



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education



MATHEMATICS

0580/04, 0581/04

Paper 4 (Extended)

October/November 2008

2 hours 30 minutes

| | | |
|-----------------------|--------------------------------|--------------------------|
| Additional Materials: | Answer Booklet/Paper | Electronic calculator |
| | Geometrical instruments | Graph paper (1 sheet) |
| | Mathematical tables (optional) | Tracing paper (optional) |

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

All working must be clearly shown. It should be done on the same sheet as the rest of the answer.

Marks will be given for working which shows that you know how to solve the problem even if you get the answer wrong.

Electronic calculators should be used.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures.

Give answers in degrees to one decimal place.

For π use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total of the marks for this paper is 130.

This document consists of **11** printed pages and **1** blank page.



**DO NOT DO ANY WORKING ON THIS QUESTION PAPER
USE THE ANSWER BOOK OR PAPER PROVIDED**

1 Beatrice has an income of \$40 000 in one year.

(a) She pays:

no tax on the first \$10 000 of her income;

10% tax on the next \$10 000 of her income;

25% tax on the rest of her income.

Calculate

(i) the total amount of tax Beatrice pays, [2]

(ii) the total amount of tax as a percentage of the \$40 000. [2]

(b) Beatrice pays a yearly rent of \$10 800.

After she has paid her tax, rent and bills, she has \$12 000.

Calculate how much Beatrice spends on bills. [1]

(c) Beatrice divides the \$12 000 between shopping and saving in the ratio

$$\text{shopping} : \text{saving} = 5 : 3.$$

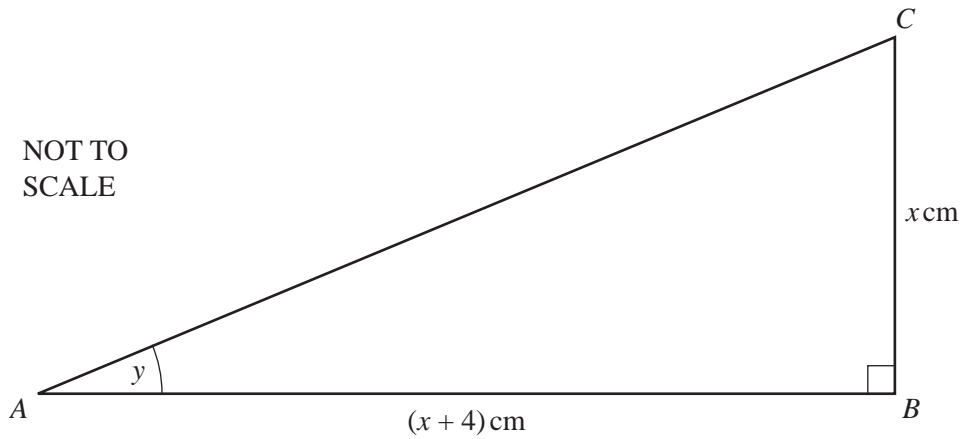
(i) Calculate how much Beatrice spends on shopping in one year. [2]

(ii) What fraction of the original \$40 000 does Beatrice **save**?

Give your answer in its lowest terms. [1]

(d) The rent of \$10 800 is an increase of 25% on her previous rent.

Calculate her previous rent. [2]



- (a) When the area of triangle ABC is 48 cm^2 ,
- (i) show that $x^2 + 4x - 96 = 0$, [2]
 - (ii) solve the equation $x^2 + 4x - 96 = 0$, [2]
 - (iii) write down the length of AB . [1]
- (b) When $\tan y = \frac{1}{6}$, find the value of x . [2]
- (c) When the length of AC is 9 cm ,
- (i) show that $2x^2 + 8x - 65 = 0$, [2]
 - (ii) solve the equation $2x^2 + 8x - 65 = 0$,
(Show your working and give your answers correct to 2 decimal places.) [4]
 - (iii) calculate the perimeter of triangle ABC . [1]
-

3 Answer the whole of this question on a sheet of graph paper.

The table shows some of the values of the function $f(x) = x^2 - \frac{1}{x}$, $x \neq 0$.

| | | | | | | | | | | |
|-----|-----|-----|-----|------|------|------|------|-----|-----|-----|
| x | -3 | -2 | -1 | -0.5 | -0.2 | 0.2 | 0.5 | 1 | 2 | 3 |
| y | 9.3 | 4.5 | 2.0 | 2.3 | p | -5.0 | -1.8 | q | 3.5 | r |

(a) Find the values of p , q and r , correct to 1 decimal place. [3]

(b) Using a scale of 2 cm to represent 1 unit on the x -axis and 1 cm to represent 1 unit on the y -axis, draw an x -axis for $-3 \leq x \leq 3$ and a y -axis for $-6 \leq y \leq 10$.

Draw the graph of $y = f(x)$ for $-3 \leq x \leq -0.2$ and $0.2 \leq x \leq 3$. [6]

(c) (i) By drawing a suitable straight line, find the three values of x where $f(x) = -3x$. [3]

(ii) $x^2 - \frac{1}{x} = -3x$ can be written as $x^3 + ax^2 + b = 0$.

Find the values of a and b . [2]

(d) Draw a tangent to the graph of $y = f(x)$ at the point where $x = -2$.

Use it to estimate the gradient of $y = f(x)$ when $x = -2$. [3]

4

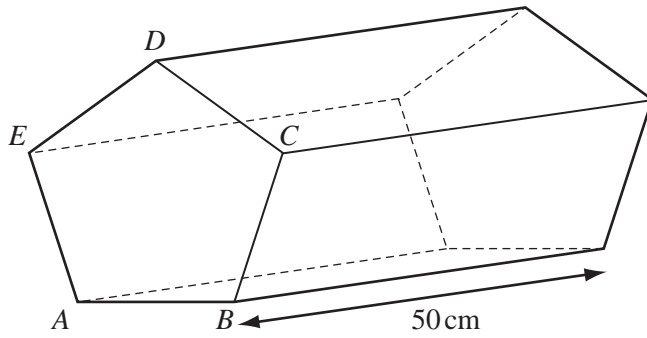
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Diagram 1

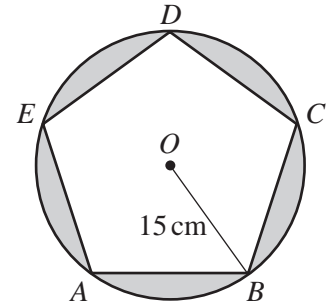


Diagram 2

Diagram 1 shows a solid wooden prism of length 50 cm.

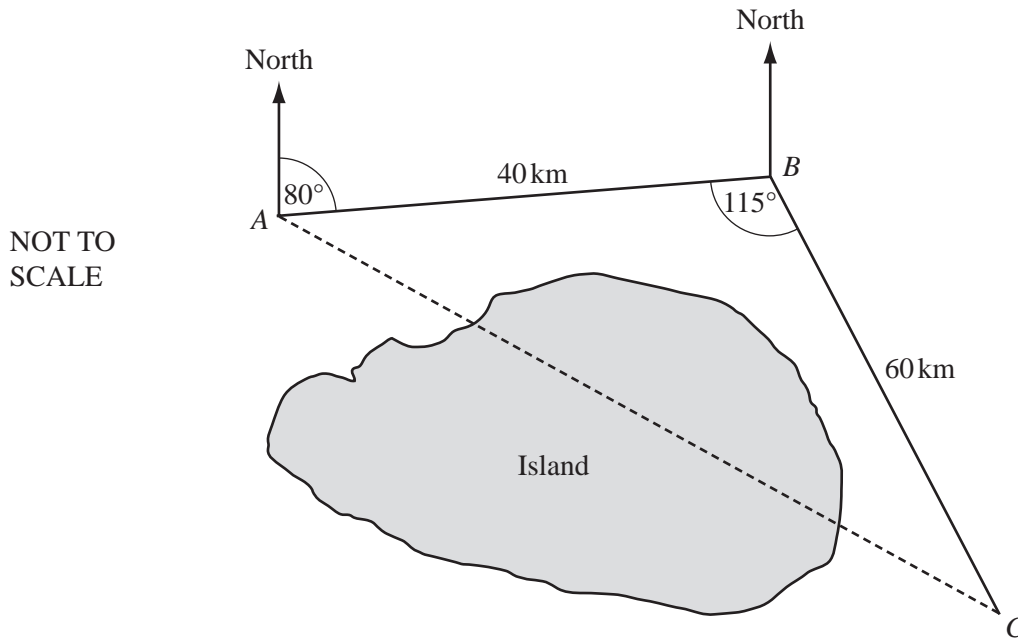
The cross-section of the prism is a regular pentagon $ABCDE$.

The prism is made by removing 5 identical pieces of wood from a solid wooden cylinder.

Diagram 2 shows the cross-section of the cylinder, centre O , radius 15 cm.

- (a) Find the angle AOB . [1]
- (b) Calculate
- (i) the area of triangle AOB , [2]
 - (ii) the area of the pentagon $ABCDE$, [1]
 - (iii) the volume of wood removed from the cylinder. [4]
- (c) Calculate the total surface area of the prism. [4]

5



To avoid an island, a ship travels 40 kilometres from A to B and then 60 kilometres from B to C .

The bearing of B from A is 080° and angle ABC is 115° .

(a) The ship leaves A at 11 55.

It travels at an average speed of 35 km/h.

Calculate, to the nearest minute, the time it arrives at C .

[3]

(b) Find the bearing of

(i) A from B ,

[1]

(ii) C from B .

[1]

(c) Calculate the straight line distance AC .

[4]

(d) Calculate angle BAC .

[3]

(e) Calculate how far C is east of A .

[3]

- 6 (a) Each student in a class is given a bag of sweets.

The students note the number of sweets in their bag.

The results are shown in the table, where $0 \leq x < 10$.

| | | | |
|----------------------------|----|----|-----|
| Number of sweets | 30 | 31 | 32 |
| Frequency (number of bags) | 10 | 7 | x |

- (i) State the mode. [1]
- (ii) Find the possible values of the median. [3]
- (iii) The mean number of sweets is 30.65.

Find the value of x . [3]

- (b) The mass, m grams, of each of 200 chocolates is noted and the results are shown in the table.

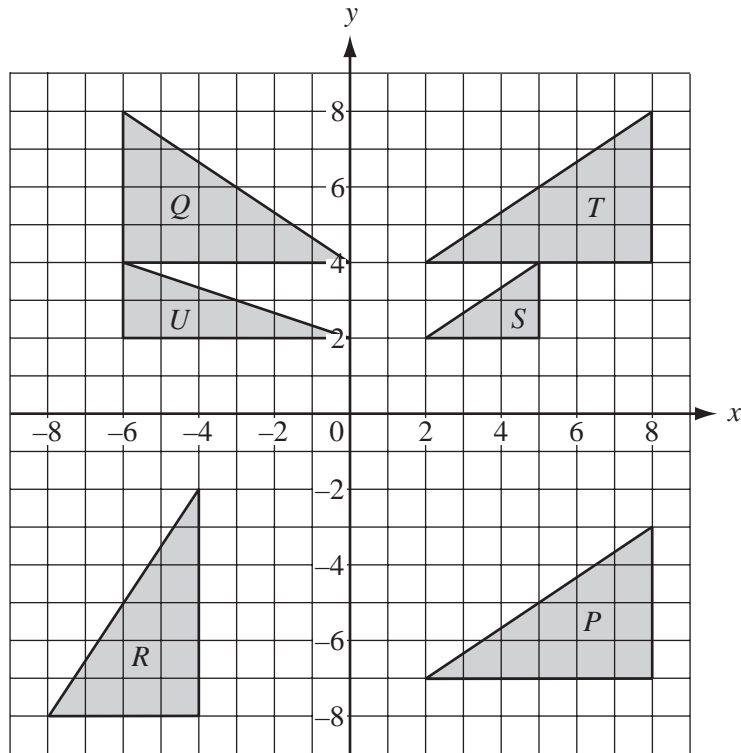
| | | | | |
|-------------------|------------------|------------------|------------------|------------------|
| Mass (m grams) | $10 < m \leq 20$ | $20 < m \leq 22$ | $22 < m \leq 24$ | $24 < m \leq 30$ |
| Frequency | 35 | 115 | 26 | 24 |

- (i) Calculate an estimate of the mean mass of a chocolate. [4]
- (ii) On a histogram, the height of the column for the $20 < m \leq 22$ interval is 11.5 cm.

Calculate the heights of the other three columns.

Do not draw the histogram. [5]

7



The diagram shows triangles P , Q , R , S , T and U .

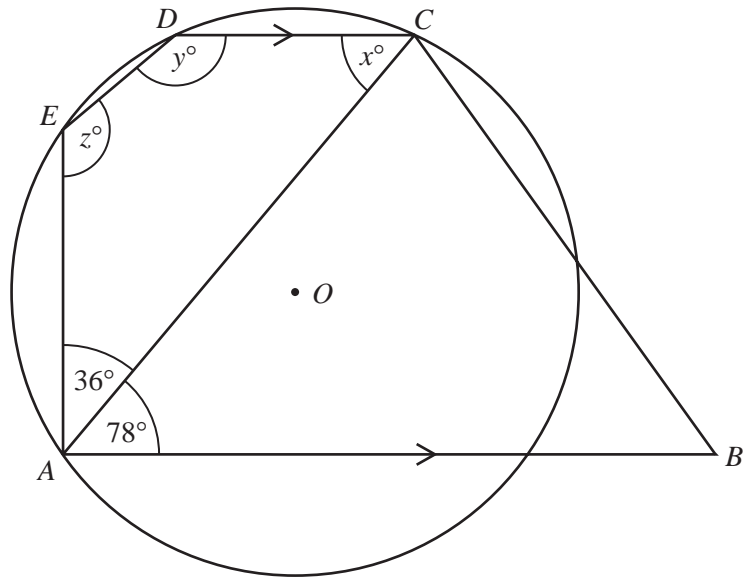
(a) Describe fully the **single** transformation which maps triangle

- (i) T onto P , [2]
- (ii) Q onto T , [2]
- (iii) T onto R , [2]
- (iv) T onto S , [3]
- (v) U onto Q . [3]

(b) Find the 2 by 2 matrix representing the transformation which maps triangle

- (i) T onto R , [2]
- (ii) U onto Q . [2]

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$ABCDE$ is a pentagon.

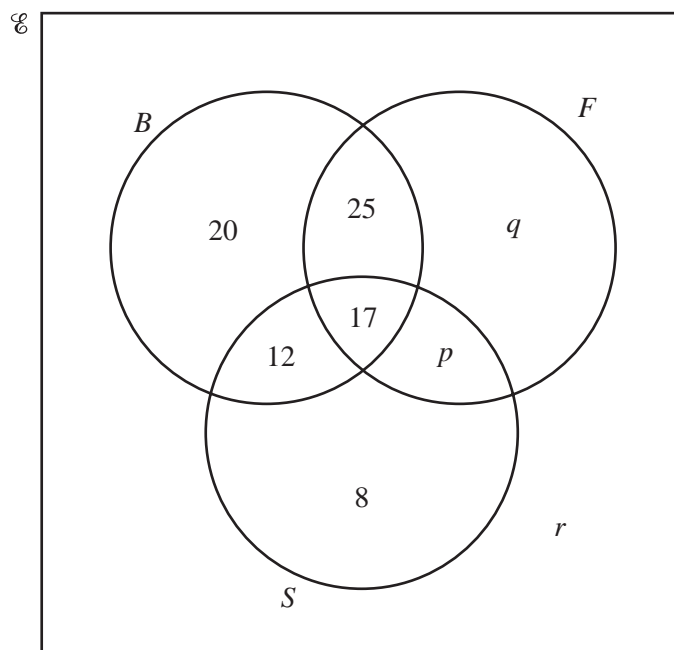
A circle, centre O , passes through the points A , C , D and E .

Angle $EAC = 36^\circ$, angle $CAB = 78^\circ$ and AB is parallel to DC .

- (a) Find the values of x , y and z , giving a reason for each. [6]
- (b) Explain why ED is **not** parallel to AC . [1]
- (c) Find the value of angle EOC . [1]
- (d) $AB = AC$.
Find the value of angle ABC . [1]

- 9 In a survey, 100 students are asked if they like basketball (B), football (F) and swimming (S).

The Venn diagram shows the results.



42 students like swimming.

40 students like exactly one sport.

- (a) Find the values of p , q and r . [3]
- (b) How many students like
- all three sports, [1]
 - basketball and swimming but not football? [1]
- (c) Find
- $n(B')$, [1]
 - $n((B \cup F) \cap S')$. [1]
- (d) One student is chosen at random from the 100 students.
Find the probability that the student
- only likes swimming, [1]
 - likes basketball but not swimming. [1]
- (e) Two students are chosen at random from those who like basketball.
Find the probability that they each like exactly one other sport. [3]

10 $1 + 2 + 3 + 4 + 5 + \dots + n = \frac{n(n+1)}{2}$

(a) (i) Show that this formula is true for the sum of the first 8 natural numbers. [2]

(ii) Find the sum of the first 400 natural numbers. [1]

(b) (i) Show that $2 + 4 + 6 + 8 + \dots + 2n = n(n + 1)$. [1]

(ii) Find the sum of the first 200 even numbers. [1]

(iii) Find the sum of the first 200 odd numbers. [1]

(c) (i) Use the formula at the beginning of the question to find the sum of the first $2n$ natural numbers. [1]

(ii) Find a formula, in its simplest form, for

$$1 + 3 + 5 + 7 + 9 + \dots + (2n - 1).$$

Show your working. [2]

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