

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

MATHEMATICS

9709/11

Paper 1 Pure Mathematics 1 (P1)

October/November 2018

1 hour 45 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** the questions in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 75.

This document consists of **20** printed pages.



- 1** Showing all necessary working, solve the equation $4x - 11x^{\frac{1}{2}} + 6 = 0$. [3]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

- 2** A line has equation $y = x + 1$ and a curve has equation $y = x^2 + bx + 5$. Find the set of values of the constant b for which the line meets the curve. [4]

[illegible]

- 3 Two points A and B have coordinates $(3a, -a)$ and $(-a, 2a)$ respectively, where a is a positive constant.

(i) Find the equation of the line through the origin parallel to AB . [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) The length of the line AB is $3\frac{1}{3}$ units. Find the value of a . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

4 The first term of a series is 6 and the second term is 2.

(i) For the case where the series is an arithmetic progression, find the sum of the first 80 terms. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) For the case where the series is a geometric progression, find the sum to infinity. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

5 (i) Show that the equation

$$\frac{\cos \theta - 4}{\sin \theta} - \frac{4 \sin \theta}{5 \cos \theta - 2} = 0$$

may be expressed as $9 \cos^2 \theta - 22 \cos \theta + 4 = 0$. [3]

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(ii) Hence solve the equation

$$\frac{\cos \theta - 4}{\sin \theta} - \frac{4 \sin \theta}{5 \cos \theta - 2} = 0$$

for $0^\circ \leq \theta \leq 360^\circ$.

[3]

[illegible]

- 6 A curve has a stationary point at $(3, 9\frac{1}{2})$ and has an equation for which $\frac{dy}{dx} = ax^2 + a^2x$, where a is a non-zero constant.

(i) Find the value of a .

[2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Find the equation of the curve.

[4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(iii) Determine, showing all necessary working, the nature of the stationary point. [2]

.....

.....

.....

.....

.....

.....

.....

.....

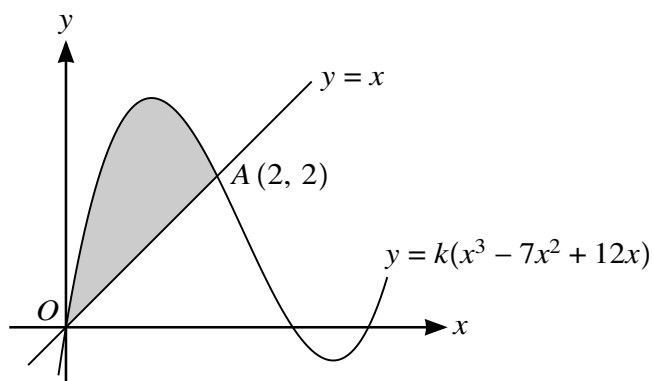
.....

.....

.....

.....

7



The diagram shows part of the curve with equation $y = k(x^3 - 7x^2 + 12x)$ for some constant k . The curve intersects the line $y = x$ at the origin O and at the point $A(2, 2)$.

(i) Find the value of k .

[1]

.....

.....

.....

.....

.....

.....

(ii) Verify that the curve meets the line $y = x$ again when $x = 5$.

[2]

.....

.....

.....

.....

.....

.....

.....

.....

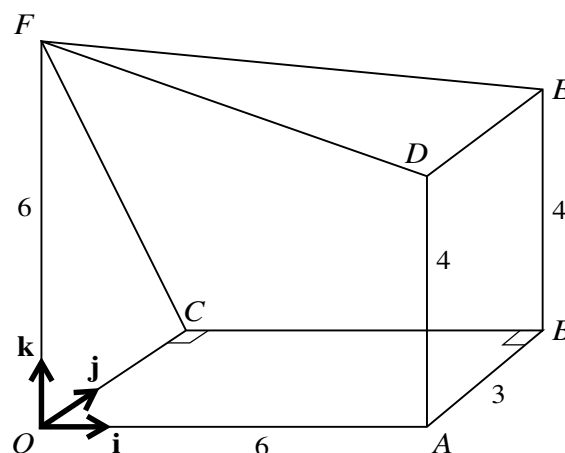
.....

.....

[5]

[illegible]

8



The diagram shows a solid figure $OABCDEF$ having a horizontal rectangular base $OABC$ with $OA = 6$ units and $AB = 3$ units. The vertical edges OF , AD and BE have lengths 6 units, 4 units and 4 units respectively. Unit vectors $\mathbf{i}$, $\mathbf{j}$ and $\mathbf{k}$ are parallel to OA , OC and OF respectively.

- (i) Find $\overrightarrow{DF}$. [1]

.....

.....

.....

.....

.....

- (ii) Find the unit vector in the direction of $\overrightarrow{EF}$. [3]

.....

.....

.....

.....

.....

.....

.....

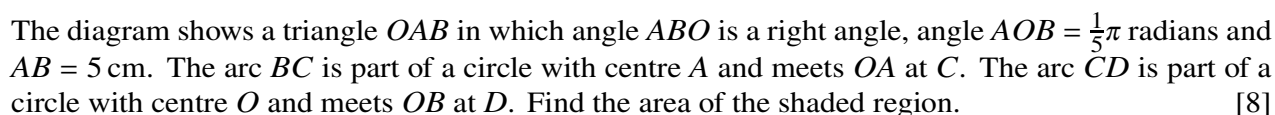
.....

.....

(iii) Use a scalar product to find angle EFD .

[4]

[illegible]

[illegible]

- 10** A curve has equation $y = \frac{1}{2}(4x - 3)^{-1}$. The point A on the curve has coordinates $(1, \frac{1}{2})$.

(i) (a) Find and simplify the equation of the normal through A .

[5]

This image shows a full page of white paper designed for handwriting practice. It features 20 evenly spaced, horizontal dotted lines that run across the entire width of the page. The lines are thin and light gray, providing a guide for letter height and placement without being distracting. There is no text or other markings on the page.

- (b) Find the x -coordinate of the point where this normal meets the curve again. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) A point is moving along the curve in such a way that as it passes through A its x -coordinate is decreasing at the rate of 0.3 units per second. Find the rate of change of its y -coordinate at A . [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- 11 (a)** The one-one function f is defined by $f(x) = (x - 3)^2 - 1$ for $x < a$, where a is a constant.

(i) State the greatest possible value of a .

[1]

.....

.....

.....

- (ii)** It is given that a takes this greatest possible value. State the range of f and find an expression for $f^{-1}(x)$. [3]

[illegible]

(b) The function g is defined by $g(x) = (x - 3)^2$ for $x \geq 0$.

- (i) Show that $gg(2x)$ can be expressed in the form $(2x - 3)^4 + b(2x - 3)^2 + c$, where b and c are constants to be found. [2]

.....

.....

.....

.....

.....

.....

- (ii) Hence expand $gg(2x)$ completely, simplifying your answer. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[illegible]

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

MATHEMATICS

9709/12

Paper 1 Pure Mathematics 1 (P1)

October/November 2018

1 hour 45 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** the questions in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 75.

This document consists of **20** printed pages.



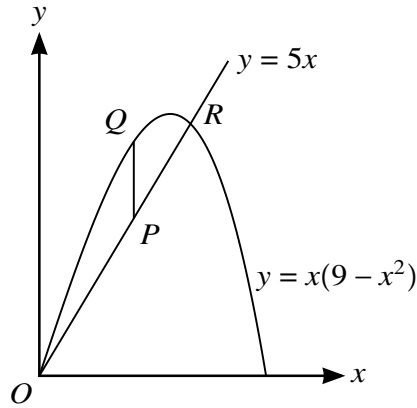
- 1** Find the coefficient of $\frac{1}{x^2}$ in the expansion of $\left(3x + \frac{2}{3x^2}\right)^7$. [4]

[illegible]

2 Showing all necessary working, find $\int_1^4 \left(\sqrt{x} + \frac{2}{\sqrt{x}} \right) dx$. [4]

[illegible]

3



The diagram shows part of the curve $y = x(9 - x^2)$ and the line $y = 5x$, intersecting at the origin O and the point R . Point P lies on the line $y = 5x$ between O and R and the x -coordinate of P is t . Point Q lies on the curve and PQ is parallel to the y -axis.

- (i) Express the length of PQ in terms of t , simplifying your answer. [2]

.....

.....

.....

.....

- (ii) Given that t can vary, find the maximum value of the length of PQ . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

4 Functions f and g are defined by

$$f : x \mapsto 2 - 3 \cos x \quad \text{for } 0 \leq x \leq 2\pi,$$

$$g : x \mapsto \frac{1}{2}x \quad \text{for } 0 \leq x \leq 2\pi.$$

(i) Solve the equation $fg(x) = 1$.

[3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Sketch the graph of $y = f(x)$.

[3]

- 5 The first three terms of an arithmetic progression are 4, x and y respectively. The first three terms of a geometric progression are x , y and 18 respectively. It is given that both x and y are positive.

(i) Find the value of x and the value of y .

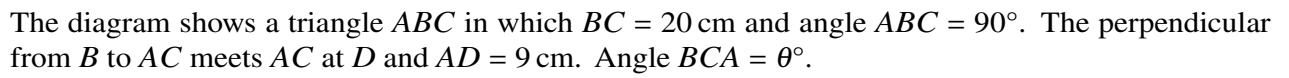
[4]

This image shows a full page of a document template. It consists of approximately 28 evenly spaced horizontal dotted lines across the entire width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings present.

(ii) Find the fourth term of each progression.

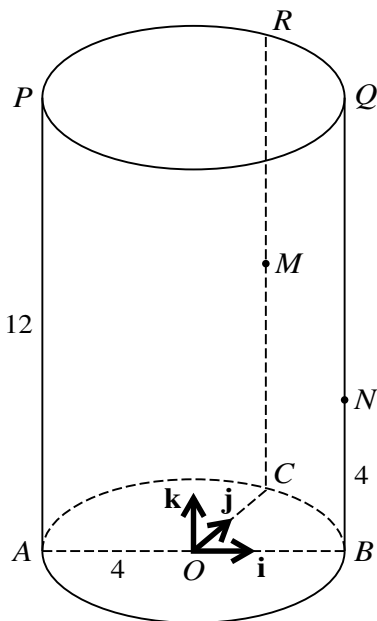
[3]

[illegible]



-
- This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[Turn over



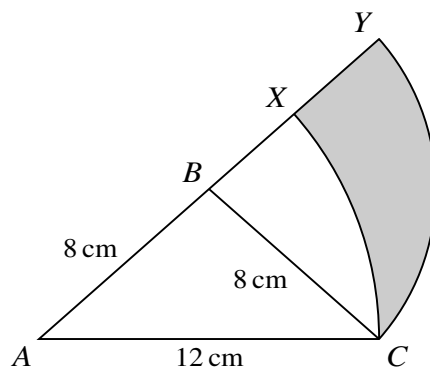
The diagram shows a solid cylinder standing on a horizontal circular base with centre O and radius 4 units. Points A , B and C lie on the circumference of the base such that AB is a diameter and angle $BOC = 90^\circ$. Points P , Q and R lie on the upper surface of the cylinder vertically above A , B and C respectively. The height of the cylinder is 12 units. The mid-point of CR is M and N lies on BQ with $BN = 4$ units.

Unit vectors $\mathbf{i}$ and $\mathbf{j}$ are parallel to OB and OC respectively and the unit vector $\mathbf{k}$ is vertically upwards.

Evaluate $\overrightarrow{PN} \cdot \overrightarrow{PM}$ and hence find angle MPN .

[7]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the entire width of the page. There are no margins, text, or other markings present.



The diagram shows an isosceles triangle ACB in which $AB = BC = 8$ cm and $AC = 12$ cm. The arc XC is part of a circle with centre A and radius 12 cm, and the arc YC is part of a circle with centre B and radius 8 cm. The points A, B, X and Y lie on a straight line.

- (i) Show that angle $CBY = 1.445$ radians, correct to 4 significant figures. [3]

[illegible]

(ii) Find the perimeter of the shaded region.

[4]

This image shows a full page of a worksheet designed for handwriting practice. It features approximately 20 evenly spaced horizontal dotted lines across the entire page, providing a guide for letter height and placement. The background is plain white, and there are no margins or additional markings.

9 The function f is defined by $f : x \mapsto 2x^2 - 12x + 7$ for $x \in \mathbb{R}$.

(i) Express $2x^2 - 12x + 7$ in the form $2(x + a)^2 + b$, where a and b are constants. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) State the range of f . [1]

.....

.....

.....

.....

.....

The function g is defined by $g : x \mapsto 2x^2 - 12x + 7$ for $x \leq k$.

- (iii) State the largest value of k for which g has an inverse. [1]

.....

.....

.....

.....

- (iv) Given that g has an inverse, find an expression for $g^{-1}(x)$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- 10** The equation of a curve is $y = 2x + \frac{12}{x}$ and the equation of a line is $y + x = k$, where k is a constant.

(i) Find the set of values of k for which the line does not meet the curve. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

In the case where $k = 15$, the curve intersects the line at points A and B .

(ii) Find the coordinates of A and B . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(iii) Find the equation of the perpendicular bisector of the line joining A and B . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

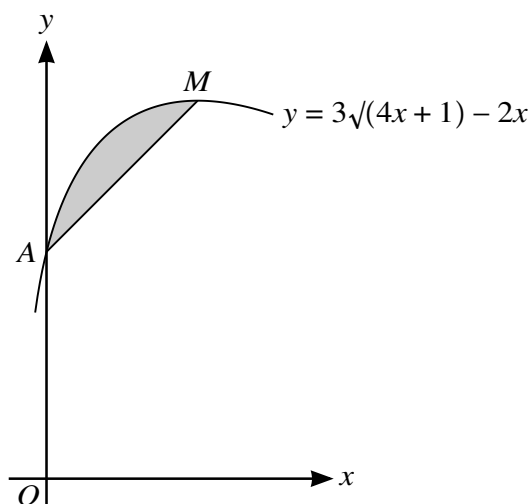
.....

.....

.....

.....

.....



The diagram shows part of the curve $y = 3\sqrt[3]{(4x + 1)} - 2x$. The curve crosses the y -axis at A and the stationary point on the curve is M .

- (i) Obtain expressions for $\frac{dy}{dx}$ and $\int y dx$. [5]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

(ii) Find the coordinates of M .

[3]

.....

.....

.....

.....

.....

.....

.....

.....

(iii) Find, showing all necessary working, the area of the shaded region.

[4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[illegible]

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

MATHEMATICS

9709/13

Paper 1 Pure Mathematics 1 (P1)

October/November 2018

1 hour 45 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** the questions in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 75.

This document consists of **20** printed pages.



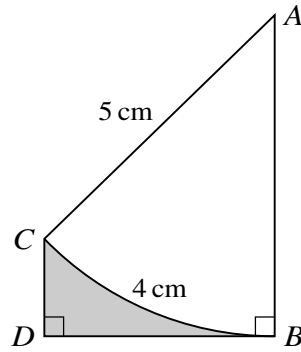
- 1** Find the coefficient of $\frac{1}{x^3}$ in the expansion of $\left(x - \frac{2}{x}\right)^7$. [3]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 2** The function f is defined by $f(x) = x^3 + 2x^2 - 4x + 7$ for $x \geq -2$. Determine, showing all necessary working, whether f is an increasing function, a decreasing function or neither. [4]

This image shows a full page of a document template. It consists of approximately 20 evenly spaced horizontal dotted lines across the entire width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings present.

3



The diagram shows an arc BC of a circle with centre A and radius 5 cm. The length of the arc BC is 4 cm. The point D is such that the line BD is perpendicular to BA and DC is parallel to BA .

(i) Find angle BAC in radians.

[1]

.....

.....

.....

.....

.....

(ii) Find the area of the shaded region BDC .

[5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- 4 Two points A and B have coordinates $(-1, 1)$ and $(3, 4)$ respectively. The line BC is perpendicular to AB and intersects the x -axis at C .

(i) Find the equation of BC and the x -coordinate of C .

[4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Find the distance AC , giving your answer correct to 3 decimal places.

[2]

.....

.....

.....

.....

.....

.....

.....

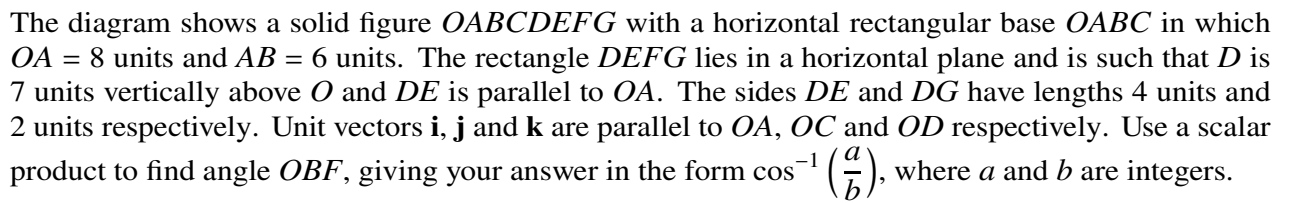
.....

.....

.....

- 5** In an arithmetic progression the first term is a and the common difference is 3. The n th term is 94 and the sum of the first n terms is 1420. Find n and a . [6]

[illegible]



[6]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

9709/13/O/N/18

for $0^\circ < \theta < 90^\circ$.

[4]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

- 8** A curve passes through (0, 11) and has an equation for which $\frac{dy}{dx} = ax^2 + bx - 4$, where a and b are constants.

(i) Find the equation of the curve in terms of a and b .

[3]

[illegible]

- (ii)** It is now given that the curve has a stationary point at $(2, 3)$. Find the values of a and b . [5]

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dotted lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, leaving ample room for writing practice. There is no text or other markings on the page.

- 9** A curve has equation $y = 2x^2 - 3x + 1$ and a line has equation $y = kx + k^2$, where k is a constant.

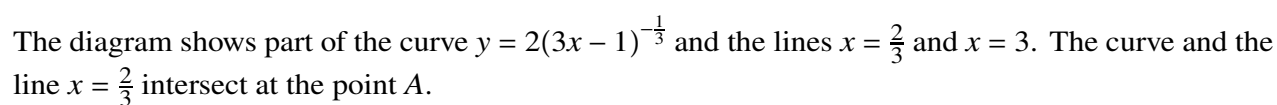
(i) Show that, for all values of k , the curve and the line meet.

[4]

[illegible]

- (ii)** State the value of k for which the line is a tangent to the curve and find the coordinates of the point where the line touches the curve. [4]

[illegible]



-
- This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dashed lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, leaving ample room for writing practice. There is no text or other markings on the page.

- (ii) Find the equation of the normal to the curve at A , giving your answer in the form $y = mx + c$. [5]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

- 11 (i)** Express $2x^2 - 12x + 11$ in the form $a(x + b)^2 + c$, where a , b and c are constants. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

The function f is defined by $f(x) = 2x^2 - 12x + 11$ for $x \leq k$.

- (ii)** State the largest value of the constant k for which f is a one-one function. [1]

.....

.....

.....

- (iii)** For this value of k find an expression for $f^{-1}(x)$ and state the domain of f^{-1} . [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

The function g is defined by $g(x) = x + 3$ for $x \leq p$.

- (iv) With k now taking the value 1, find the largest value of the constant p which allows the composite function fg to be formed, and find an expression for $fg(x)$ whenever this composite function exists. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[illegible]

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.