JUNE 2000 PAPER 2

SECTION I

Answer ALL the questions in this section.

ALL working must be clearly shown.

June 2000 – Question 1

(a) Calculate the exact value of $1\frac{1}{3} - 3\frac{5}{6} \div 5\frac{1}{9}$ (4)

(b) Write the value of 0.428×2.75

(i) exactly in decimal form
(ii) to two decimal places
(iii) to two significant figures. (3)

(c) A company sells its printers to customers in order to make a profit of 25%. Calculate

(i) the price a customer pays for a printer which the company bought for \$1 700

(ii) the price the company paid for a printer which was sold to a customer for \$2 500. (5)

Total 12 marks

June 2000 – Question 2

(a) Factorize completely:

(i) $3xy - x$

(ii) $4a^2 - 9$

(iii) $(x-y)^2 - x + y$ (5)

(b) The floor of a room is in the shape of a rectangle. The floor is c meters long. The width of the floor is 2 metres less than its length.

(i) State, in terms of c
(a) the width of the floor
(b) the area of the floor.

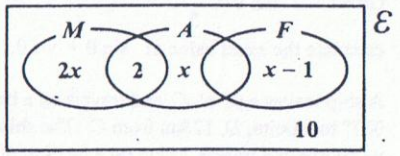
(ii) If the area of the floor is 15 m^2, write down an equation in c to show this information.

(iii) Use the equation to determine the width of the floor. (7)

Total 12 marks

June 2000 – Question 3

(a) The Venn Diagram below shows the number of students doing Mathematics (M), Accounts (A) and French (F) in a class of 50.



(i) Write down an expression, in terms of x, for the number of students who do Accounts.

(ii) Write down an equation, in terms of x, which shows the information in the Venn diagram

(iii) Determine the number of students who do Mathematics only.

(iv) Determine the number of students who do French. (8)

(b) Solve the simultaneous equations

$$3a - 2b = 12$$
$$2a + b = 1 \quad (4)$$

Total 12 marks

June 2000 – Question 4

(a) Using ruler and compasses only:

(i) Construct ΔABD such that $BD = 7$ cm, angle ABD = angle $ADB = 60°$.

(ii) Construct AX which is perpendicular to BD and which intersects BD at X.

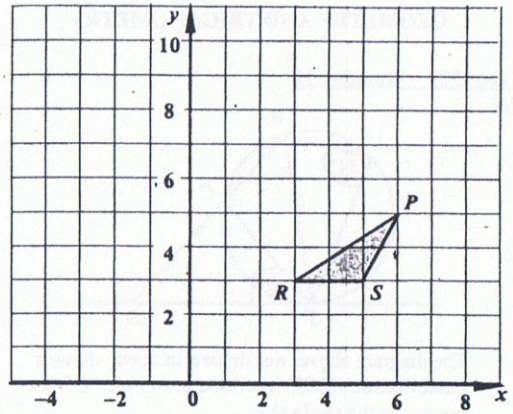
(iii) Complete the quadrilateral $ABCD$ such that $AC = 2AX$.

(iv) Measure and write down the length of AC.

(v) Name the type of quadrilateral you have drawn.

[Show all construction lines clearly.] (7)

(b) Write your answer to this question on the graph below.



The diagram on the graph shows triangle PRS.

T is a translation given by the vector $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$.

R is a rotation of 90° about the origin (0 , 0)

(i) Draw and label triangle $P'R'S'$, the image of triangle PRS under T.

(ii) Under the rotation R, triangle $P'R'S'$ is mapped onto triangle $P''R''S''$. Draw and label triangle $P''R''S''$. (4)

Total 11 marks

June 2000 – Question 5

Given that $f: x \to 3 - x$ and $g: x \to \frac{x+2}{x-5}$

(a) Calculate $g(2)$. (2)

(b) State the value of x for which $g(x)$ is not defined.

(c) Derive an expression for $gf(x)$. (3)

(d) Calculate the value of $f^{-1}(4)$. (4)

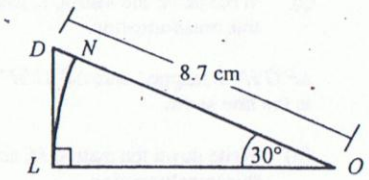
Total 10 marks

June 2000 – Question 6

(a) An aircraft left Jamaica at 13:55 hrs and travelled to Barbados via Antigua. The average speed of the aircraft was 420 km per hour. It arrived in Antigua at 16:45 hrs local time.

Given that Antigua is ONE hour AHEAD of Jamaica, calculate the distance between Jamaica and Antigua. **(4)**

(b)



[Take $\pi = 3.14$]

In the diagram above, **not drawn to scale**, OLN is a sector of a circle, centre O and ON is produced to D. Angle $DLO = 90°$, angle $DOL = 30°$, $DO = 8.7$cm.

Calculate

(i) the length, in cm, of DL

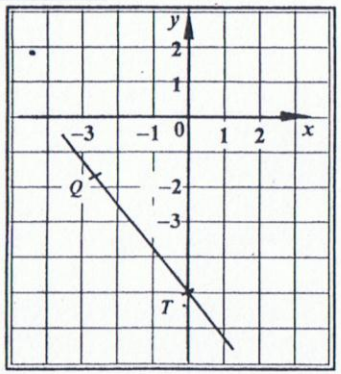
(ii) the radius of the sector OLN

(iii) the area of the sector OLN. **(7)**

Total 11 marks

June 2000 – Question 7

(a)



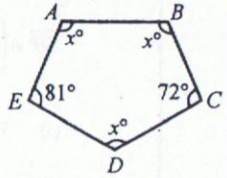
The graph above shows a straight line QT intersecting the y-axis at T.

(i) State the coordinates of T.

(ii) Calculate the gradient of QT.

(iii) Determine the equation of QT. **(5)**

(b) $ABCDE$ is a pentagon, **not drawn to scale**, with $\hat{A} = \hat{B} = \hat{D} = x°$.



Angle $C = 72°$ and angle $E = 81°$.

Calculate the value of x. **(5)**

Total 10 marks

June 2000 – Question 8

The table gives the marks of 100 students in an exam.

Marks (x)	Frequency (f)	Cumulative Frequency
1 – 10	15	15
11 – 20	25	
21 – 30	30	
31 – 40	22	
41 – 50	8	

(a) Copy and complete the table. **(2)**

(b) Plot a cumulative frequency curve to show this information using a scale of 1 cm to represent 5 marks on the horizontal axis and 1 cm to represent 10 students on the vertical axis. **(6)**

(c) Show on your graph how to estimate

(i) the lower quartile

(ii) the upper quartile. **(2)**

(d) Use your estimates to calculate the interquartile range. **(1)**

(e) Given that 20% of the students passed the exam, determine the pass mark. **(1)**

Total 12 marks

SECTION II

Answer TWO questions in this section.

RELATIONS AND FUNCTIONS

June 2000 – Question 9

(a) Solve $8x^2 + 3y^2 = 50$

$2x + y = 5$ **(8)**

(b) (i) Write the expression $9x^2 - 9x + 1$ in the form $a(x + b)^2 + c$, where a, b and c are real numbers.

(ii) State whether the function $y = 9x^2 - 9x + 1$ has a maximum or minimum value.

(iii) State the value of x at which this maximum or minimum value occurs. **(7)**

Total 15 marks

June 2000 – Question 10

(a) Copy and complete the table below for the function $f(x) = -x^2 + 3x - 2$.

x	–1	0	1	2	3	4
$f(x)$	–6		0			–6

(3)

(b) Using 2 cm to represent 1 unit on the x-axis and 1 cm to represent 1 unit on the y-axis, draw the graph of $f(x) = -x^2 + 3x - 2$ for $-1 \le x \le 4$ **(4)**

(c) Using the graph, determine:

(i) The maximum value of $f(x)$

(ii) The value of x for which $f(x)$ is maximum

(iii) The values of x for which $f(x) > 0$ **(4)**

(d) (i) Using the same scale and the same axes, draw the line $g(x) = -3$

(ii) Use the graphs of $f(x) = -x^2 + 3x - 2$ and $g(x) = -3$ to find the roots of the equation $-x^2 + 3x + 1 = 0$. **(4)**

Total 15 marks

GEOMETRY AND TRIGONOMETRY

June 2000 – Question 11

The base, N, of an antenna rests on horizontal ground. The angle of elevation of the top R, from a point H on the ground is 42°.

The angle of elevation of R from a second point G, 6 m closer to N than H, is 53.2°.

(a) Draw a diagram to show the information above, labelling all given points, distances and angles. **(4)**

(b) Calculate, to 3 significant figures

(i) the length RG

(ii) the height RN, of the antenna. **(7)**

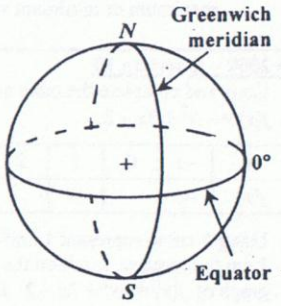
(c) A third point, C, lies on the ground 5.4 m from N. The angle of depression of C from R is x degrees.

Calculate, to the nearest degree, the value of x.

Total 15 marks

June 2000 – Question 12

(a) [Take the radius of the earth to be 6400 km and use $\pi = 3.14$]



The diagram represents the earth and shows the equator and the Greenwich meridian.

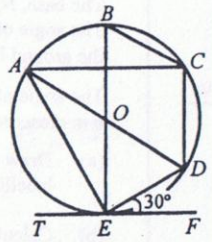
Town I is at (16°N , 30°W)
Town J is at (16°N , 45°W)

(i) Copy the diagram and show the positions of Town I and Town J.

(ii) Calculate the radius of the circle of latitude on which Town I and J are situated.

(iii) Calculate the shortest distance, measured along the earth's surface, between the two towns. **(9)**

(b) In the figure, **not drawn to scale**, O is the centre of the circle $ABCDE$ and TEF is a tangent to the circle at E.



Given that $\angle DEF = 30°$, calculate, giving reasons to support your answer, the size of the angle

(i) ACD
(ii) EAD
(iii) EOD
(iv) BCD

(6)

Total 15 marks

VECTORS AND MATRICES

June 2000 – Question 13

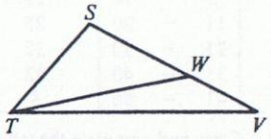
(a) The position vectors of the points P, Q and R relative to an origin O are

$$\overrightarrow{OP} = \begin{pmatrix} 7 \\ 9 \end{pmatrix}, \quad \overrightarrow{OQ} = \begin{pmatrix} 4 \\ 6 \end{pmatrix} \quad \text{and} \quad \overrightarrow{OR} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$$

(i) Express, in the form $\begin{pmatrix} a \\ b \end{pmatrix}$, the vectors $\overrightarrow{PQ}$ and $\overrightarrow{RQ}$.

(ii) Show, by calculation, that PQ makes an angle of 45° with the x-axis. **(5)**

(b)



In the diagram above, **not drawn to scale**, $\overrightarrow{TS} = \underline{p} + 2\underline{r}$, $\overrightarrow{VS} = 3\underline{r}$ and W is a point on SV such that $SW = 2WV$.

(i) Determine the vectors $\overrightarrow{TW}$ and $\overrightarrow{TV}$.

(ii) A point X lies outside ΔSTV such that $\overrightarrow{VX} = 2\underline{p} + \underline{r}$.

Show that T, W and X lie on a straight line. **(10)**

Total 15 marks

June 2000 – Question 14

(a) Given that $P = \begin{pmatrix} 2 & 1 \\ 5 & -3 \end{pmatrix}$

(i) Evaluate the inverse, P^{-1}, of P.

(ii) Use a **matrix method** to solve

$$x\begin{pmatrix} 2 \\ 5 \end{pmatrix} + y\begin{pmatrix} 1 \\ -3 \end{pmatrix} = \begin{pmatrix} 7 \\ 1 \end{pmatrix} \qquad \textbf{(7)}$$

(b) ΔFGH is mapped onto $\Delta F'G'H'$ under a reflection in the y-axis.

(i) Write down the matrix, L, associated with this transformation.

$\Delta F'G'H'$ is mapped onto $\Delta F''G''H''$ by a reflection in the line $y = x$.

(ii) Write down the matrix, M, associated with this transformation.

(iii) Determine the single matrix, K, which represents the transformation L followed by M.

(iv) Describe fully the single transformation represented by K. **(8)**

Total 15 marks