CANDIDATE NAME

CENTRE NUMBER

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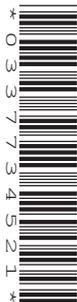
MATHEMATICS 0626/06

Paper 6 (Extended) May/June 2018

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

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 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** questions.
Electronic calculators should be used.
If working is required for any question it must be shown below that question.
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 96.

International Examinations

[Turn over

1 Anna owns a small business.

(a) The rent for Anna's office increases from £350 per month to £427 per month.

Calculate the percentage increase in Anna's rent.

....% [3]

(b) Anna invests £5640 in a savings account that pays compound interest at a rate of 2.5% per year.
She wants to leave her money in the account until she has £7100.

Anna's friend says:

At this interest rate it will take ten years before you have £7100 in your account.

Is Anna's friend correct?
Show how you decide.

.... [3]

(c) In a sale, prices are reduced by 25%.
Anna buys a laptop in the sale for £344.25 .

What was the price of the laptop before the sale?

£... [3]

(d) Anna buys some software from an American website.
The price of the software in dollars is $372.
The exchange rate is £1 = $1.46 **correct to two decimal places**.

Calculate the upper bound of the price that Anna pays.
Give your answer in pounds correct to the nearest penny.

£... [3]

2 Sai works as a computer technician and travels to visit customers.

(a) The table shows some conversions between units.

1 mile	=	1.6 kilometres
1 gallon	=	4.55 litres

Sai's car travels 45 miles per gallon of fuel.
The fuel tank on Sai's car contains 50 litres and is full.

Sai always refills his car with fuel when he has around $\frac{1}{4}$ of a tank left.

Jac is a customer who lives in France.
Sai drives a total of 416 km to Jac's office.

Does Sai refill his car with fuel before he arrives at Jac's office?
Show how you decide.

[5]

(b) (i) Sai takes the ferry to France and is standing on the deck.
The pressure on the deck, in **newtons per m²**, is calculated using the formula

$$\text{Pressure} = \frac{\text{Weight in newtons}}{\text{Area in contact with deck in m}^2}.$$

- Sai weighs 650 newtons.
- Both Sai's shoes are in contact with the deck.
- The area of the bottom of **one** of his shoes is $330 \, \text{cm}^2$.

Calculate the pressure made by Sai on the deck.
Give your answer in standard form, in **newtons per m²**.

....N/m² [3]

(ii) Paul is also a passenger on the ferry and is standing on the deck.
Paul's feet are much larger than Sai's feet.
Paul weighs the same as Sai.

Explain how the pressure made on the deck by Paul is different from the pressure made on the deck by Sai.

.... [1]

**(c)** The table shows information about the distances travelled by Sai, one month, when visiting customers.

Distance (m miles)	Frequency
$0 < m \leqslant 10$	36
$10 < m \leqslant 20$	32
$20 < m \leqslant 50$	7
$50 < m \leqslant 100$	1

Calculate an estimate for the mean distance Sai travels for each visit.

....miles [4]

3 **(a)** A bus is stationary at a bus stop.
It moves off and accelerates at a constant rate for 8 seconds until it reaches a speed of 12 metres per second.
The bus travels at a constant speed for the next 20 seconds.
It then decelerates at a constant rate for 12 seconds until it stops at the next bus stop.

(i) Complete the speed-time graph for this journey.
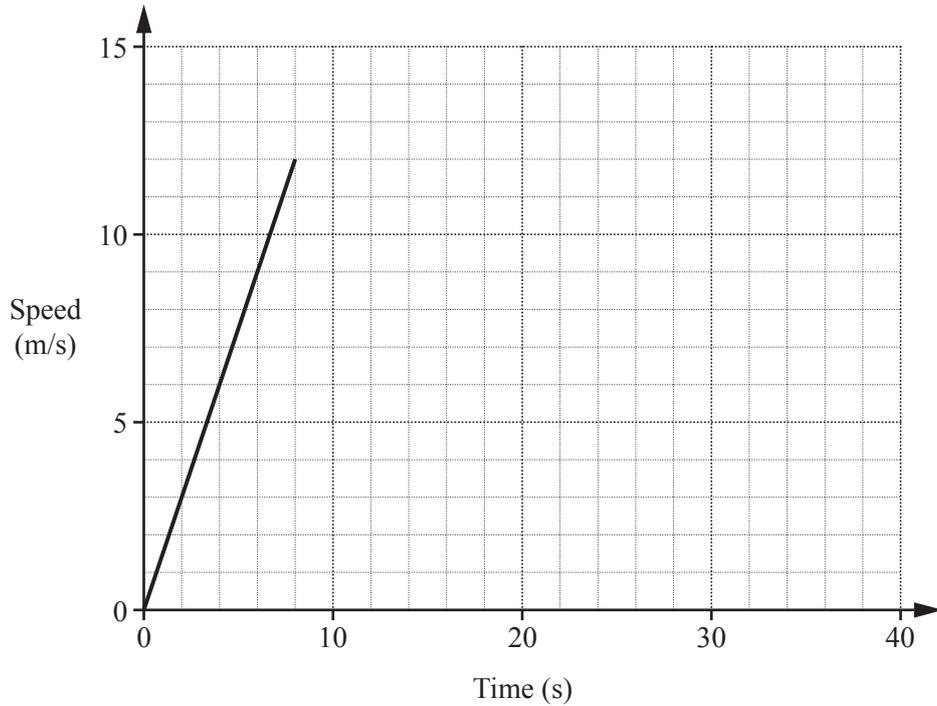
[2]

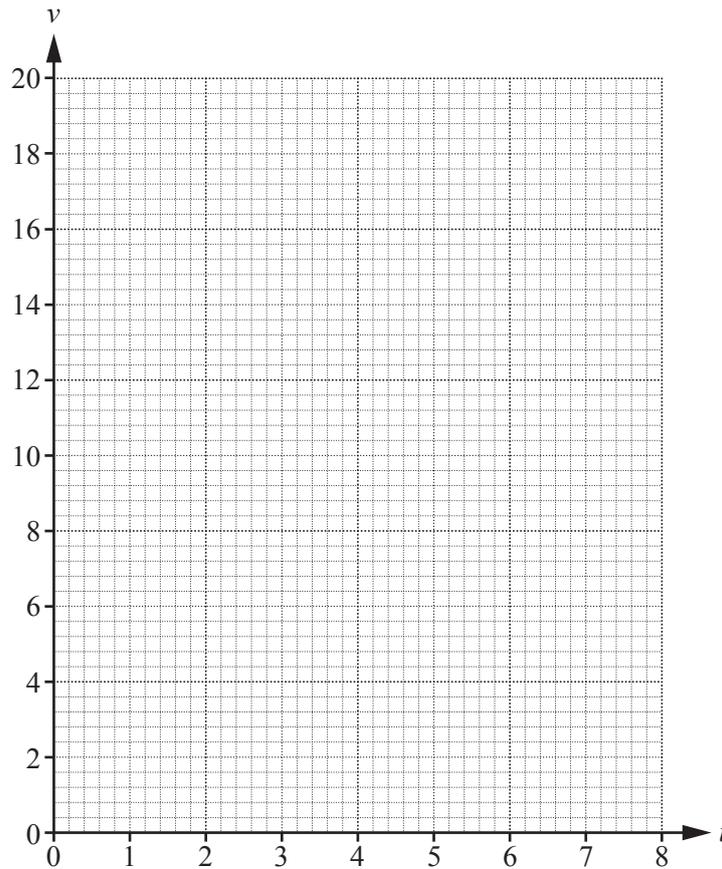**(ii)** Find the acceleration, in m/s^2, in the first 8 seconds.

....m/s^2 [1]

(b) A particle travels with speed v metres per second for t seconds where

$$v = 8t - t^2.$$

(i) On the grid, draw the graph of $v = 8t - t^2$ for $0 \leqslant t \leqslant 8$.

t	0	2	4	6	8
v	0				0

[4]

(ii) **Using your graph,** find an estimate for the acceleration of the particle after 6 seconds.
You must show your method clearly.

.... m/s^2 [3]

4 This cumulative frequency table summarises the times taken by 100 students to complete a puzzle.

Time taken (t minutes)	$t \leqslant 5$	$t \leqslant 10$	$t \leqslant 15$	$t \leqslant 20$	$t \leqslant 25$	$t \leqslant 30$
Cumulative frequency	0	15	55	80	96	100

(a) How many students took more than 10 minutes but not more than 15 minutes?

.... [1]

(b) Draw a cumulative frequency diagram to represent the information in the table.
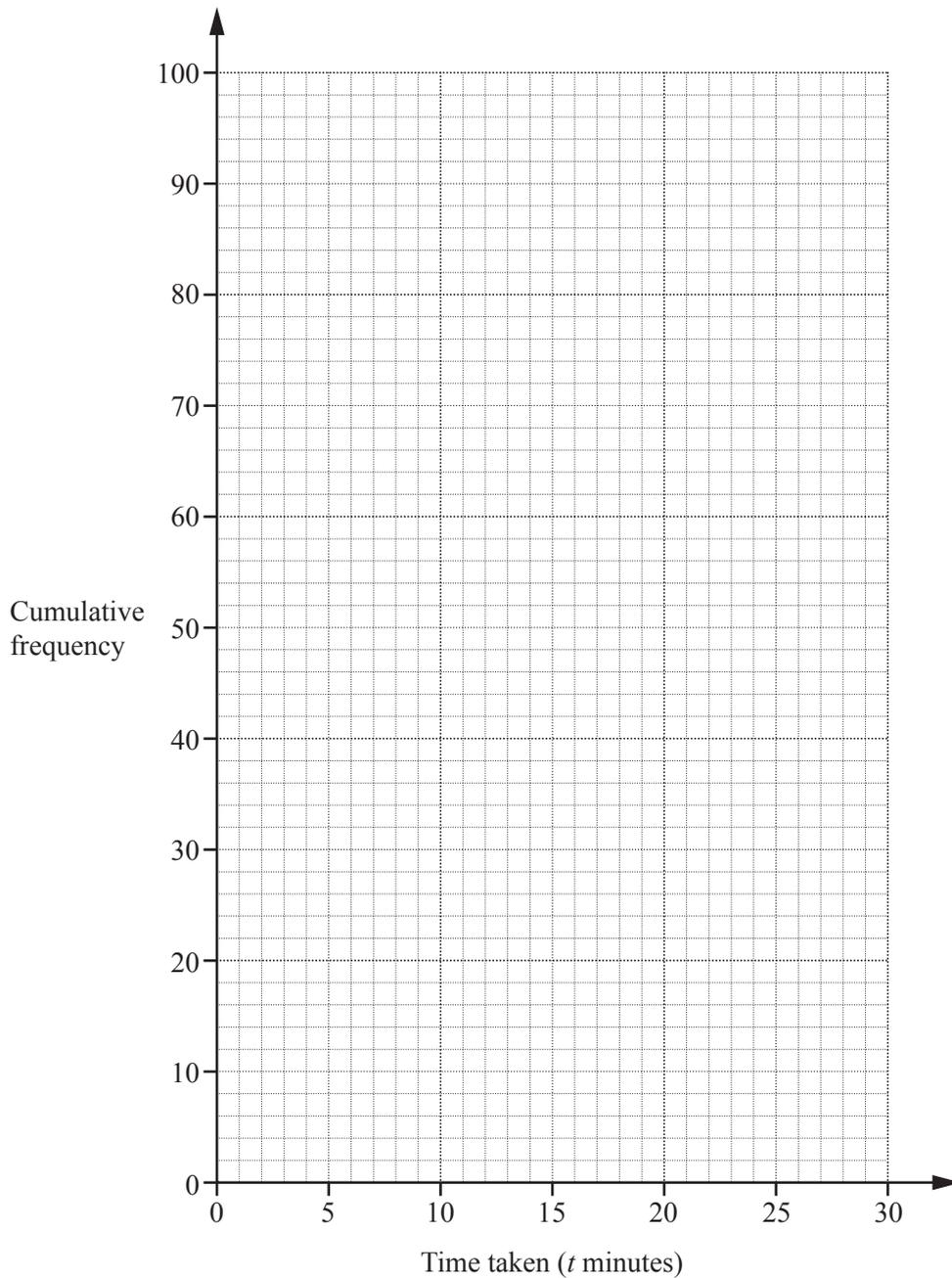
[2]

(c) Use your graph to estimate

    (i) the median,

....minutes [1]

    (ii) the inter-quartile range,

....minutes [2]

    (iii) the number of students who took more than 21 minutes.

.... [2]

5   **(a)** $f(x) = x^3 - x + 1$

    (i) Find $f(0.5)$.

.... [1]

    (ii) Find and simplify an expression for $f(2x)$.

.... [2]
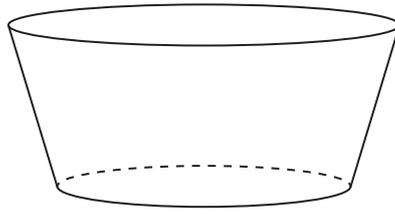
(b) $g(x) = 3^x$ $h(x) = 2x + 1$

Find an expression for $gh(x)$.
Give your answer in the form $p \times q^x$, where p and q are values to be found.
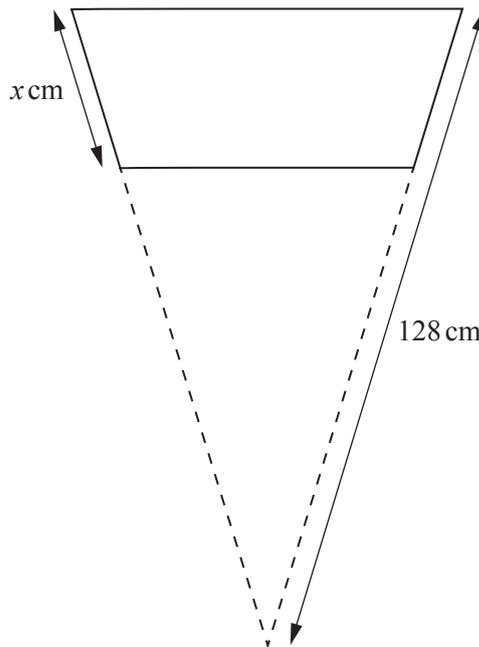
.... [3]

6 The diagram shows a water container with a solid base and an open top.
The solid base is a circle with area 9900 cm^2.
The open top is a circle with area 17 600 cm^2.

NOT TO
SCALE

The diagram below shows a cross-section of the container.

x cm

128 cm

NOT TO
SCALE

(a) Find the value of x.

$x = $ .... [4]

(b) Show that the total surface area of the container is $23\,100\,\text{cm}^2$ correct to 3 significant figures.

[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]

[4]

7 A company makes two different magazines, Teen-Art and Super-Draw.
The company also makes stickers and pens which are included with each magazine.

Each Teen-Art magazine includes   3 stickers   and   2 pens.
Each Super-Draw magazine includes   4 stickers   and   1 pen.

The company uses
- at most 600 stickers per hour
- 100 or more pens per hour.

The company makes x Teen-Art magazines per hour and y Super-Draw magazines per hour.

**(a)** One inequality showing part of this information is $3x + 4y \leqslant 600$.

Write down another inequality in terms of x and y.

.... [1]

(b) The number of Super-Draw magazines is at least half the number of Teen-Art magazines made per hour.

Complete the diagram to show clearly the region defined by this information and the two inequalities in **part (a)**. Shade the regions that are **not** required.

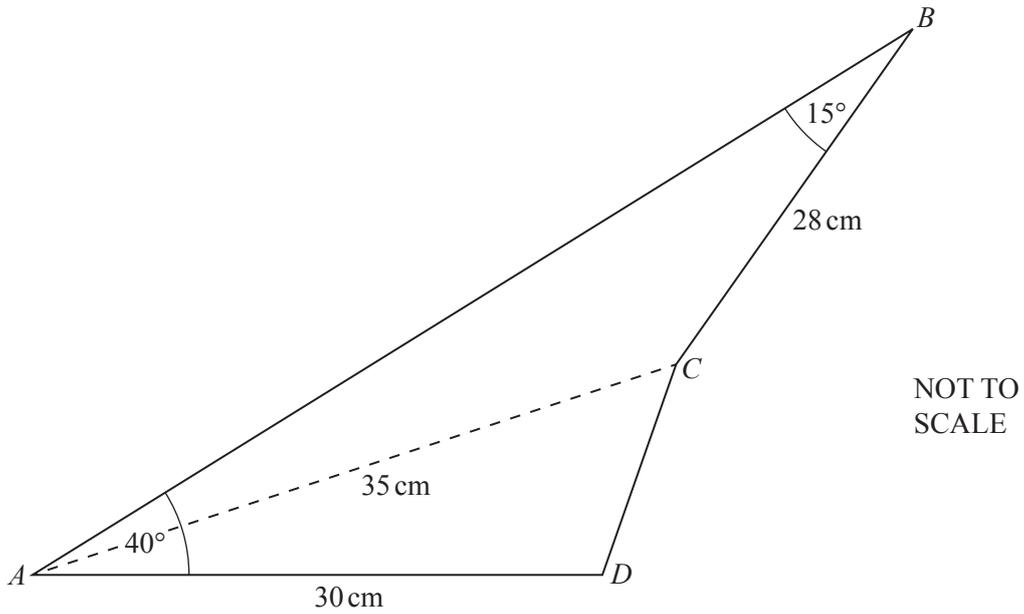The lines $y = \frac{1}{2}x$ and $3x + 4y = 600$ have been drawn for you.
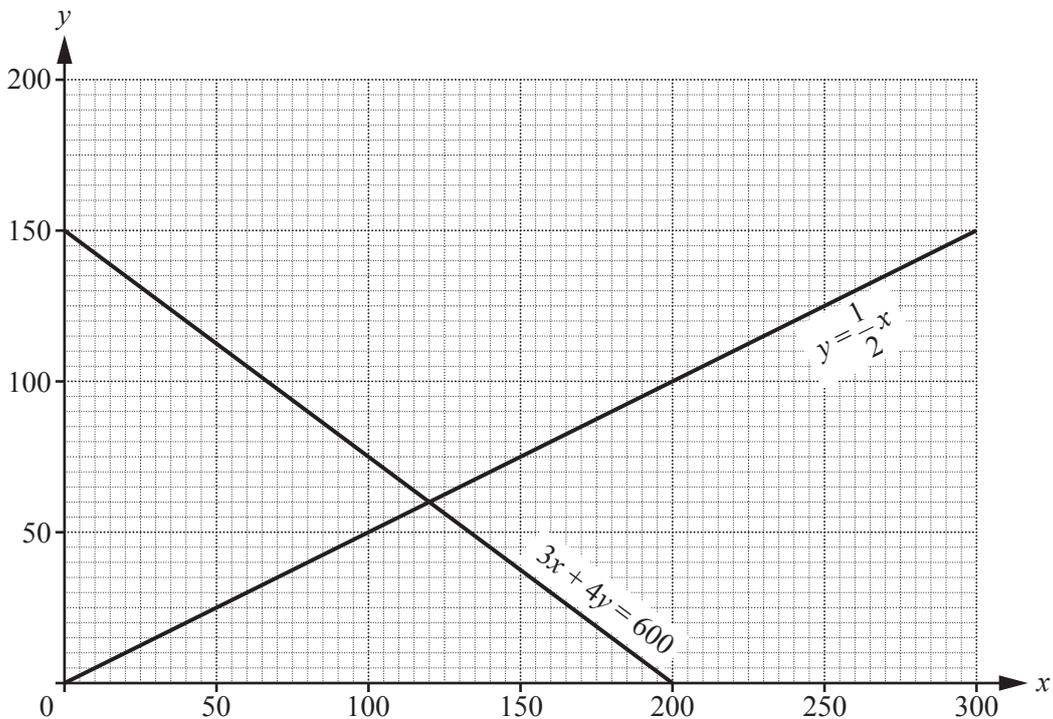
[3]

(c) Each magazine is sold at a profit of £2.

Use your answer to **part (b)** to find the number of each type of magazine that the company should make per hour to make the greatest possible profit.

Teen-Art ....

Super-Draw .... [2]

8 The diagram shows a quadrilateral *ABCD*.
Angle *ABC* = 15° and angle *BAD* = 40°.
AC = 35 cm, *AD* = 30 cm and *BC* = 28 cm.

(a) Find the area of triangle *ABC*.

....cm² [5]

(b) Find the length of *CD*.

CD = ... cm [4]

9 **(a)** Sami tries to differentiate $y = 20x^2 + 2$.

Sami writes:

$$\frac{dy}{dx} = 40x + 2x$$

Explain why Sami is incorrect.

....

.... [1]

(b) A curve has equation $y = 2x^4 + \frac{x}{8}$.

(i) Find $\frac{dy}{dx}$.

$\frac{dy}{dx} =$ .... [2]

(ii) Find the *x* co-ordinate of the turning point of the curve.

x = ... [2]

(iii) Show that this turning point is a minimum.

[2]

(iv) Line L is a tangent to the curve at the point where $x = \frac{1}{2}$.

Line M is perpendicular to line L.

Find the gradient of line M.

.... [3]

10 $A = \begin{pmatrix} 2 & -3 \\ 10 & 5 \end{pmatrix}$ $B = \begin{pmatrix} 5 & 6 \\ -2 & 4 \end{pmatrix}$ $2B - C = \begin{pmatrix} 27 & -1 \\ 2 & -10 \end{pmatrix}$

(a) Find the determinant of **A**.

.... [1]

(b) Find B^{-1}.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(c) Find **C**.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(d) Calculate **AB**.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

11 Stefan drives 30 miles from his home to work.
He drives to work at an average speed of x mph.

(a) Find an expression in terms of x for the time, in hours, it takes Stefan to drive to work.

.... [1]

(b) Stefan's journey home is the same distance as his journey to work.
His average speed on his journey home from work is 10 mph slower than on his journey to work.

Find an expression in terms of x for the time, in hours, it takes him to drive home.

.... [1]

(c) Stefan spends a **total** of 1 hour driving to and from work.

Find the average speed of Stefan's car on his journey to work.
You must show all your working.

.... mph [5]

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