s) ____________________

Candidate signature ____________________

AS
MATHEMATICS

Unit Pure Core 1 Non-Calculator

Wednesday 18 May 2016 Morning Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- the blue AQA booklet of formulae and statistical tables.

You must **not** use a calculator.

Instructions
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
- Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- The use of calculators is **not** permitted.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

Advice
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.

Answer **all** questions.

Answer each question in the space provided for that question.

1 The line AB has equation $5x + 3y + 3 = 0$.

(a) The line AB is parallel to the line with equation $y = mx + 7$.

Find the value of m.

[2 marks]

(b) The line AB intersects the line with equation $3x - 2y + 17 = 0$ at the point B.

Find the coordinates of B.

[3 marks]

(c) The point with coordinates $(2k + 3,\ 4 - 3k)$ lies on the line AB.

Find the value of k.

[2 marks]

QUESTION PART REFERENCE

Answer space for question 1

QUESTION PART REFERENCE	Answer space for question 1

2 (a) Simplify $\left(3\sqrt{5}\right)^2$.

[1 mark]

(b) Express $\dfrac{\left(3\sqrt{5}\right)^2+\sqrt{5}}{7+3\sqrt{5}}$ in the form $m+n\sqrt{5}$, where m and n are integers.

[4 marks]

QUESTION PART REFERENCE

Answer space for question 2

QUESTION PART REFERENCE	Answer space for question 2

3 (a) (i) Express $x^2 - 7x + 2$ in the form $(x - p)^2 + q$, where p and q are rational numbers.
[2 marks]

(ii) Hence write down the minimum value of $x^2 - 7x + 2$.
[1 mark]

(b) Describe the geometrical transformation which maps the graph of $y = x^2 - 7x + 2$ onto the graph of $y = (x - 4)^2$.
[3 marks]

QUESTION PART REFERENCE

Answer space for question 3

QUESTION PART REFERENCE	Answer space for question 3

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4 The polynomial $\mathrm{p}(x)$ is given by $\mathrm{p}(x) = x^3 - 5x^2 - 8x + 48$.

(a) (i) Use the Factor Theorem to show that $x + 3$ is a factor of $\mathrm{p}(x)$.
[2 marks]

(ii) Express $\mathrm{p}(x)$ as a product of three linear factors.
[3 marks]

(b) (i) Use the Remainder Theorem to find the remainder when $\mathrm{p}(x)$ is divided by $x - 2$.
[2 marks]

(ii) Express $\mathrm{p}(x)$ in the form $(x-2)(x^2 + bx + c) + r$, where b, c and r are integers.
[3 marks]

QUESTION PART REFERENCE

Answer space for question 4

QUESTION PART REFERENCE	**Answer space for question 4**

5 A circle with centre $C(5, -3)$ passes through the point $A(-2, 1)$.

(a) Find the equation of the circle in the form

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

[3 marks]

(b) Given that AB is a diameter of the circle, find the coordinates of the point B.

[2 marks]

(c) Find an equation of the tangent to the circle at the point A, giving your answer in the form $px + qy + r = 0$, where p, q and r are integers.

[5 marks]

(d) The point T lies on the tangent to the circle at A such that $AT = 4$.

Find the length of CT.

[3 marks]

QUESTION PART REFERENCE

Answer space for question 5

QUESTION PART REFERENCE

Answer space for question 5

6 (a) A curve has equation $y = 8 - 4x - 2x^2$.

(i) Find the values of x where the curve crosses the x-axis, giving your answer in the form $m \pm \sqrt{n}$, where m and n are integers.

[2 marks]

(ii) Sketch the curve, giving the value of the y-intercept.

[2 marks]

(b) A line has equation $y = k(x + 4)$, where k is a constant.

(i) Show that the x-coordinates of any points of intersection of the line with the curve $y = 8 - 4x - 2x^2$ satisfy the equation

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

[1 mark]

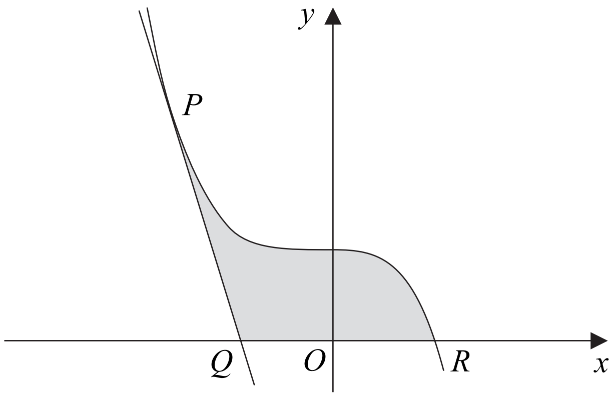
(ii) Find the values of k for which the line is a tangent to the curve $y = 8 - 4x - 2x^2$.

[3 marks]

QUESTION PART REFERENCE	Answer space for question 6

QUESTION PART REFERENCE	Answer space for question 6

7 The diagram shows the sketch of a curve and the tangent to the curve at P.



The curve has equation $y = 4 - x^2 - 3x^3$ and the point $P(-2, 24)$ lies on the curve. The tangent at P crosses the x-axis at Q.

(a) (i) Find the equation of the tangent to the curve at the point P, giving your answer in the form $y = mx + c$.

[5 marks]

(ii) Hence find the x-coordinate of Q.

[1 mark]

(b) (i) Find $\int_{-2}^{1} (4 - x^2 - 3x^3)\,dx$.

[5 marks]

(ii) The point $R(1, 0)$ lies on the curve. Calculate the area of the shaded region bounded by the curve and the lines PQ and QR.

[3 marks]

QUESTION PART REFERENCE	**Answer space for question 7**

QUESTION PART REFERENCE

Answer space for question 7

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QUESTION PART REFERENCE	**Answer space for question 7**

QUESTION PART REFERENCE	Answer space for question 7

8 The gradient, $\frac{dy}{dx}$, at the point (x, y) on a curve is given by

$$\frac{dy}{dx} = 54 + 27x - 6x^2$$

(a) (i) Find $\frac{d^2y}{dx^2}$.

[2 marks]

(ii) The curve passes through the point $P\left(-1\frac{1}{2}, 4\right)$.

Verify that the curve has a minimum point at P.

[4 marks]

(b) (i) Show that at the points on the curve where y is decreasing

$$2x^2 - 9x - 18 > 0$$

[2 marks]

(ii) Solve the inequality $2x^2 - 9x - 18 > 0$.

[4 marks]

QUESTION PART REFERENCE	Answer space for question 8

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END OF QUESTIONS