

SECTION I

Answer ALL the questions in this section.

ALL working must be clearly shown.

June 2001 – Question 1

- (a) Express in fractional form, in its lowest terms,

$$\text{the exact value of } \frac{3\frac{1}{7} - \frac{2}{3}}{2\frac{6}{7}} \quad (3)$$

- (b) Write 0.08909

- (i) in standard form
 (ii) correct to two significant figures. (3)

- (c) A Building Society offers a rate of 11% per annum simple interest. Beth-Ann deposited \$24 000 in the Society for 15 months.

- (i) Calculate the amount of money due to her at the end of this period.

The Building Society charges her a processing fee of \$1 500.

- (ii) Calculate this fee as a percentage of the money originally deposited. (5)

Total 11 marks

June 2001 – Question 2

- (a) Factorize completely:

(i) $4y^2 + y$
 (ii) $6x^2 - 13x - 5$ (3)

- (b) Solve the inequality
- $\frac{-2}{3}x \geq 4$
- . (3)

- (c) A restaurant bill of \$350 was paid using \$5 notes and \$50 notes. The total number of notes used was 16.

Let x represent the number of \$5 notes.
Let y represent the number of \$50 notes.

- (i) Write TWO equations in x and y to represent the information given.
 (ii) Hence, calculate the number of \$5 notes and the number of \$50 notes. (6)

Total 12 marks

June 2001 – Question 3

- (a) Solve the equation
- $6x - 8(x + 3) = 10$
- . (3)

- (b)
- $A = \begin{pmatrix} 2 & 1 \\ -3 & 4 \end{pmatrix}$
- ,
- $B = \begin{pmatrix} x \\ 4 \end{pmatrix}$
- and
- $C = \begin{pmatrix} 12 \\ x \end{pmatrix}$
-
- given that
- $AB = C$
- , calculate the value of
- x
- . (3)

- (c) The Universal set
- $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$
-
- $A = \{0, 1, 2, 7, 9\}$
-
- $B = \{3, 4, 5\}$
-
- $C = \{2\}$

- (i) Draw a Venn Diagram to represent the above information.

- (ii) List, using set notation, the members of the set
- $A' \cap B'$
- . (6)

Total 12 marks

June 2001 – Question 4

- (a) Using ruler and compasses only:

- (i) Construct triangle
- DEF
- with
- $EF = DF = 7.5$
- cm and
- $DE = 5$
- cm.

- (ii) Construct the circle which lies within triangle
- DEF
- and touches each side of the triangle

- (iii) Measure and write the radius of the circle.

[Show all construction line clearly.] (6)

- (b)
- P
- is the point
- $(4, 2)$
- ,
- Q
- is the point
- $(12, 5)$
- and
- R
- is the point
- $(1, 3)$
- . Calculate

- (i) the length of
- PR

- (ii) the gradient of
- PQ

- (iii) the equation of the line passing through
- R
- parallel to
- PQ
- . (6)

Total 12 marks

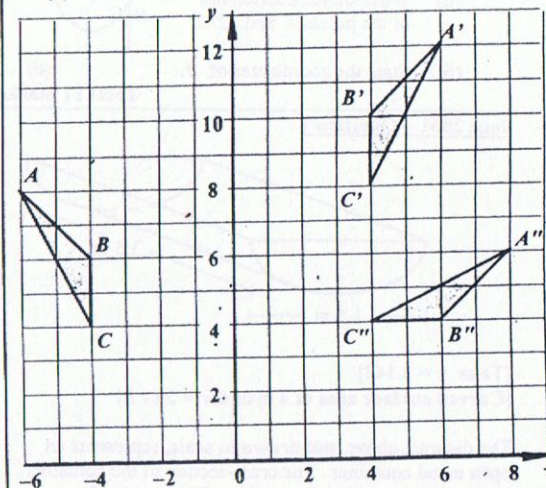
June 2001 – Question 5

- (a) A vertical pole stands on horizontal ground. From the top of the pole,
- h
- metres high, the angle of depression of a spot 10 m from the foot of the pole is
- 25°
- .

- (i) Sketch a diagram to represent this information, showing the pole, the ground and the measurements given.

- (ii) Calculate the value of
- h
- . (6)

(b)



In the diagram above, triangle ABC is mapped onto $A'B'C'$ and $A''B''C''$ under two different transformations. Describe FULLY the transformation which maps triangle ABC onto

- (i) triangle $A'B'C'$
 (ii) triangle $A''B''C''$. (5)

Total 11 marks

June 2001 – Question 6

- (a) Given that $g(x) = x + 3$ and $h(x) = x^2$,
calculate (i) $g(-5)$
(ii) $g^{-1}(7)$
(iii) $hg(0)$. (5)

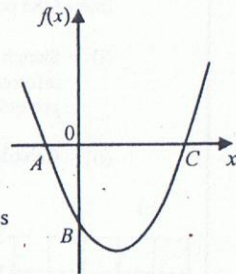
- (b) The diagram above shows the graph of the function

$$f(x) = x^2 - 3x - 10.$$

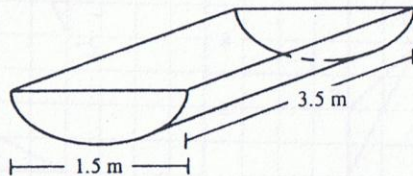
- (i) Determine the values of x for which $f(x) = 0$.

- (ii) What are the coordinates of the points A and C ?

- (iii) State the coordinates of B . (6)



Total 11 marks

June 2001 – Question 7

[Take $\pi = 3.142$]

[Curved surface area of a cylinder = $2\pi r h$]

The diagram above, not drawn to scale, represents an open metal container. The cross-section of the container is a semi-circle of diameter 1.5 m. The length of the container is 3.5 m.

- (a) Write down the radius of the cross-section of the container. (1)
- (b) Calculate, in m^2 , to two decimal places
(i) the area of the cross-section of the container
(ii) the outer curved surface area of the container
(iii) the total outer area of the container. (6)

- (c) Calculate the capacity, in m^3 , of the container. (1)
- (d) Water is poured into the container at a rate of 30 litres per minute. Calculate the length of time, in minutes, it would take to just fill the container.

$$[1 \text{ m}^3 = 1000 \text{ l}] \quad (3)$$

Total 11 marks

June 2001 – Question 8

- (a) The table below shows the income a company received from sales between 1995 and 2000.

Income (\$'000)	50	60	65	40	30	60
Year	1995	1996	1997	1998	1999	2000

- (i) Using a scale of 1 cm to represent \$10 000 on the vertical axis and 2 cm to represent 1 year on the horizontal axis, draw a line graph to represent this information.
- (ii) State the period during which the income showed the greatest rate of decrease.
- (iii) State the period during which the income showed the greatest rate of increase.
- (iv) Would you expect the sales in the year 2001 to increase or decrease? Using your graph state a reason for your answer. (9)
- (b) Determine the probability that in a year chosen at random, the income from sales would be greater than \$60 000. (1)

Total 10 marks

SECTION II

Answer TWO questions in this section.

RELATIONS AND FUNCTIONS**June 2001 – Question 9**

- (a) Calculate the values of y for which

$$5y^2 + 13y - 6 > 0 \quad (5)$$

- (b) (i) Write the expression $4x^2 - 9x + 1$ in the form $a(x+h)^2 + k$, where a , h and k are real numbers.
- (ii) State whether the function $f(x) = 4x^2 - 9x + 1$ has a maximum or minimum value.
- (iii) Write down the value of x at which the maximum or minimum occurs.
- (iv) Solve the equation $4x^2 = 9x - 1$ giving your answers to 2 decimal points. (10)

Total 15 marks

June 2001 – Question 10

- (a) A farmer grows x acres of peas and y acres of tomatoes. He has 12 acres available to plant peas and tomatoes.

- (i) Write an inequality in x and y to satisfy this condition.

The farmer must plant at least 2 acres of peas and at least 3 acres of tomatoes.

- (ii) Write TWO inequalities to satisfy these conditions.

The number of acres of tomatoes planted must NOT be more than twice the number of acres of peas planted.

- (iii) Write an inequality in x and y to satisfy this condition.

- (iv) Using a scale of 1 cm to represent one acre on each axis, draw graphs of the inequalities you have written at (i), (ii) and (iii) above.

- (v) By shading the UNWANTED region, label as S the region which satisfies all four inequalities. (11)
- (b) The farmer makes a profit of \$75 on each acre of peas and \$50 on each acre of tomatoes.
- (i) Write an expression in x and y for the total profit, P , which may be earned on the peas and tomatoes. (4)
- (ii) Use the graph to determine the number of acres of peas and tomatoes the farmer should plant in order to make the maximum profit. (4)
- (iii) State the maximum profit. (4)

Total 15 marks

GEOMETRY AND TRIGONOMETRY

June 2001 – Question 11

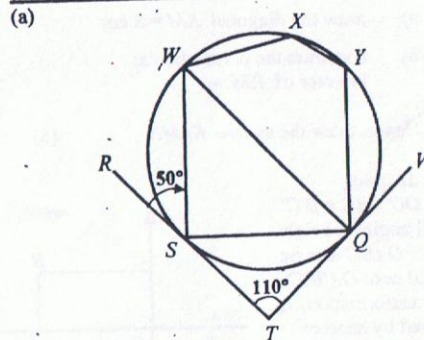
- (a) Q , R and S are three points on level ground. S is due east of Q and $QS = 45$ metres. The bearing of R from Q is 042° and the bearing of S from R is 110° .
- (i) Draw a diagram to show this information indicating clearly the bearings and distances given.
- (ii) Calculate the bearing of R from S .
- (iii) Calculate, in metres, the distance RS , correct to 2 significant figures.

[Solutions by accurate drawing not accepted] (10)

- (b) Two towns C and D are situated at $(35^\circ\text{N}, x^\circ\text{W})$ and $(35^\circ\text{N}, 18^\circ\text{W})$ respectively. C is due west of D . The distance CD , measured along the parallel of latitude is 2100 km. Calculate, to the nearest degree, the value of x .
- [Use $\pi = 3.14$ and $R = 6370$ km]. (5)

Total 15 marks

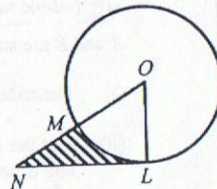
June 2001 – Question 12



In the diagram above, **not drawn to scale**, RST and TQV are tangents to the circle $QSWXY$. Angle $RSW = 50^\circ$, angle $STQ = 110^\circ$, and SW is parallel to QY .

Calculate, giving reasons for your answers, the sizes of angles

- (i) $\angle WQS$
 (ii) $\angle WSQ$
 (iii) $\angle WQY$
 (iv) $\angle WXY$. (8)
- (b) The diagram, **not drawn to scale**, shows a circle, centre O , radius 15 cm. The length of the minor arc LM is 9 cm and LN is a tangent to the circle. OMN is a straight line.
- (i) Calculate, in radians, the size of angle MOL .



- Hence, calculate
- (ii) the area of the minor sector OML
 (iii) the area of the shaded region. (7)

Total 15 marks

VECTORS AND MATRICES

June 2001 – Question 8

- (a) R is the matrix $\begin{pmatrix} 3r & -1 \\ s & 2s \end{pmatrix}$.
- (i) State, in terms of s and r , the determinant of R .
- (ii) If $r = \frac{1}{3}$ and $s = 4$, determine the inverse of R .

- (iii) State a pair of values of r and s , not including zero, which would make the matrix R a singular matrix. (7)

- (b) The position vectors of the points V , E and D relative to an origin O are $\vec{OV} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$, $\vec{OE} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$, $\vec{OD} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$ respectively.

- (i) Express the following vectors in the form $\begin{pmatrix} a \\ b \end{pmatrix}$: \vec{VE} , \vec{DV} , \vec{ED}
- (ii) Prove that the points V , E and D lie on a straight line and show their relative position on the line.
- (iii) State the value of the ratio $EV:DV$. (8)

Total 15 marks

June 2001 – Question 14

- (a) Q and R are transformations represented by matrices $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ and $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ respectively.
- (i) Describe FULLY the transformations represented by Q and by R .
- (ii) Determine the SINGLE matrix, L , which represents the transformation R followed by Q .
- (iii) Calculate the coordinates of the image of the point $(-1, 3)$ under L .
- (iv) Determine L^{-1} , the inverse of L .
- (v) Using L^{-1} , calculate the coordinates of the point whose image under L is $(-5, 2)$. (8)
- (b) The matrix $T = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ maps $(1, 3)$ onto $(-1, 3)$.
- (i) Determine the values of a , b , c and d .
- (ii) The point $(1, 3)$ lies on a line V . Given that $(-4, 2)$ also lies on V , determine the equation of V , the image of V , under the transformation T . (7)

Total 15 marks