OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
General Certificate of Secondary Education

MATHEMATICS SYLLABUS A 1962/5

PAPER 5 (Higher Tier)

Monday **5 JUNE 2006** Afternoon 2 hours

Candidates answer on the question paper.
Additional materials:
Geometrical instruments
Tracing paper (optional)

Candidate Name	Centre Number	Candidate Number

TIME 2 hours

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Show your working. Marks may be given for working that shows that you know how to solve the problem even if you get the answer wrong.

INFORMATION FOR CANDIDATES

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

WARNING

You are not allowed to use a calculator in this paper.

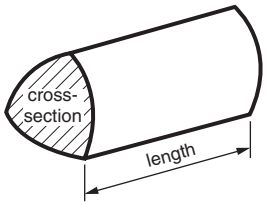
FOR EXAMINER'S USE

This question paper consists of 18 printed pages and 2 blank pages.

Registered Charity Number: 1066969
[Turn over

Formulae Sheet: Higher Tier

Volume of prism = (area of cross-section) x length

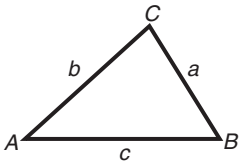


In any triangle *ABC*

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

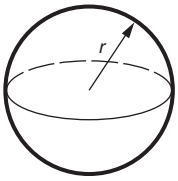
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

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



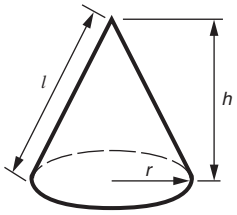
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$



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

Curved surface area of cone $= \pi rl$

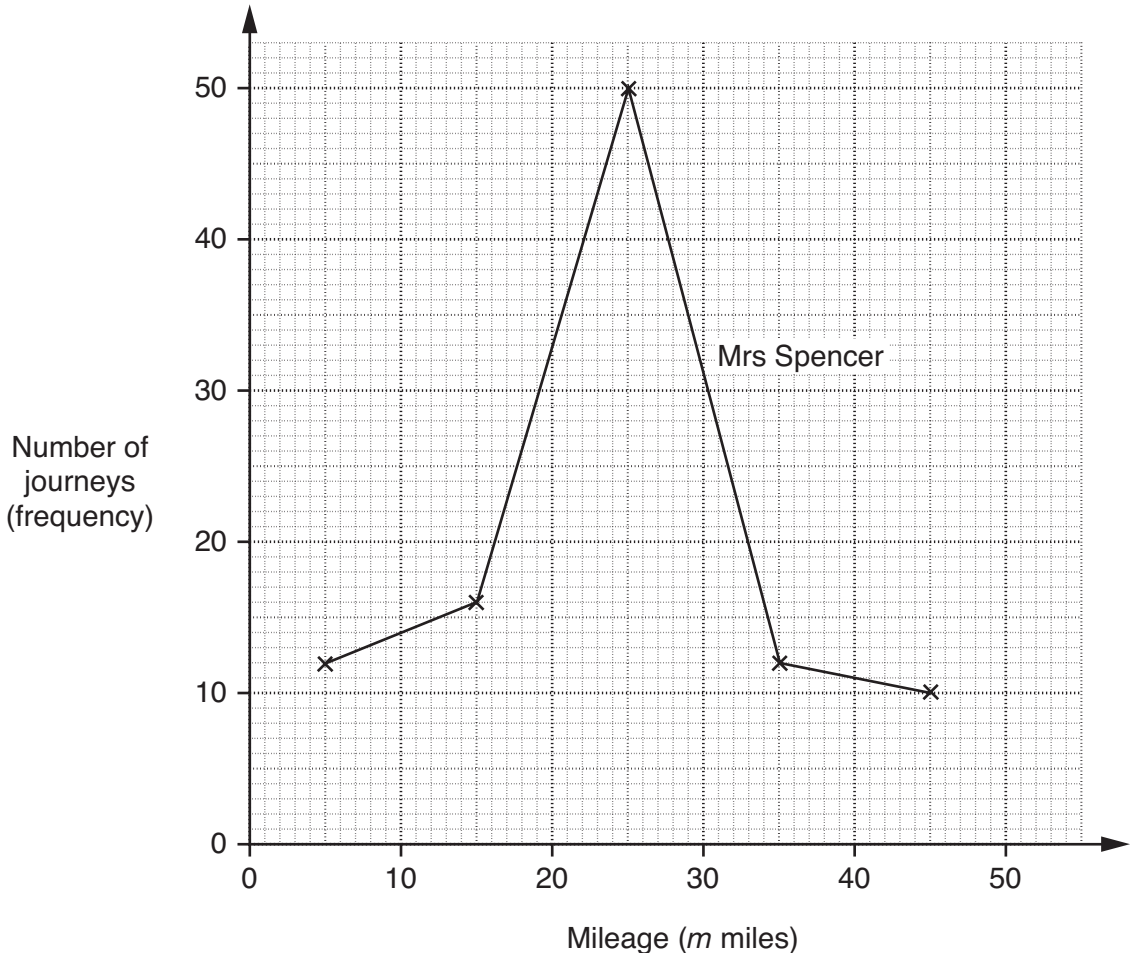


The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$
where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

1 Mrs Spencer and Mr Patel both work for the same company.
In 2005 they each recorded the mileage of every journey they made for the company.
The mileages for Mrs Spencer's journeys are summarised in the frequency polygon below.



The mileages for Mr Patel's journeys are summarised in this table.

Mileage (*m* miles)	$0 < m \leqslant 10$	$10 < m \leqslant 20$	$20 < m \leqslant 30$	$30 < m \leqslant 40$
Frequency	38	44	10	8

(a) Draw, on the same grid, the frequency polygon for the mileages of Mr Patel's journeys. [2]

(b) Make two comparisons between the mileages of Mrs Spencer's and Mr Patel's journeys.

1. _____

_____

2. _____

_____[2]

2 **(a)** **(i)** Solve.

$$4x < 2x + 3$$

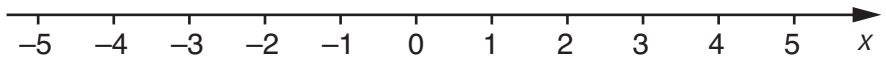
.....

.....

.....

(a)(i) _____[2]

(ii) Show your solution to part **(i)** on the number line below.



[1]

(b) Solve algebraically.

$$7x + 2y = 17$$
$$3x + 2y = 5$$

.....

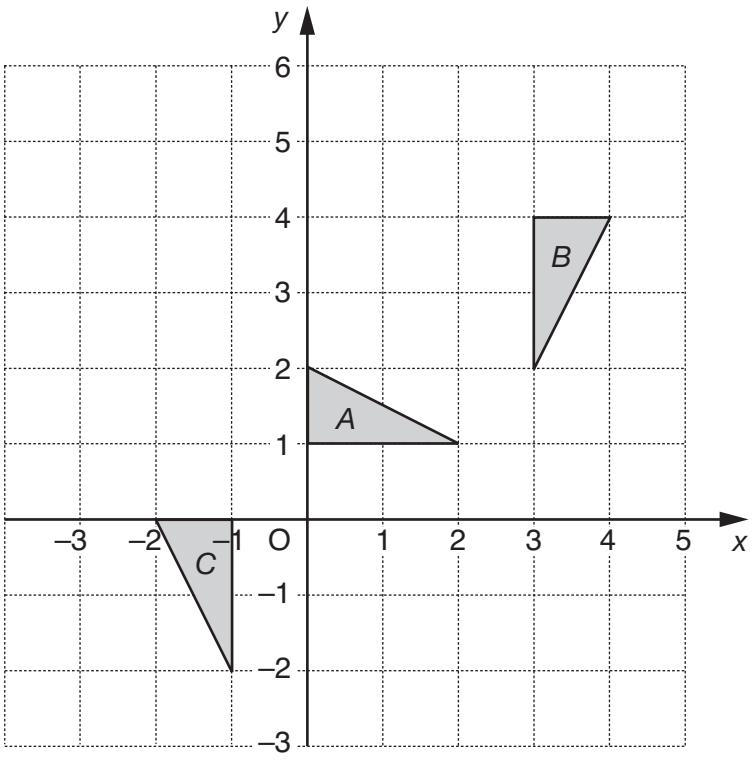
.....

.....

.....

(b) x = _____ y = _____[2]

3



(a) Translate triangle *A* by the vector $\begin{pmatrix} 0 \\ 3 \end{pmatrix}$. [1]

(b) Describe fully the **single** transformation that maps

(i) triangle *A* onto triangle *B*,

_____

_____[3]

(ii) triangle *A* onto triangle *C*.

_____[2]

[Turn over

4 **(a)** Write each of the following as a single power of 2.

(i) $2^3 \times 2^4$

(a)(i) _____[1]

(ii) $\dfrac{2^8}{2^2}$

(ii) _____[1]

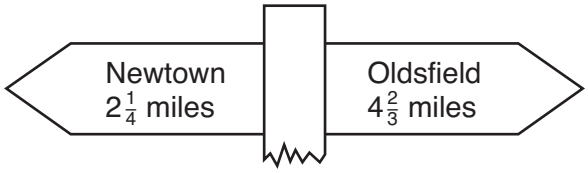
(b) **(i)** Write 23 700 000 in standard form.

(b)(i) _____[1]

(ii) Write 5.03×10^{-4} as an ordinary number.

(ii) _____[1]

(c) This sign is on the road from Newtown to Oldsfield.
Work out how far it is between the two towns using this road.



.....

.....

.....

(c) _____miles [3]

(d) Tom worked out that each day at school he walked $2\frac{3}{8}$ miles.
How far did he walk altogether in 5 school days?

.....

.....

.....

.....

.....

(d) _____miles [3]

5 In the following expressions L, W and H are all lengths.
Decide, for each of the expressions, whether it could represent a length, an area or a volume.

(a) LWH

.....

(a) _____[1]

(b) $L + W + H$

.....

(b) _____[1]

(c) $LW + WH + HL$

.....

(c) _____[1]

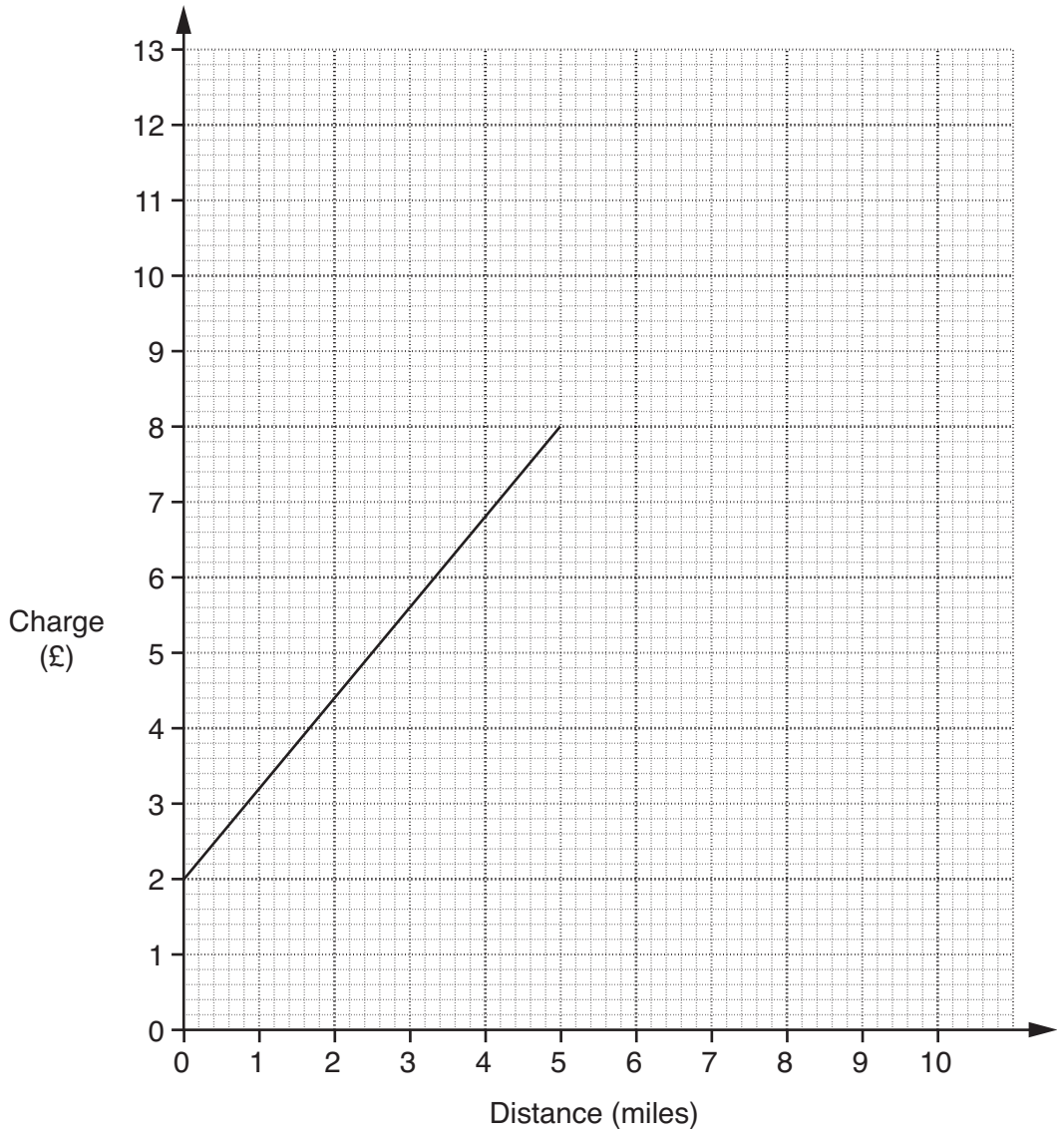
6

STU'S TAXIS

Rates

A fixed charge
plus
x pence per mile for the first 5 miles
plus
80 pence per mile for any extra distance over 5 miles

The graph shows the rates charged by Stu's Taxis for journeys of 0 to 5 miles.



(a) How much is the fixed charge?

(a) £ _____[1]

(b) Calculate the value of *x*.

.....

(b) _____[2]

(c) Add a line to the graph to show the charges for distances from 5 to 10 miles.

.....[2]

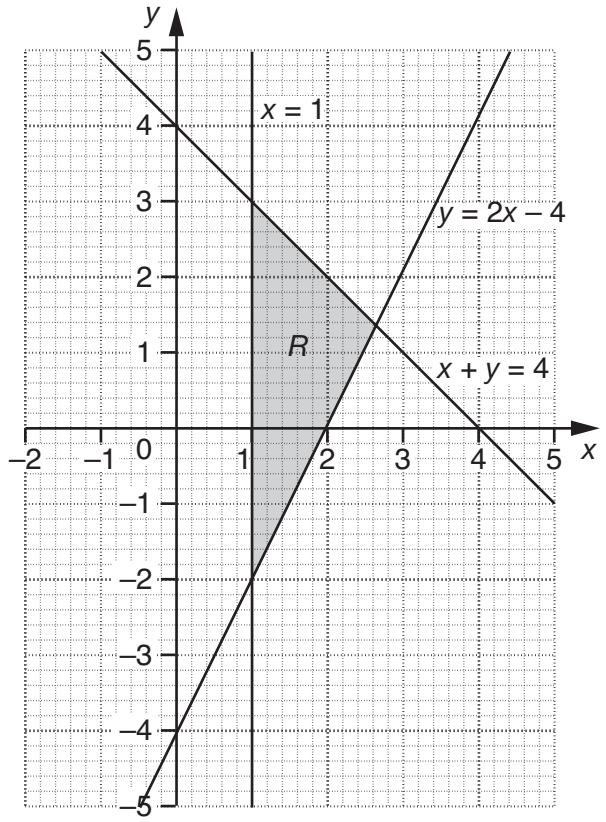
(d) What is the average cost per mile for a journey of 8 miles?
Give your answer in pence.

.....

.....

(d) _____p [2]

7



(a) Write down the three inequalities which define the shaded region *R* shown on the grid above.

(a) _____

_____

_____[3]

(b) The boundaries are included in the region.
Find the minimum value of $x + y$ in the shaded region *R*.

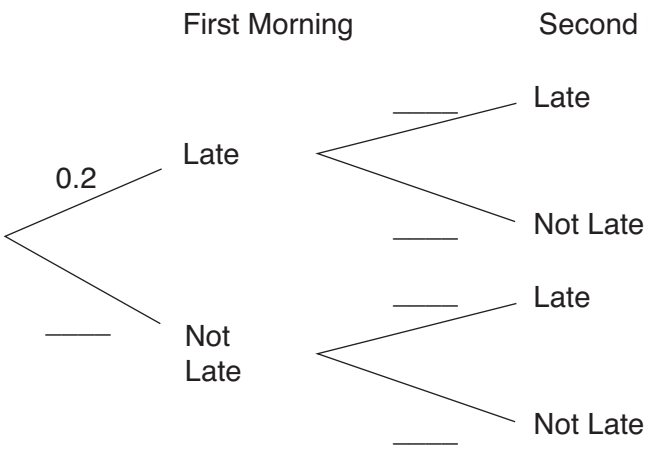
.....

(b) _____[2]

---

8 On any morning the probability that the school bus is late is 0.2.

(a) Complete the tree diagram below to show the probabilities of the school bus being late on two consecutive mornings.



[2]

(b) Use the tree diagram to work out the probability that the school bus is not late on the first morning **and** not late on the second morning.

.....

.....

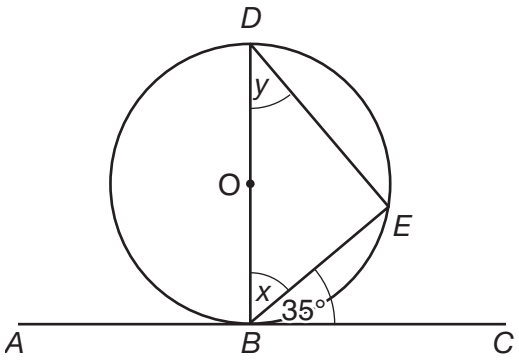
.....

.....

.....

(b) _____[2]

9 In the diagram, *ABC* is a tangent to the circle, centre O.
BD is a diameter.
Angle *EBC* = 35°.



NOT TO SCALE

(a) Work out angle *x*.
Give a reason for your answer.

.....

.....

x = _____° because _____

_____[2]

(b) Work out angle *y*.
Give reasons for your answer.

.....

.....

y = _____° because _____

_____

_____[3]

10 **(a)** In each part give one example to show that the statement is **false**.
You must show your working.

(i) For every non-zero number y, $2y > y$.

_____

_____[1]

(ii) For every non-zero number x, $x^2 > x$.

_____

_____[2]

(b) Given that $-5 \leqslant x \leqslant 3$ and $-7 \leqslant y \leqslant 4$, find

(i) the largest value of x^2,

.....

.....

(b)(i) _____[1]

(ii) the largest value of $y - x$,

.....

.....

(ii) _____[1]

(iii) the smallest value of xy.

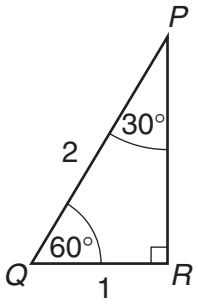
.....

.....

(iii) _____[1]

11 The diagram shows a right-angled triangle PQR.

PQ is 2 units long and QR is 1 unit long.
Angle $PQR = 60°$ and angle $QPR = 30°$.



NOT TO SCALE

(a) Find $\sin 60°$.

Give your answer in the form $\frac{\sqrt{a}}{b}$.

.....

.....

.....

.....

(a) _____[3]

(b) Find $\tan 30°$.

Give your answer in the form $\frac{\sqrt{a}}{b}$.

.....

.....

.....

(b) _____[2]

12 **(a)** Factorise completely.

$$12a^2 - 3b^2$$

.....

.....

.....

(a) _____[3]

(b) Rearrange

$$ay + b = cx - y$$

to make y the subject.

.....

.....

.....

.....

.....

(b) _____[3]

(c) $y = z^2 + 2$ $\quad$ $2x + z = 5$

By eliminating z, express y in terms of x only.
Write your answer in the form $y = ax^2 + bx + c$ where a, b and c are integers.

.....

.....

.....

.....

.....

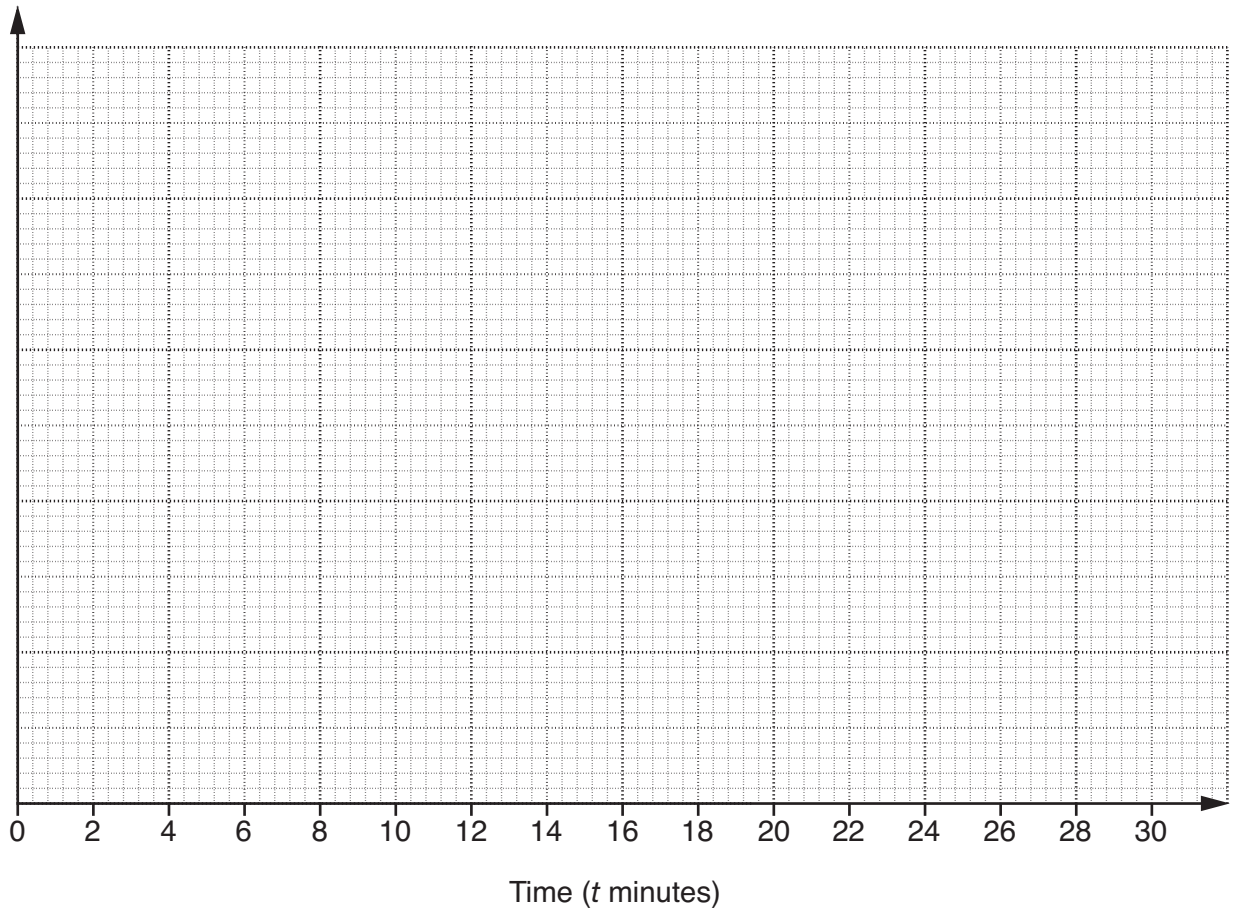
.....

(c) _____[5]

13 The table shows the distribution of the times (t minutes) of 500 calls to Ann's mobile phone.

Time (t minutes)	Frequency
$0 < t \leqslant 2$	24
$2 < t \leqslant 6$	66
$6 < t \leqslant 10$	200
$10 < t \leqslant 20$	140
$20 < t \leqslant 30$	70

(a) Draw a histogram, on the grid below, to show this information. [4]



(b) Estimate the number of calls Ann received which lasted

(i) less than 4 minutes,

.....

(b)(i) _____[1]

(ii) between 18 and 28 minutes.

.....

.....

(ii) _____[2]

14 Chay rows a distance of 960 km at an average speed of x km/h.
Doug rows the same distance. His average speed is 1 km/h less than Chay's.
Doug takes 32 hours longer than Chay.

(a) Form an equation in x and show that it simplifies to

$$\frac{30}{x-1} - \frac{30}{x} = 1$$

_____

_____

_____

_____[3]

(b) Solve, algebraically,

$$\frac{30}{x-1} - \frac{30}{x} = 1.$$

to find Chay's average speed.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

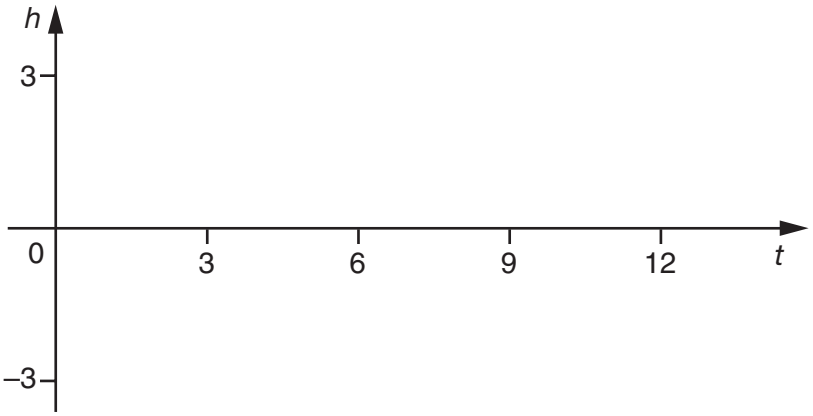
.....

(b) _____km/h [7]

15 The diagram shows an indicator for the height of the water in a tidal river. At high tide the water is 3 m above zero and at low tide the water is 3 m below zero.

The equation $h = 3\sin(30t)°$ can be used to find the height of the water at t hours after midnight.

(a) On the given axes sketch a graph of $h = 3\sin(30t)°$ for $0 \leqslant t \leqslant 12$.



[3]

(b) On how many occasions in the 12 hours is the height of the water 2 m above zero?

(b) _____[1]

---

16 Show that

$$\sqrt{2}\left(\sqrt{10}+\sqrt{6}\right)=2\left(\sqrt{5}+\sqrt{3}\right).$$

_____

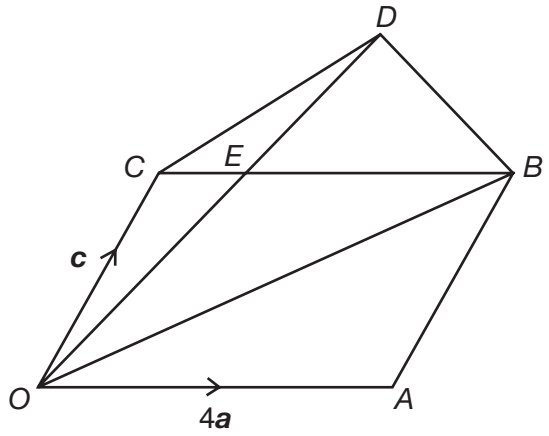
_____

_____

_____

_____[2]

17



NOT TO SCALE

In the diagram $OABC$ is a parallelogram.
$\overrightarrow{OA} = 4\boldsymbol{a}$, $\overrightarrow{OC} = \boldsymbol{c}$, $\overrightarrow{CE} = \frac{1}{4}\overrightarrow{CB}$, $\overrightarrow{OD} = \frac{4}{3}\overrightarrow{OE}$

(a) Find, in terms of $\boldsymbol{a}$ and $\boldsymbol{c}$,

(i) $\overrightarrow{OB}$,

.....

(a)(i) _____[1]

(ii) $\overrightarrow{OE}$,

.....

(ii) _____[1]

(iii) $\overrightarrow{OD}$,

.....

(iii) _____[1]

(iv) $\overrightarrow{CD}$.

Give your answer in its simplest form.

.....

.....

(iv) _____[2]

(b) Use your answers to part **(a)** to explain why $OBDC$ is a trapezium.

_____

_____

_____[1]

BLANK PAGE

BLANK PAGE