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MATHEMATICS

0580/02

Paper 2 Non-calculator (Extended)

For examination from 2025

SPECIMEN PAPER

2 hours



You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- Calculators must **not** be used in this paper.
- You may use tracing paper.
- You must show all necessary working clearly.

INFORMATION

- The total mark for this paper is 100.
- The number of marks for each question or part question is shown in brackets [].

This document has **18** pages. Any blank pages are indicated.

Calculators must **not** be used in this paper.

- 1 Work out $(0.01)^2$.

\mathcal{R}

$$\left(\frac{1}{100}\right)^2 = \frac{1}{10000}$$

..... 0.0001 [1]

- 2 Write 57.3997 correct to 4 significant figures.

\mathcal{R}

..... 57.40 [1]

- 3 Aimee changes 250 euros into dollars.

\mathcal{R}

The exchange rate is 1 euro = \$1.10.

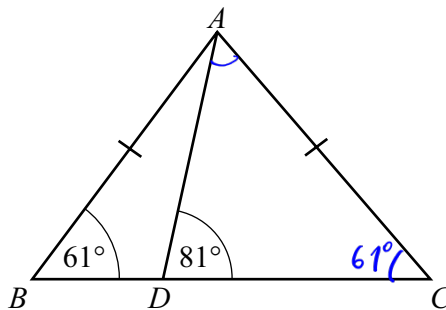
Calculate the number of dollars Aimee receives.

$$250 \times 1.1 = 250(1 + 0.1) = 250 + 25$$

\$ 275 [1]

- 4 The diagram shows two triangles, ABD and ADC .

\mathcal{R}



NOT TO
SCALE

BDC is a straight line, $AB = AC$, angle $ABD = 61^\circ$ and angle $ADC = 81^\circ$.

Work out angle DAC .

$$\widehat{ACB} = \widehat{ABC} = 60^\circ$$

$$\widehat{DAC} = 180^\circ - (81^\circ + 61^\circ) = 180^\circ - 142^\circ = 38^\circ$$

Angle $DAC =$ 38° [2]

5 Convert 0.17 m^2 into cm^2 .

\mathcal{R}

$$\begin{aligned} 0.17 &\times 100^2 \\ &= 0.17 \times 10^4 \\ &= 1700 \end{aligned}$$

..... 1700 cm^2 [1]

6 The mass of a solid metal cuboid is 4 kg. The volume of the cuboid is 600 cm^3 .

\mathcal{R}

Calculate the density of the metal, giving your answer in g/cm^3 .

[Density = mass \div volume]

$$\frac{4000}{600} = \frac{40}{6} = \frac{20}{3}$$

..... $\frac{20}{3}$ g/cm^3 [2]

7

\mathcal{R}

$$\mathbf{u} = \begin{pmatrix} 3 \\ -2 \end{pmatrix} \quad \mathbf{v} = \begin{pmatrix} -12 \\ 5 \end{pmatrix}$$

(a) Find $\mathbf{u} - 2\mathbf{v}$.

$$\begin{pmatrix} 3 \\ -2 \end{pmatrix} - 2 \begin{pmatrix} -12 \\ 5 \end{pmatrix} = \begin{pmatrix} 3 \\ -2 \end{pmatrix} - \begin{pmatrix} -24 \\ 10 \end{pmatrix} = \begin{pmatrix} 27 \\ -12 \end{pmatrix}$$

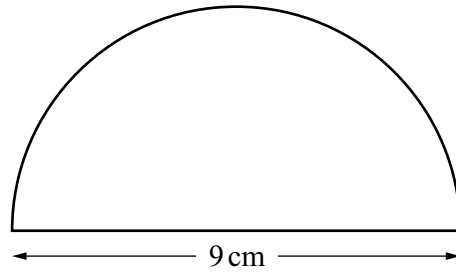
$$\begin{pmatrix} 27 \\ -12 \end{pmatrix}$$

[2]

(b) Find $|\mathbf{v}|$.

$$\sqrt{(-12)^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169} = 13$$

..... 13 [2]

8
KNOT TO
SCALE

The diagram shows a semicircle with diameter 9 cm.

Calculate the total perimeter of this semicircle.
Give your answer in exact form.

$$9 + \frac{2\pi \times 4.5}{2} = 9 + 4.5\pi$$

..... $9 + 4.5\pi$ cm [3]

9 In a sequence

K

$$T_1 = 17 \quad T_2 = 12 \quad T_3 = 7 \quad T_4 = 2.$$

$\underbrace{\hspace{1.5cm}}_{-5}$
 $\underbrace{\hspace{1.5cm}}_{-5}$
 $\underbrace{\hspace{1.5cm}}_{-5}$

Find

(a) T_5

..... -3 [1]

(b) T_n .

..... $-5n + 22$ [2]

10 Work out $2\frac{2}{3} + 3\frac{1}{2}$.

R Give your answer as a mixed number in its simplest form.

$$\frac{8}{3} + \frac{7}{2} = \frac{16}{6} + \frac{21}{6} = \frac{37}{6} = 6\frac{1}{6}$$

..... $6\frac{1}{6}$ [3]

11 Find the value of $64^{\frac{2}{3}}$.

R $(\sqrt[3]{64})^2 = 4^2 = 16$

..... 16 [2]

12 Work out, giving your answer in standard form,

R (a) $(7.1 \times 10^{-15}) \times (2 \times 10^3)$

$$(7.1 \times 2) \times (10^{-15} \times 10^3) = 14.2 \times 10^{-12}$$

..... 1.42×10^{-11} [2]

(b) $(5.2 \times 10^7) + (5.2 \times 10^6)$.

$$52 \times 10^6 + 5.2 \times 10^6$$

$$(52 + 5.2) 10^6$$

$$57.2 \times 10^6$$

..... 5.72×10^7 [2]

- 13 Find the number of sides of a regular polygon with interior angle 162° .

(R)

$$\frac{(n-2) 180}{n} = 162$$

$$180n - 360 = 162n$$

$$18n = 360$$

$$n = 20$$

..... 20 [2]

- 14 The range, mode, median and mean of five positive integers are all equal to 10.

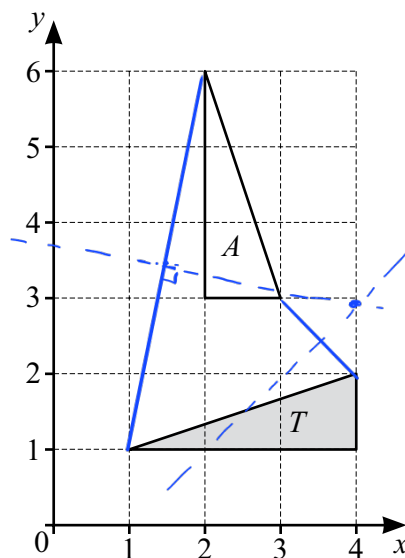
(R)

Find one possible set of these five integers.

..... 5, 10, 10, 10, 15 [4]

15

(R)



Describe fully the **single** transformation that maps triangle T onto triangle A .

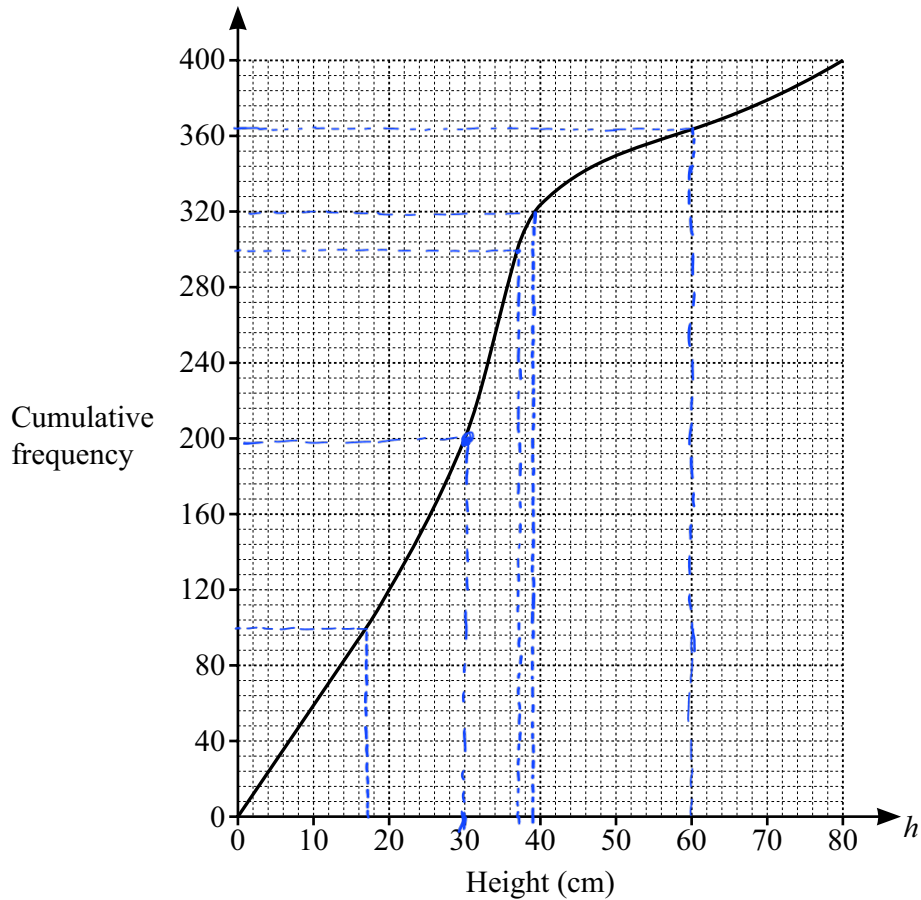
..... Rotation clockwise 90° around point $(4, 3)$

..... [3]

16 A student measures the height, h cm, of each of 400 plants.



(a) The cumulative frequency diagram shows the results.



Use the diagram to find an estimate for

(i) the median

..... 30 cm [1]

(ii) the interquartile range

$$37 - 17$$

..... 20 cm [2]

(iii) the 80th percentile

..... 39 cm [2]

(iv) the number of plants with a height greater than 60 cm.

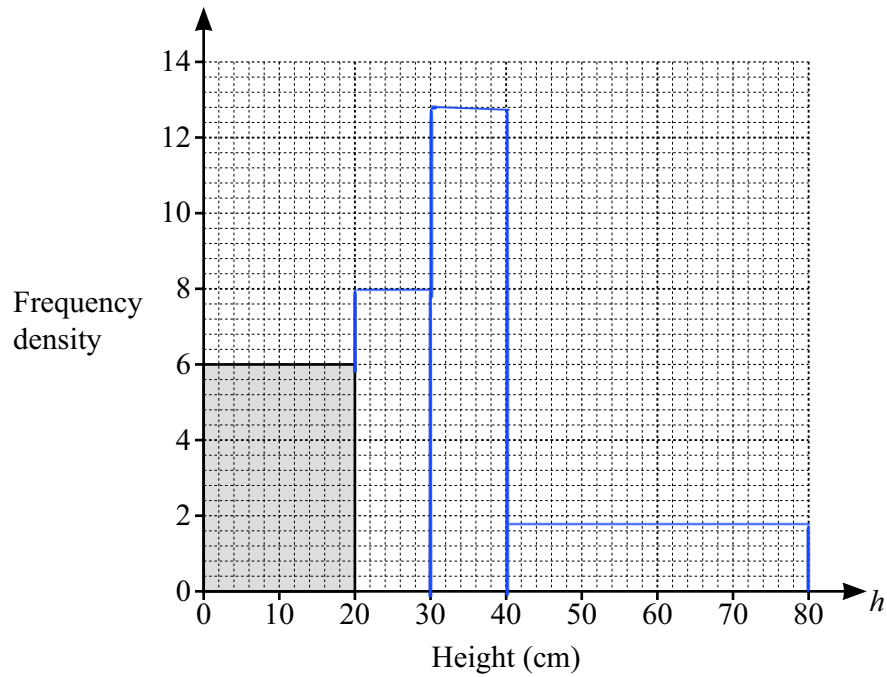
$$400 - 364 = 36$$

..... 36 [2]

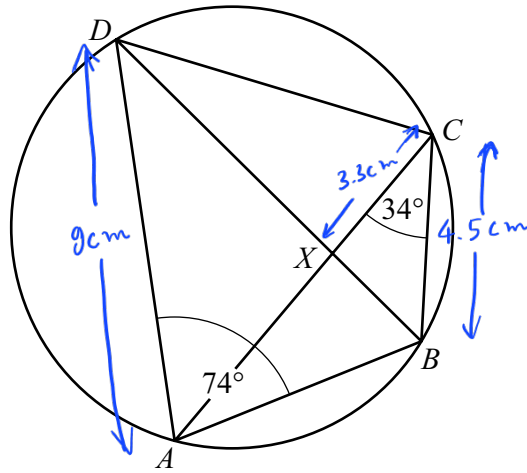
(b) The heights are also shown in the frequency table.

Height (h cm)	$0 < h \leq 20$	$20 < h \leq 30$	$30 < h \leq 40$	$40 < h \leq 80$
Frequency	120	80	124	76
<i>class interval</i>	<i>20</i>	<i>10</i>	<i>10</i>	<i>40</i>
<i>freq. density</i>	<i>6</i>	<i>8</i>	<i>12.4</i>	<i>1.9</i>

Complete the histogram to show this information.



[3]



NOT TO SCALE

The diagram shows a cyclic quadrilateral $ABCD$.
 BD and AC intersect at X .

- (a) Angle $BAD = 74^\circ$ and angle $BCA = 34^\circ$.

Find

- (i) angle BDA

Angle $BDA = \dots\dots\dots 34^\circ \dots\dots\dots [1]$

- (ii) angle BCD

$180^\circ - 74^\circ$

Angle $BCD = \dots\dots\dots 106^\circ \dots\dots\dots [1]$

- (iii) angle ABD .

$106^\circ - 34^\circ$

Angle $ABD = \dots\dots\dots 72^\circ \dots\dots\dots [1]$

- (b) In the diagram, triangle ADX is similar to triangle BCX .
 $BC = 4.5$ cm, $AD = 9$ cm and $CX = 3.3$ cm.

Work out XD .

$\triangle ADX \sim \triangle BCX$

$$\frac{DX}{CX} = \frac{AD}{BC}$$

$$\frac{DX}{3.3} = \frac{9}{4.5}$$

$$\Rightarrow DX = \frac{9 \times 3.3}{4.5}$$

$XD = \dots\dots\dots \frac{33}{5} \dots\dots\dots \text{cm} [2]$

18 $f(x) = 3 - 2x$ $g(x) = 2x + 3$ $h(x) = 2^x$

R

(a) (i) Find $f(-3)$.

$$3 - 2(-3)$$

..... 9 [1]

(ii) Find $gf(-3)$.

$$g f(-3) = g(9) = 2 \times 9 + 3$$

..... 21 [1]

(b) Find $f^{-1}(x)$.

$$x(-2) \rightarrow +3$$

$$: (-2) \leftarrow -3$$

$$f^{-1}(x) = \frac{x-3}{-2} \dots\dots\dots [2]$$

(c) Find x when $gg(x) = 7$.

$$\begin{aligned} 2(2x+3) + 3 &= 7 \\ 4x + 6 + 3 &= 7 \\ 4x &= -2 \\ x &= -0.5 \end{aligned}$$

$x = \dots\dots\dots -0.5 \dots\dots\dots [3]$

(d) Find x when $h^{-1}(x) = 5$.

$$\begin{aligned} y &= 2^x \Rightarrow \sqrt[x]{y} = 2 \\ \text{Swap: } \sqrt[4]{x} &= 2 \\ \sqrt[5]{x} &= 2 \end{aligned}$$

$x = \dots\dots\dots 3.2 \dots\dots\dots [2]$

19 (a) Simplify.



$$\begin{aligned} & \sqrt{32} + \sqrt{98} \\ & \sqrt{16 \times 2} + \sqrt{49 \times 2} \\ & = 4\sqrt{2} + 7\sqrt{2} \\ & = 11\sqrt{2} \end{aligned}$$

..... $11\sqrt{2}$ [2]

(b) Rationalise the denominator.

$$\frac{1}{\sqrt{2}+1} = \frac{1(\sqrt{2}-1)}{(\sqrt{2}+1)(\sqrt{2}-1)} = \frac{\sqrt{2}-1}{2-1} = \sqrt{2}-1$$

..... $\sqrt{2}-1$ [2]

20

$$y \propto \frac{1}{\sqrt{x}}$$

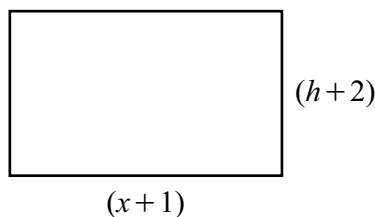
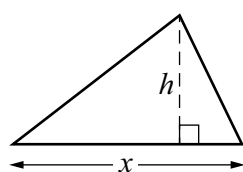

When $y = 8$, $x = 4$.Find y when $x = 49$.

$$\begin{aligned} y &= \frac{k}{\sqrt{x}} \\ 8 &= \frac{k}{\sqrt{4}} \Rightarrow k = 8 \times 2 = 16 \\ &\Rightarrow y = \frac{16}{\sqrt{x}} \\ \text{When } x &= 49, \quad y = \frac{16}{\sqrt{49}} \end{aligned}$$

$y = \dots\dots\dots \frac{16}{7} \dots\dots\dots$ [3]

21 In this question, all measurements are in centimetres.

R



NOT TO
SCALE

The height of the triangle is h and the height of the rectangle is $(h+2)$.
The length of the base of the triangle is x and the length of the rectangle is $(x+1)$.
The area of the triangle is 11 cm^2 and the area of the rectangle is 39 cm^2 .

(a) Write down an expression, in terms of x , for the height of the rectangle.

$$(h+2)(x+1) = 39$$

$$h+2 = \frac{39}{x+1}$$

$$\frac{39}{x+1} \dots\dots\dots [1]$$

(b) Show that $2x^2 - 15x + 22 = 0$.

$$\frac{1}{2}hx = 11$$

$$\left(\frac{39}{x+1} - 2\right)x = 22$$

$$[39 - 2(x+1)]x = 22(x+1)$$

$$39x - 2x^2 - 2x = 22x + 22$$

$$2x^2 - 15x + 22 = 0$$

[3]

(c) By factorising and solving $2x^2 - 15x + 22 = 0$, find the two possible heights of the triangle.

$$(2x - 11)(x - 2) = 0$$

$$2x - 11 = 0 \quad \text{or} \quad x - 2 = 0$$

$$2x = 11 \quad \text{or} \quad x = 2$$

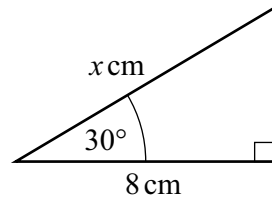
$$x = 5.5 \quad \text{or} \quad x = 2$$

$$\Rightarrow h = \frac{22}{5.5} = \frac{220}{55} = \frac{20}{5} = 4 \quad \text{or} \quad h = \frac{22}{2} = 11$$

$$h = \dots\dots\dots 4 \dots\dots \text{ or } h = \dots\dots\dots 11 \dots\dots [5]$$

22

R

NOT TO
SCALEFind the exact value of x .

$$\cos 30^\circ = \frac{8}{x}$$

$$\Rightarrow x = \frac{8}{\cos 30^\circ} = \frac{8}{\frac{\sqrt{3}}{2}} = \frac{16}{\sqrt{3}}$$

$$x = \frac{16}{\sqrt{3}} \dots \dots \dots [4]$$

23 Write as a single fraction in its simplest form.

R

$$\frac{3}{x-4} - \frac{4}{x+3}$$

$$\frac{3(x+3) - 4(x-4)}{(x-4)(x+3)}$$

$$\frac{3x + 9 - 4x + 16}{(x-4)(x+3)}$$

$$\frac{-x + 25}{(x-4)(x+3)} \dots \dots \dots [3]$$

24 (a) Write $x^2 - 4x + 7$ in the form $(x - a)^2 + b$.

7

$$x^2 - 2 \times 2 + 2^2 + 3$$

$$(x - 2)^2 + 3$$

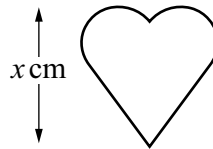
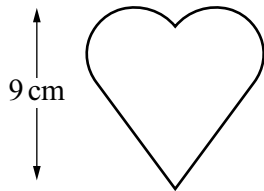
$$(x - 2)^2 + 3 \dots\dots\dots [2]$$

(b) Write down the coordinates of the turning point of the graph of $y = x^2 - 4x + 7$.

$$(\dots\dots 2 \dots\dots, \dots\dots 3 \dots\dots) [1]$$

25

7



NOT TO SCALE

The two shapes are mathematically similar.

The area of the larger shape is 36 cm^2 and the area of the smaller shape is 25 cm^2 .

The height of the larger shape is 9 cm and the height of the smaller shape is x cm.

Find the value of x .

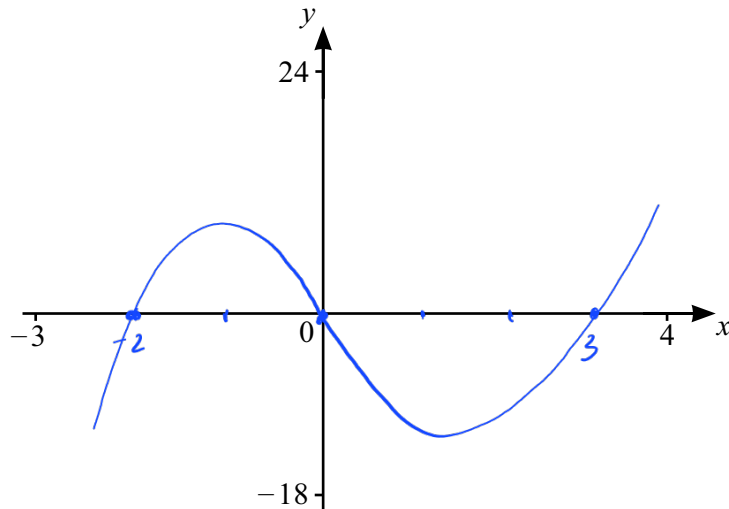
$$\frac{36}{25} = \left(\frac{9}{x}\right)^2$$

$$\frac{9}{x} = \frac{6}{5}$$

$$6x = 9 \times 5$$

$$x = \frac{45}{6}$$

$$x = \dots\dots\dots \frac{15}{2} \dots\dots\dots [3]$$



$$f(x) = x(x+2)(x-3)$$

- (a) On the diagram, sketch the graph of $y = f(x)$ for $-3 \leq x \leq 4$. Show the values of the intersections with the axes. [3]

- (b) Expand and simplify.

$$\begin{aligned} & x(x+2)(x-3) \\ & (x^2 + 2x)(x-3) \\ & x^3 + 2x^2 - 3x^2 - 6x \end{aligned}$$

$$\dots x^3 - x^2 - 6x \dots [3]$$

- (c) A is the point $(1, -6)$. The tangent to the graph of $y = f(x)$ at A meets the y -axis at B .

Find the coordinates of B .

$$\frac{dy}{dx} = 3x^2 - 2x - 6$$

$$m_{\text{tangent}} = 3(1)^2 - 2 \times 1 - 6 = -5$$

$$\text{Equation of tangent: } y - (-6) = -5(x - 1)$$

$$B \text{ is on the } y\text{-axis} \Rightarrow x_B = 0$$

$$y_B + 6 = -5(0 - 1) = 5$$

$$\Rightarrow y_B = 5 - 6 = -1$$

$$(\dots 0 \dots, \dots -1 \dots) [5]$$