

Surname	
Other Names	
Candidate Signature	

Centre Number						Candidate Number				
---------------	--	--	--	--	--	------------------	--	--	--	--

Examiner Comments		Total Marks

MATHEMATICS

AS PAPER 1

CM

December Mock Exam (Edexcel Version)

Time allowed: 2 hours

Instructions to candidates:

- In the boxes above, write your centre number, candidate number, your surname, other names and signature.
- Answer ALL of the questions.
- You must write your answer for each question in the spaces provided.
- You may use a calculator.

Information to candidates:

- Full marks may only be obtained for answers to ALL of the questions.
- The marks for individual questions and parts of the questions are shown in round brackets.
- There are 14 questions in this question paper. The total mark for this paper is 100.

Advice to candidates:

- You should ensure your answers to parts of the question are clearly labelled.
- You should show sufficient working to make your workings clear to the Examiner.
- Answers without working may not gain full credit.

AS/P1/D17

© 2017 crashMATHS Ltd.



1 The equation $kx^2 + (3 - k)x - 4 = 0$ has two equal roots.

Find the possible values of the constant k .

(3)

TOTAL 3 MARKS



1 2 3 3 2 2 1 2 8 D 1 7 4

2 Solve the equation

$$a^{\frac{1}{2}} + \sqrt{4a} = 3$$

(3)

TOTAL 3 MARKS



1 2 3 3 2 2 1 2 8 D 1 7 4



3 Figure 1 shows a sketch of the curve with equation $y = f(x)$.

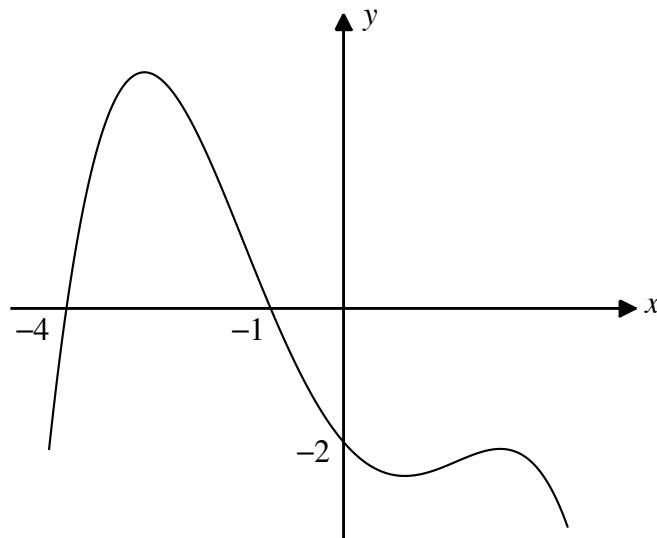


Figure 1

On separate axes, sketch the curves with equation

(i) $y = \frac{1}{2}f(x)$ **(3)**

(ii) $y = f(-x)$ **(3)**

On each sketch, you should show clearly the coordinates of any points where the curve crosses or meets the coordinate axes.



Question 3 continued

TOTAL 6 MARKS



1 2 3 3 2 2 1 2 8 D 1 7 4



4 Three vectors $\mathbf{p}$, $\mathbf{q}$ and $\mathbf{r}$ are defined such that

$$\mathbf{p} = 12\mathbf{i} - a\mathbf{j}$$

$$\mathbf{q} = 6\mathbf{i} + (9 - 5a)\mathbf{j}$$

$$\mathbf{r} = \mathbf{q} - \mathbf{p}$$

where $\mathbf{i}$ and $\mathbf{j}$ are perpendicular unit vectors.

Given that $\mathbf{p}$ and $\mathbf{q}$ are parallel vectors,

(a) find the value of the constant a .

(3)

(b) Find $|\mathbf{r}|$.

(3)



Question 4 continued**TOTAL 6 MARKS**

1 2 3 3 2 2 1 2 8 D 1 7 4



- 5 The curve C has the equation $y = f(x)$, where $f(x) = px - 18\sqrt{x}$, $x \geq 0$, and p is a constant.

Figure 2 shows a sketch of the curve C .

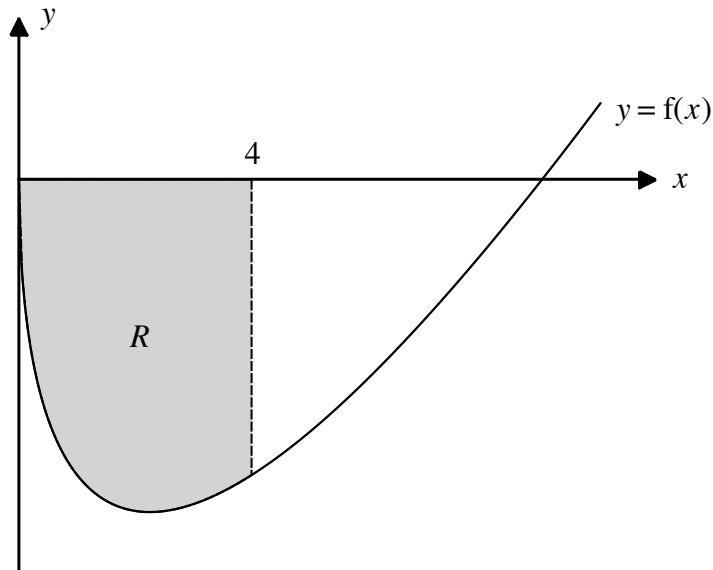


Figure 2

The region R , shown shaded in **Figure 2**, is bounded by the curve, the x axis and the line $x = 4$.

Given that the **area** of the region R is 48 units²,

- find the value of p . (5)
- Use calculus to find the coordinates of the minimum point on the curve C . (4)
- Using further differentiation, verify that the point found in (b) is a minimum. (3)



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.



[illegible]

Question 5 continued**TOTAL 12 MARKS**

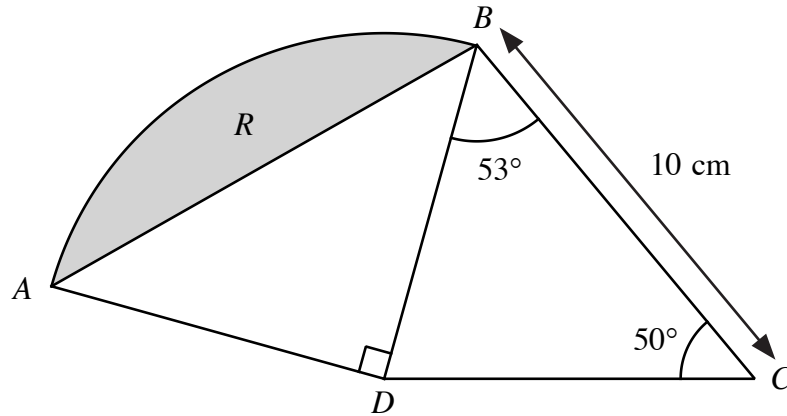
--	--



1 2 3 3 2 2 1 2 8 D 1 7 4



6

**Figure 3**

The shape $ABCD$, as shown in **Figure 3**, consists of a triangle BCD joined to a sector ABD of a circle with centre D .

Angle $DBC = 53^\circ$, angle $BCD = 50^\circ$ and $BC = 10$ cm.

- (a) Find the length of AD . (2)
- (b) Find the area of the shaded region R . (3)
- (c) Calculate the perimeter of the shape $ABCD$. Give your answer to one decimal place. (4)



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.



[illegible]

Question 6 continued**TOTAL 9 MARKS**

1 2 3 3 2 2 1 2 8 D 1 7 4



- 7 (a) In descending powers of x , find the first four terms in the binomial expansion of

$$\left(2 - \frac{1}{\sqrt{x}}\right)^8$$

giving each term in its simplest form.

(5)

- (b) Bernoulli's inequality states that

$$(1+x)^r \geq 1+rx$$

for all integers $r \geq 0$ and every real number $x \geq -1$.

- (i) By using the binomial theorem on $(1+x)^r$, prove Bernoulli's inequality for $x > 0$. (2)

- (ii) Verify Bernoulli's inequality for the case $x = 0$. (1)

- (iii) Use a counter-example to show that Bernoulli's inequality is not valid for $x < -1$. (2)



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.



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.



TOTAL 10 MARKS

- 8 (i) The function f is defined such that

$$f(x) = ax^b$$

where a and b are constants.

Given that the curve with equation $y = f(x)$ passes through the points $(4, 5)$ and $(8, 12)$, find the values of a and b . (4)

- (ii) The table below shows the atomic number n and the melting point (y degrees Celsius) for some alkali metals.

Metal	Lithium	Sodium	Potassium	Rubidium	Caesium
n	3	11	19	37	55
y	180.5	97.8	63.7	38.9	28.5

A graph of $\ln(y)$ against $\ln(n)$ is produced using these data. A line of best fit is then drawn for these data and it passes through the points $(5, 2.79)$ and $(45, -22.77)$.

- (a) Express y in terms of n . (4)

Francium is also an alkali metal. The atomic number of Francium is 87.

- (b) Using your answer to (a), estimate the melting point of Francium. (2)

- (c) Comment on the reliability of your estimate in (b). (1)



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.



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.



Question 8 continued**TOTAL 11 MARKS**

--	--



1 2 3 3 2 2 1 2 8 D 1 7 4



9 The curve C has the equation $y = f(x)$, where

$$f(x) = -2x^3 + 9x^2 - x - 12$$

(a) Show that the curve C crosses the x axis when $x = 4$. (1)

(b) Express $f(x)$ as a product of three linear factors. (4)

(c) Sketch the curve with equation $y = f(x)$.

On your sketch, show clearly the coordinates of any points where the curve C crosses or meets the coordinate axes. (3)

(d) Find all the solutions to the equation

$$-2(x-4)^3 + 9(4-x)^2 - (x-4) - 12 = 0$$

(2)



[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.



Question 9 continued**TOTAL 10 MARKS**

--	--



1 2 3 3 2 2 1 2 8 D 1 7 4



10 The curve C has the equation $y = g(x)$ and is defined such that

$$\frac{dy}{dx} = \frac{16x^3 - 9x}{x(3 - 4x)}, \quad x > 1$$

Given that the curve passes through the point $(2, -12)$, find the values of a , b and c such that

$$g(x) = a(x - b)^2 + c$$

(7)



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.



This image shows a full page of blank, lined paper. It features approximately 28 horizontal blue or grey lines spaced evenly apart, typical of notebook paper. The lines extend across the entire width of the page, leaving small margins at the top and bottom. There are no vertical lines, text, or other markings on the page.



Question 10 continued**TOTAL 7 MARKS**

1 2 3 3 2 2 1 2 8 D 1 7 4



11 The straight line l is perpendicular to the line $qx = -2y + 4$, where q is a constant.

(a) Find, in terms of q , the gradient of the line l .

(2)

The curve C has the equation $y = \frac{1}{x^2} + \frac{3\sqrt{x}}{p}$, where p is a constant and x is positive. The tangent to the curve C at $x = 1$ is parallel to l .

(b) Express p in terms of q .

(5)



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.



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.



Question 11 continued**TOTAL 7 MARKS**

1 2 3 3 2 2 1 2 8 D 1 7 4



12 (a) Solve the equation $\cos \theta = -0.3$ for $-180^\circ \leq \theta \leq 360^\circ$. **(3)**

(b) (i) Prove that $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$. **(1)**

(ii) Hence, show that

$$\frac{1 + \sin x \cos x}{\cos^3 x - \sin^3 x} + \frac{1}{\cos x + \sin x} \equiv \frac{2 \cos x}{\cos^2 x - \sin^2 x}$$
(3)

(iii) Deduce that

$$\frac{1 + \sin x \cos x}{\cos^3 x - \sin^3 x} + \frac{1}{\cos x + \sin x} + \frac{\sin^2 x - 2 \cos x - 1}{\cos^2 x - \sin^2 x} \equiv \frac{1}{\tan^2 x - 1}$$
(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.



Question 12 continued**TOTAL 10 MARKS**

--	--



1 2 3 3 2 2 1 2 8 D 1 7 4



13 (a) Prove, from first principles, that

$$\frac{d}{dx}(x^3) = 3x^2$$

(3)

(b) By considering derivatives, or otherwise, evaluate

$$\lim_{h \rightarrow 0} \frac{(x+h)^3 - x^3}{\sqrt{x+h} - \sqrt{x}}$$

(3)



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.



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.



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.

TOTAL 6 MARKS

1881

TOTAL FOR PAPER IS 100 MARKS

1 2 3 3 2 2 1 2 8 D 1 7 4

