

NOTICE TO CUSTOMER:

The sale of this product is intended for use of the original purchaser only and for use only on a single computer system. Duplicating, selling, or otherwise distributing this product is a violation of the law ; **your license of the product will be terminated at any moment if you are selling or distributing the products.**

No parts of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher.

1.

Given that $x = 3$ is a solution of the equation $f(x) = 0$, solve $f(x) = 0$ completely.

(5)



Question 1 continued

Lined area for writing the answer to Question 1.

(Total 5 marks)

Q1

Small box for marking the question.

Turn over



$$\sum_{r=1}^n (6r^2 + 4r - 1) = n(n+2)(2n+1)$$

(5)

(2)



Question 2 continued

Lined area for writing the answer to Question 2.

(Total 7 marks)

Q2

Small rectangular box for marking.

Turn over



- (a) Write the cartesian equation of H in the form $xy = c^2$.

Points A and B on the hyperbola have parameters $t = 1$ and $t = 5$ respectively.

- (b) Find the coordinates of the mid-point of AB .

(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.



Question 3 continued

Lined area for writing the answer to Question 3.

(Total 4 marks)

Q3

Small rectangular box for marking the answer to Question 3.

Turn over



$$\sum_{r=1}^n \frac{1}{r(r+1)} = \frac{n}{n+1}$$



Question 4 continued

Lined area for writing the answer to Question 4.

(Total 5 marks)

Q4

Small box for marking the question.

Turn over



$$f(x) = 3\sqrt{x} + \frac{18}{\sqrt{x}} - 20$$

-
- 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 5 continued

Lined area for writing the answer to Question 5.

(Total 9 marks)

Q5

Small rectangular box for marking.

Turn over



$$u_1 = 6 \text{ and } u_{n+1} = 6u_n - 5, \text{ for } n \geq 1.$$

(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.



Question 6 continued

Lined area for writing the answer to Question 6.

(Total 5 marks)

Q6

Small rectangular box for marking the answer to Question 6.

Turn over



(a) find $\mathbf{X}^{-1}$ in terms of a .

Given that $\mathbf{X} + \mathbf{X}^{-1} = \mathbf{I}$, where $\mathbf{I}$ is the 2×2 identity matrix,

(3)



Question 7 continued

Lined area for writing the answer to Question 7.

(Total 6 marks)

Q7

Small rectangular box for marking.

Turn over



- (a) Show that an equation of the tangent to the parabola at Q is

This tangent meets the y -axis at the point R .

- (3)

- (1)

- (2)

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire width, providing a guide for handwriting or typing. The paper itself is a clean, off-white color. There are no margins, text, or other markings present on the page.

— 100 —

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.

Q8

11/11/2016

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

11/11/2016



Question 9 continued

Lined area for writing the answer to Question 9.

(Total 10 marks)

Q9

Turn over

10.

- (4)

(b) Find **D**.

- (2)

(1)

- (4)

- (3)

This image shows a blank 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.

© 2006 The Authors
Journal compilation © 2006 Blackwell Publishing Ltd

11/11/2016

Q10

--	--

--	--

- $$z_1 = 2 - i \quad \text{and} \quad z_2 = -8 + 9i$$

- (1)

(2)

- (2)

- (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.

Question 1 continued

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 8 marks)

Q1

$$\sum_{r=1}^n r(r+1)(r+3) = \frac{1}{12}n(n+1)(n+2)(3n+k),$$

(7)

(b) Hence evaluate $\sum_{r=21}^{40} r(r+1)(r+3)$.

(2)

Question 2 continued

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 2 continued

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 9 marks)

Q2

$$f(x) = (x^2 + 4)(x^2 + 8x + 25)$$

(5)

(2)

Question 3 continued

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire width, providing a guide for writing. The paper itself is a clean, off-white color. There are no margins, text, or other markings present on the page.

(Total 7 marks)

Q3

Question 4 continued

[illegible]

Question 4 continued

[illegible]

(Total 10 marks)

Q4

5.

$$\mathbf{R} = \begin{pmatrix} a & 2 \\ a & b \end{pmatrix}, \text{ where } a \text{ and } b \text{ are constants and } a > 0.$$

(a) Find $\mathbf{R}^2$ in terms of a and b .

(3)

Given that $\mathbf{R}^2$ represents an enlargement with centre $(0, 0)$ and scale factor 15,

(b) find the value of a and the value of b .

(5)

Question 5 continued

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 8 marks)

Q5

- 6.** The parabola C has equation $y^2 = 16x$.

- (a) Verify that the point $P(4t^2, 8t)$ is a general point on C . (1)

- (b) Write down the coordinates of the focus S of C . (1)

- (c) Show that the normal to C at P has equation

$$y+tx=8t+4t^3 \tag{5}$$

The normal to C at P meets the x -axis at the point N .

- (d) Find the area of triangle PSN in terms of t , giving your answer in its simplest form. (4)

Question 6 continued

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 6 continued

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 11 marks)

Q6

(2)

$$\mathbf{B} = \begin{pmatrix} 3 & -2 \\ -1 & 4 \end{pmatrix}$$

(3)

(3)

Question 7 continued

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 8 marks)

Q7

8. Prove by induction that, for $n \in \mathbb{Z}^+$,

(a) $f(n) = 5^n + 8n + 3$ is divisible by 4,

(7)

$$(b) \quad \begin{pmatrix} 3 & -2 \\ 2 & -1 \end{pmatrix}^n = \begin{pmatrix} 2n+1 & -2n \\ 2n & 1-2n \end{pmatrix}$$

(7)

Question 8 continued

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 14 marks)

TOTAL FOR PAPER: 75 MARKS

END

mock papers 3

1. The complex numbers z_1 and z_2 are given by

$$z_1 = 2 + 8i \quad \text{and} \quad z_2 = 1 - i$$

Find, showing your working,

- (a) $\frac{z_1}{z_2}$ in the form $a + bi$, where a and b are real,

(3)

- (b) the value of $\left| \frac{z_1}{z_2} \right|$,

(2)

- (c) the value of $\arg \frac{z_1}{z_2}$, giving your answer in radians to 2 decimal places.

(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.

Q1

© 2006 The Authors

$$f(x) = 3x^2 - \frac{11}{x^2}$$

- The equation $f(x) = 0$ has a root α between 1.3 and 1.4

- (c) Taking 1.4 as a first approximation to α , apply the Newton-Raphson procedure once to $f(x)$ to obtain a second approximation to α , giving your answer to 3 decimal places. (5)

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire width, providing a template for handwriting practice or general note-taking. The margins are consistent on all sides.



Question 2 continued

Lined area for writing the answer to Question 2.

(Total 9 marks)

Q2

Small rectangular box for marking.

Turn over



$$\begin{aligned} u_1 &= 2, \\ u_{n+1} &= 5u_n - 4, \quad n \geq 1. \end{aligned}$$

(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.



Question 3 continued

Lined area for writing the answer to Question 3.

(Total 4 marks)

Q3

Small box for marking the answer to Question 3.

Turn over



4.

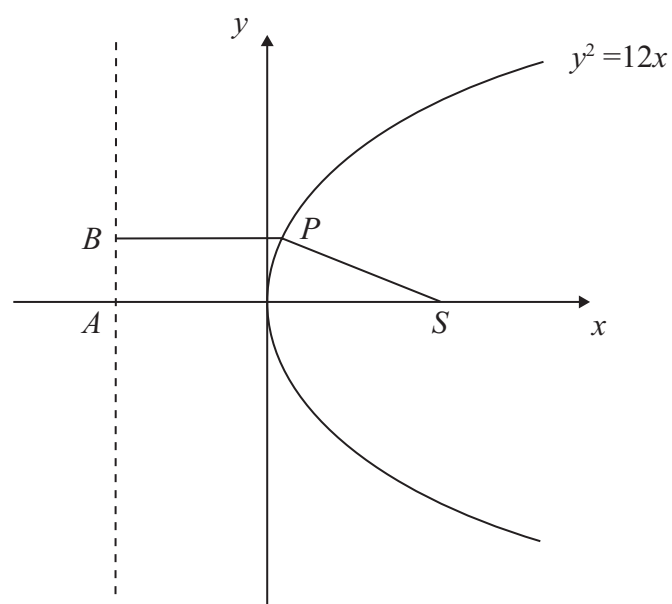
**Figure 1**

Figure 1 shows a sketch of part of the parabola with equation $y^2 = 12x$.

The point P on the parabola has x -coordinate $\frac{1}{3}$.

The point S is the focus of the parabola.

(a) Write down the coordinates of S .

(1)

The points A and B lie on the directrix of the parabola.

The point A is on the x -axis and the y -coordinate of B is positive.

Given that $ABPS$ is a trapezium,

(b) calculate the perimeter of $ABPS$.

(5)



Question 4 continued

Lined area for writing the answer to Question 4.

(Total 6 marks)

Q4

Small rectangular box for marking.

Turn over



$$\mathbf{A} = \begin{pmatrix} a & -5 \\ 2 & a+4 \end{pmatrix}, \text{ where } a \text{ is real.}$$

- (2)

- (3)

(3)



Question 5 continued

Lined area for writing the answer to Question 5.

(Total 8 marks)

Q5

Small rectangular box for marking.

Turn over



$$x^3 - 12x^2 + cx + d = 0, \quad c, d \in \mathbb{R},$$



Question 6 continued

Lined area for writing the answer to Question 6.

(Total 8 marks)

Q6

Small rectangular box for marking the answer to Question 6.

Turn over



The point $P\left(ct, \frac{c}{t}\right)$ is a general point on H .

$$t^2 y + x = 2ct$$

The tangents to H at the points A and B meet at the point $(15c, -c)$.

(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.

© 2006 The Authors

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire surface, typical of notebook or school paper. There are no margins, text, or other markings present.



Question 7 continued

Lined area for writing the answer to Question 7.

(Total 9 marks)

Q7

Small box for marking the question.

Turn over



$$\sum_{r=1}^n r^3 = \frac{1}{4} n^2 (n+1)^2 \quad (5)$$
$$\sum_{r=1}^n (r^3 + 3r + 2) = \frac{1}{4} n(n+2)(n^2 + 7) \quad (5)$$

(c) Hence evaluate $\sum_{r=15}^{25} (r^3 + 3r + 2)$

— 100 —



Question 8 continued

Lined area for writing the answer to Question 8.

(Total 12 marks)

Q8

--	--

Turn over



$$\mathbf{M} = \begin{pmatrix} \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{pmatrix}$$

- (e) Find the coordinates of C . (2)

Q9

END

1.

$$z = 2 - 3i$$

- (a) Show that $z^2 = -5 - 12i$.

(2)

Find, showing your working,

- (b) the value of $|z^2|$,

(2)

- (c) the value of $\arg(z^2)$, giving your answer in radians to 2 decimal places.

(2)

- (d) Show z and z^2 on a single Argand diagram.

(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.



Question 1 continued

Lined area for writing the answer to Question 1.

(Total 7 marks)

Q1

Small box for marking the question.

Turn over



$$\mathbf{M} = \begin{pmatrix} 2a & 3 \\ 6 & a \end{pmatrix}, \text{ where } a \text{ is a real constant.}$$

(3)

(2)



Question 2 continued

Lined area for writing the answer to Question 2.

(Total 5 marks)

Q2

Small box for marking the question.

Turn over



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 3 continued

Lined area for writing the answer to Question 3.

(Total 10 marks)

Q3	
-----------	--

Turn over



$$f(x) = x^3 + x^2 + 44x + 150$$

(a) find the value of a and the value of b .

(2)

(4)

(1)



Question 4 continued

Lined area for writing the answer to Question 4.

(Total 7 marks)

Q4

Small box for marking the question.

Turn over



(1)

(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.



Question 5 continued

Lined area for writing the answer to Question 5.

(Total 5 marks)

Q5

Small box for marking the question.

Turn over



(a) an enlargement with centre $(0, 0)$ and scale factor 8,

(1)

Hence, or otherwise,

$$\mathbf{A} = \begin{pmatrix} 6 & 1 \\ 4 & 2 \end{pmatrix} \text{ and } \mathbf{B} = \begin{pmatrix} k & 1 \\ c & -6 \end{pmatrix}, \text{ where } k \text{ and } c \text{ are constants.}$$

Given that $\mathbf{AB}$ represents the same transformation as $\mathbf{T}$,

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 6 continued

Lined area for writing the answer to Question 6.

(Total 9 marks)

Q6

Small box for marking the question.

Turn over



$$f(n) = 2^n + 6^n$$

(3)

(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.



Question 7 continued

Lined area for writing the answer to Question 7.

(Total 7 marks)

Q7

Small box for marking the question.

Turn over



The point A on H has x -coordinate $3c$.

(1)

(5)

(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.



Question 8 continued

Lined area for writing the answer to Question 8.

(Total 11 marks)

Q8	
-----------	--

Turn over



$$\sum_{r=1}^n r^2 = \frac{1}{6}n(n+1)(2n+1) \quad (6)$$

(b) show that

where a and b are integers to be found. (5)

$$\sum_{r=n+1}^{2n} (r+2)(r+3) = \frac{1}{3}n(7n^2 + 27n + 26) \quad (3)$$
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 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.

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.

Q9

END

$$z = 5 - 3i, \quad w = 2 + 2i$$

(a) z^2 ,

(2)

$$(b) \quad \frac{z}{w}.$$

(3)

Q1

(Total 5 marks)

2.

$$\mathbf{A} = \begin{pmatrix} 2 & 0 \\ 5 & 3 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} -3 & -1 \\ 5 & 2 \end{pmatrix}$$

(a) Find $\mathbf{AB}$.

(3)

Given that

$$\mathbf{C} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$$

(b) describe fully the geometrical transformation represented by $\mathbf{C}$,

(2)

(c) write down $\mathbf{C}^{100}$.

(1)

(Total 6 marks)

Q2

Question 3 continued

Question 3 continued

(Total 10 marks)

Q3

Question 4 continued

(Total 4 marks)

Q4

for all positive integers n .

(5)

$$\sum_{r=20}^{50} r(r+1)(r+5)$$

(2)

Question 5 continued

Question 5 continued

Q5

(Total 7 marks)

6.

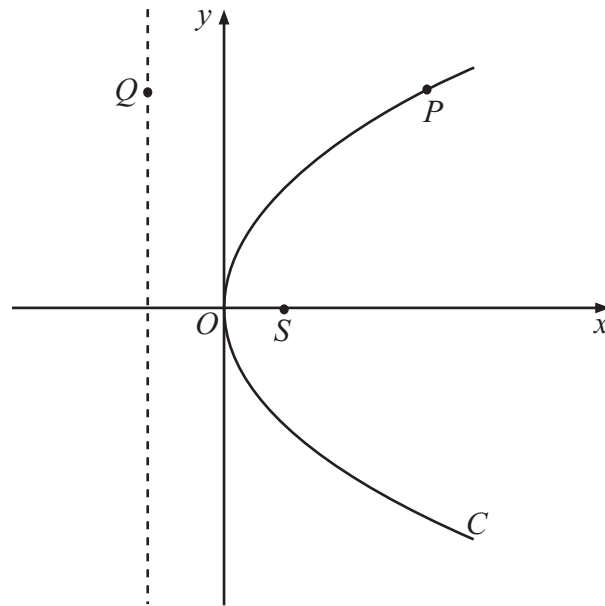


Figure 1

Figure 1 shows a sketch of the parabola C with equation $y^2 = 36x$.
The point S is the focus of C .

(a) Find the coordinates of S . (1)

(b) Write down the equation of the directrix of C . (1)

Figure 1 shows the point P which lies on C , where $y > 0$, and the point Q which lies on the directrix of C . The line segment QP is parallel to the x -axis.

Given that the distance PS is 25,

(c) write down the distance QP , (1)

(d) find the coordinates of P , (3)

(e) find the area of the trapezium $OSPQ$. (2)

Question 6 continued

Question 6 continued

(Total 8 marks)

Q6

7. $z = -24 - 7i$

(a) Show z on an Argand diagram. (1)

(b) Calculate $\arg z$, giving your answer in radians to 2 decimal places. (2)

It is given that

$$w = a + bi, \quad a \in \mathbb{R}, b \in \mathbb{R}$$

Given also that $|w| = 4$ and $\arg w = \frac{5\pi}{6}$,

(c) find the values of a and b , (3)

(d) find the value of $|zw|$. (3)

Question 7 continued

Question 7 continued

Q7

(Total 9 marks)

Question 8 continued

Question 8 continued

(Total 9 marks)

Q8

Question 9 continued

(Total 5 marks)

Q9

$$y = -\frac{1}{t^2}x + \frac{12}{t} \quad (5)$$

(b) Find the coordinates of A and B . (7)

Question 10 continued

Question 10 continued

