Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTER NUMBER

CANDIDATE NUMBER

ADDITIONAL MATHEMATICS (US) **0459/02**

Paper 2 **May/June 2014**

2 hours

Candidates answer on the Question Paper

Additional Materials: Electronic calculator
List of formulas and statistical tables (MF25)

READ THESE INSTRUCTIONS FIRST

Write your Center number, candidate number, and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of points is given in parentheses [ ] at the end of each question or part question.
The total number of points for this paper is 80.

This document consists of **16** printed pages.

CAMBRIDGE International Examinations

1 It is given that $f(x) = x^3 - 2x^2 - x - 2$.

(i) Evaluate $f(3)$.

(ii) Express $f(x)$ in the form $(x - 3)(x^2 + ax + b) + c$, where a, b and c are constants to be found. [4]

2 The complex numbers z and $\overline{z}$ are defined as $z = a + 2\mathrm{i}$ and $\overline{z} = a - 2\mathrm{i}$, where a is real.

(i) Justifying your answer, determine whether each of the following is real or imaginary.

(a) $z + \overline{z}$

(b) $z \times \overline{z}$

(c) $z - \overline{z}$

(ii) Find the values of a for which $z \div \overline{z}$ is imaginary. [4]

3 Solutions to this question by accurate drawing will not be accepted.

Four straight lines have equations $2y = x + 3$, $y = 14 - 2x$, $4y = 2x - 9$ and $y = 4 - 2x$.

(i) Show that these four lines form a rectangle. [

(ii) Find the length of a diagonal of this rectangle. [5]

(iii) Find the coordinates of the midpoint of a diagonal of this rectangle. [2]

4 $\mathbf{A}$ and $\mathbf{B}$ are 2×2 matrices such that $\mathbf{A}^{-1} = \mathbf{B}^2$.

(i) Show that $\mathbf{AB} = \mathbf{B}^{-1}$.

(ii) Hence show that $\mathbf{AB} = \mathbf{BA}$. [2]

5 It is known that, without medication, 5 in 6 patients with a particular disease will recover in le

(i) Find the probability that, without medication, 25 patients with the disease will all recover in le year.

In a medical trial a new drug is given to 25 patients newly diagnosed with the disease and it is found that all of them recover in less than a year.

(ii) Use your answer to part **(i)** to comment on the possible effectiveness of the new drug. [2]

6 The table shows the results for two classes in a mathematics test.

Score	0	1	2	3	4	5	6	7	8	9	10
Number of students in class *A*	0	0	5	6	4	5	4	5	6	5	0
Number of students in class *B*	1	0	0	0	5	16	11	4	3	0	0

(i) Use the shapes of the data sets to make two comparisons between the results for the classes. [2]

(ii) It was decided to ignore, in class *B*, the result of Freda who scored 0.

(a) State briefly what effect this will have on the median for class *B*. [1]

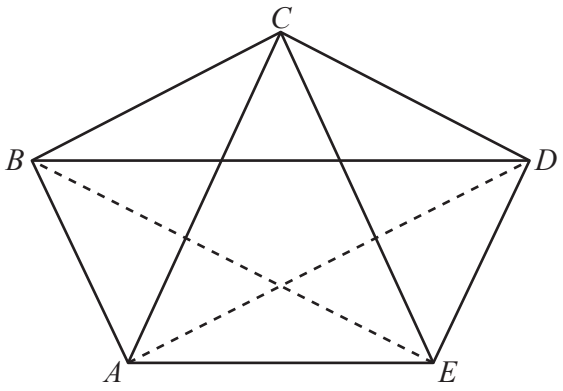
(b) Without calculation, state briefly what effect this will have on the standard deviation for class *B*. [1]

(iii) The mean score for class *A* is 5.525 and the mean score for class *B* is 5.45.

(a) Calculate the mean for class *B* without Freda's score.

(b) Compare the overall scores of the two classes, commenting on the effect of ignoring Freda's score. [1]

7



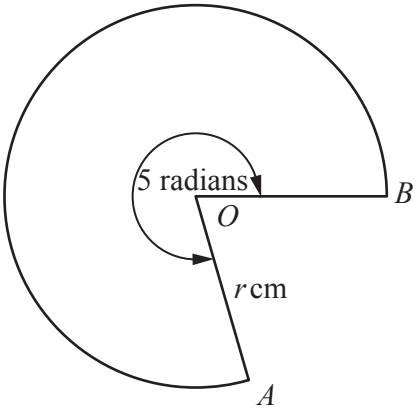
ABCDE is a pentagon such that $BE = DA$. Triangles *BCD* and *ACE* are isosceles with bases *BD* and *AE* respectively. Prove that

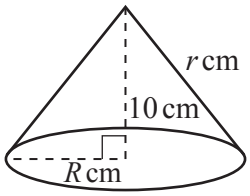
(i) angle *BCA* = angle *DCE*, [3]

(ii) $AB = ED$, [2]

(iii) angle *ABD* = angle *EDB*. [2]

8





The major sector, AOB, of a circle with radius r cm, has an angle of 5 radians. This sector is made into a right cone of height 10 cm, slant height r cm and base radius R cm by bringing the radii OA and OB together. It is given that the major arc, AB, is of length kr cm.

(i) Write down the value of k. [1]

(ii) Find the value of r, giving your answer correct to 1 decimal place. [4]

(iii) Calculate the surface area of the cone. [2]

9 A crab fisherman wishes to travel directly between two marker buoys that are 6 km apart, the second marker buoy from the first being 120°. His boat moves at 12 kmh^{-1} relative to the water. has a constant speed of 5 kmh^{-1} from the west. Calculate

(i) the course the fisherman must set, [

(ii) the time it will take him to travel between the marker buoys. [4]

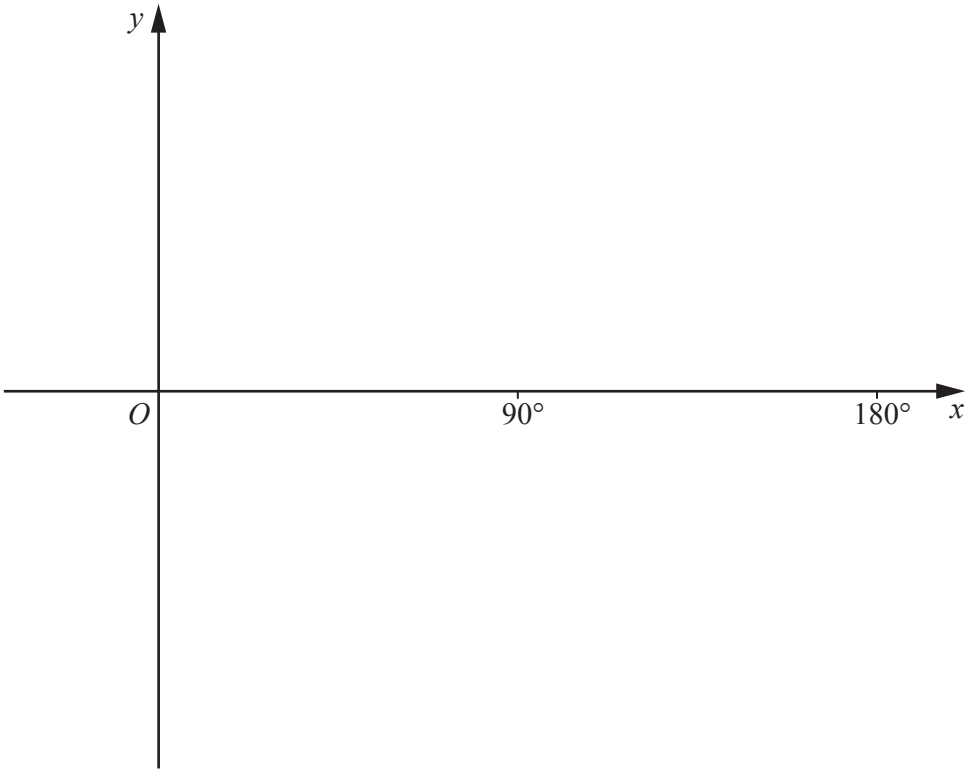
10 The function f is defined, for $x \geqslant 0°$, by $f(x) = 3\sin 4x + 1$.

(i) State the amplitude and period of f.

Amplitude ..... Period .....

(ii) Write down the equation of the midline of f. [1]

(iii) Sketch the graph of $y = f(x)$ for $0° \leqslant x \leqslant 180°$. [3]

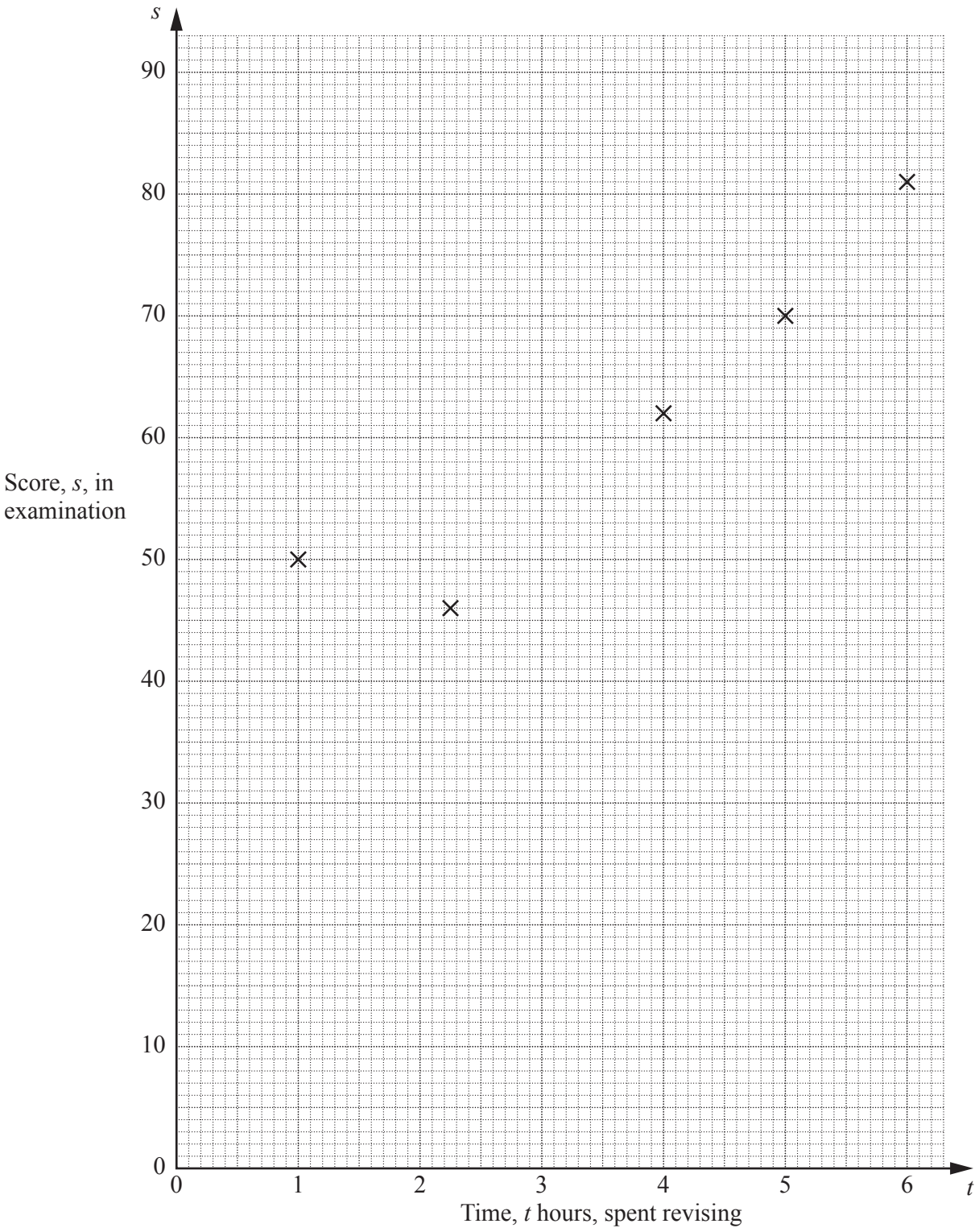


(iv) Solve $3\sin 4x + 1 = 1$ for $0° \leqslant x \leqslant 180°$. [2]

11 A researcher is investigating whether there is a link between the amount of time students spen[illegible] their performance in an examination. A random sample of 10 students is selected. The table show[illegible] s, of each student in the examination and the time, t hours, that each spent revising.

Student	A	B	C	D	E	F	G	H	I	J
Time spent revising (t hours)	4	2.25	6	5	1	0	2.5	3.75	3	4.5
Score in examination (s)	62	46	81	70	50	8	50	60	65	68

(i) Complete the scatter plot to represent this information. The first five points have been plotted for you. [2]



(ii) Given that the mean time spent revising was 3.2 hours and the mean score obtained wa[illegible]e equation of a line which best fits your scatter diagram.

(iii) Give an interpretation of the slope of your line of best fit in the context of the data. [1]

Jonah spent 1.9 hours revising for the examination.

(iv) Predict the score that Jonah obtained in the examination. [1]

Alex spent 10 hours revising but missed the examination. He claims that, based on this survey, he would have obtained a score above 80.

(v) Comment on Alex's claim. [1]

Question 12 is printed on the next page.

12 **(a)** The recursive relation between the terms of the sequence 3, 17, 73, 297, … is $f(n+1) = af(n) + b$ for $n \geqslant 1$, where a and b are constants. Find the value of a and of b.

(b) A father invests \$1650 in a fund for his child at a compound interest rate of 3.5% per year. Write down the recursive function which generates the values of the investment at the end of each year, assuming that no money is withdrawn from the fund. [2]