

Rewarding Learning

General Certificate of Secondary Education January 2012

Mathematics


Unit T4
(With calculator)
Higher Tier
[GMT41]

## WEDNESDAY 11 JANUARY

$9.15 \mathrm{am}-11.15 \mathrm{am}$

## TIME

2 hours.

## INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer all eighteen questions.
Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You may use a calculator for this paper.

## INFORMATION FOR CANDIDATES

The total mark for this paper is 100 .
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question. Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in question 7.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is overleaf.

| For Examiner's <br> use only |  |
| :---: | :---: |
| Question <br> Number | Marks |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |
| 11 |  |
| 12 |  |
| 13 |  |
| 14 |  |
| 15 |  |
| 16 |  |
| 17 |  |
| 18 |  |
| Total |  |
| Marks |  |

## Formula Sheet

Volume of prism $=$ area of cross section $\times$ length


Area of trapezium $=\frac{1}{2}(a+b) h$


Volume of cone $=\frac{1}{3} \pi r^{2} h$
Curved surface area of cone $=\pi r l$


## Quadratic Equation

The solutions of $a x^{2}+b x+c=0$ where $a \neq 0$, are given by

$$
x=\frac{-b \pm \sqrt{b^{2}-4 a c}}{2 a}
$$

In any triangle $\boldsymbol{A B C}$


Sine Rule: $\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$

Cosine Rule: $a^{2}=b^{2}+c^{2}-2 b c \cos A$

Area of triangle $=\frac{1}{2} a b \sin C$

1 (a) Jane attends both piano and flute lessons on August 31st.
She attends flute lessons every 8 days and piano lessons every 10 days. On what date will she next attend both lessons?

Answer $\qquad$
(b) An electric fire cost $£ 135.66$ including VAT at $20 \%$.

How much VAT was payable on the bill?

Answer £ $\qquad$ [3]

2 Fifty-five pupils in Year 11 do an end of year French test.
Their data is recorded in the table below.

| Mark | $0-20$ | $21-40$ | $41-60$ | $61-80$ | $81-100$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Frequency | 6 | 17 | 20 | 9 | 3 |

(a) Complete the cumulative frequency table below.

| Mark <br> (less than or equal to) | 20 | 40 | 60 | 80 | 100 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Cumulative Frequency | 6 |  |  |  |  |

(b) Draw a cumulative frequency graph opposite to illustrate this information.
(c) Use your graph to estimate the median mark.

Answer $\qquad$

The pass mark for the examination was 52 .
(d) Use your graph to estimate the number of students who passed the examination.

Answer $\qquad$
(e) Draw a box plot for the data on the grid below your graph.



3 (a) Solve the simultaneous equations

$$
\begin{aligned}
& 7 x+3 y=15 \\
& 4 x+3 y=6
\end{aligned}
$$

$\qquad$ , $y=$ $\qquad$
(b) Solve the equation $\frac{4 x+1}{12}+\frac{2 x-3}{6}=\frac{7}{4}$

Answer $x=$ $\qquad$ [4]

4 The diagram shows a pyramid PQRS in which RS is at right angles to the horizontal base $\mathrm{PQR} . \mathrm{PQ}=5 \mathrm{~cm}, \mathrm{QR}=13 \mathrm{~cm}$, angle $\mathrm{PQR}=90^{\circ}$ and angle $\mathrm{RQS}=48^{\circ}$.

(a) Calculate the length SR.

Answer $\qquad$ cm [3]
(b) Calculate the size of angle RPS.

Answer $\qquad$ ${ }^{\circ}$ [3]

(a) Write down the gradient of the line drawn above.

## Answer

$\qquad$
(b) Hence write down the equation of this line.

Answer $\qquad$

6 In the diagram EC is a diameter of the circle and $\mathrm{AE}=\mathrm{AB}$.
The line TN is the tangent at A .


Given that angle TAE $=32^{\circ}$ and angle $\mathrm{CED}=20^{\circ}$, calculate the size of each of the following:
(a) Angle EBC = $\qquad$ $\circ$
(b) Angle ABE = $\qquad$ $-$
(c) Angle $\mathrm{BAE}=$ $\qquad$ ${ }^{\circ}$
(d) Angle $\mathrm{BCE}=$ $\qquad$ -
(e) Angle $\mathrm{BED}=$ $\qquad$ -

## Quality of written communication will be assessed in this question.

7 There are 600 pupils at Willow High School.
The table below shows information about the pupils.

| Year group | Number of boys | Number of girls |
| :---: | :---: | :---: |
| 8 | 82 | 65 |
| 9 | 74 | 64 |
| 10 | 57 | 55 |
| 11 | 55 | 58 |
| 12 | 49 | 41 |

Andrew, Karan and Caroline are carrying out a survey in the school to get some information about the use of the school library.

They each decide that they will survey 50 pupils but each of them selects their sample in a different way.
(a) Andrew is going to visit a different Year 8 class each morning for a week and will survey 5 boys and 5 girls each day.

Comment on this method of sampling.
$\qquad$
$\qquad$
(b) Karan gets an alphabetical list of all 600 pupils in the school and selects every 10th name on the list until she has 50 names. She then surveys these pupils.

Comment on this method of sampling.
$\qquad$
$\qquad$
(c) Caroline takes a sample, stratified both by Year group and by gender, of 50 of the 600 pupils.
(i) Calculate the number of Year 10 boys in her sample.

Answer $\qquad$
(ii) Caroline stated that "There will be twice as many Year 8 boys as Year 12 girls in my sample."

Is Caroline's statement correct?
You must explain how you reached your decision.

8 (a) Factorise fully $3 p^{2}-75 q^{2}$

Answer $\qquad$
(b) Solve $x^{2}-5 x-24=0$

Answer $x=$ $\qquad$ [3]

9 (a) Find the equation of the line through $(0,4)$ perpendicular to the line $y=3 x+7$

Answer
(b) Expand and simplify $(3 p+2 q)(4 p-7 q)$.

Answer
$10 y$ is inversely proportional to the square of $x$.
When $x=3, y=4$
(a) Find a formula connecting $y$ and $x$.

Answer
(b) Calculate $y$ when $x=12$

Answer
(c) What happens to the value of $y$ when $x$ is doubled? Explain your answer.
Answer $\qquad$
$\qquad$
$\qquad$
,

Answ $\qquad$
$\qquad$

11 A field ABCD has straight sides. $\mathrm{AB}=80 \mathrm{~m}$.
An underground pipeline crosses the field from B to D and is 264 m long.
Angle $\mathrm{ABD}=44^{\circ}$.

(a) Calculate the area of ABD .

Answer $\qquad$

A safety shutoff valve is placed at the midpoint of BD.
(b) Calculate the distance from the corner A to the valve.
$\qquad$ m [3]

12 The length of a rectangle, $x$, is 5 cm more than the breadth. Its diagonal is 12 cm long.


Diagram not drawn accurately
(a) Show that $x$ is a solution of the equation $2 x^{2}-10 x-119=0$
(b) Solve the equation to find the length of the rectangle.

Give your answer correct to 1 decimal place.

Answer $x=$ $\qquad$ cm [3]
$\qquad$

## BLANK PAGE

(Questions continue overleaf)

13 Martin recorded the length, in minutes, of the films shown on television in one week.

Below is a partially completed frequency table and opposite is a partially completed histogram for his data.

| Length in minutes (m) | Frequency |
| :---: | :---: |
| $0<\mathrm{m} \leq 60$ | 30 |
| $60<\mathrm{m} \leq 80$ |  |
| $80<\mathrm{m} \leq 90$ | 68 |
| $90<\mathrm{m} \leq 100$ | 96 |
| $100<\mathrm{m} \leq 140$ |  |

(a) Use the information in the histogram to complete the frequency table.
(b) Complete the histogram by drawing the missing bars.
(c) Estimate the number of films whose length is between $\frac{3}{4}$ hour and $1 \frac{1}{4}$ hours.

Answer

Martin also recorded the lengths, in minutes, of all the films shown on television the following week. He made a new histogram.

Some of his data are given in the table below.

| Length in minutes (m) | Frequency | Height of bar (mm) |
| :---: | :---: | :---: |
| $60<\mathrm{m} \leq 100$ | 144 | 72 |
| $100<\mathrm{m} \leq 160$ | $x$ |  |

(d) Complete the table by finding the height of the second bar, giving your answer in terms of $\boldsymbol{x}$.


14 Prove that $\left(\frac{8}{27}\right)^{-\frac{4}{3}} \times 0.25^{-2}=81$
Show each step of your working.
Do not use your calculator.

15 In a circular circus ring, centre N , three wires $\mathrm{OA}, \mathrm{OB}$ and OC of equal length are attached from $\mathrm{A}, \mathrm{B}, \mathrm{C}$ on the circumference of the ring floor to the top of the tent O . The angles $\mathrm{BOC}, \mathrm{COA}$ and AOB are each equal to $90^{\circ}$ and the angle $\mathrm{ANB}=120^{\circ}$. The chords $\mathrm{AB}, \mathrm{BC}$ and CA are each 25 m in length.

(a) Explain why angle $\mathrm{NAB}=30^{\circ}$.
(b) Calculate the radius of the circus ring.

Answer $\qquad$ m [3]
(c) Calculate the length of one of the wires.

Answer $\qquad$ m [2]

16 Given that $x^{2}-8 x+p \equiv(x+q)^{2}$ find $p$ and $q$.
$\qquad$ ,$q=$ $\qquad$ [3]

17 Solve $\frac{2}{x+1}+\frac{6}{3 x-2}=1$

Answer $x=$


The diagonals CE and DF of a cyclic quadrilateral CDEF intersect at G.
Given that $\mathrm{CF}=\mathrm{FE}$, prove that angle CGD $=$ angle FED.

## THIS IS THE END OF THE QUESTION PAPER

Permission to reproduce all copyright material has been applied for In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA will be happy to rectify any omissions of acknowledgement in future if notified

