



Cambridge O Level

CANDIDATE
NAME

CENTRE
NUMBER

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MATHEMATICS (SYLLABUS D)

4024/22

Paper 2

October/November 2020

2 hours 30 minutes

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.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

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 **20** pages. Blank pages are indicated.

- 1 (a) The cash price of a car is \$13 000.
Marta pays in instalments for this car.

Marta pays a deposit of 15% of the cash price.
She then pays 24 monthly instalments of \$500.

Calculate the total amount Marta pays for the car.

\$ [3]

- (b) The price of a phone is reduced by 12% in a sale.
The sale price of the phone is \$286.

Calculate the price of the phone before the sale.

\$ [2]

- (c) The exchange rate between dollars (\$) and pounds (£) is $\$1 = \pounds 0.71$.
The exchange rate between euros (€) and pounds (£) is $\pounds 1 = \text{€} 0.87$.

Calculate the exchange rate between dollars and euros.
Give your answer correct to 2 decimal places.

$\$1 = \text{€} \dots\dots\dots$ [2]

- (d) Samuel invests \$1500 in an account paying 1.9% per year compound interest. Nina invests \$1500 in an account paying 1.9% per year simple interest. They each leave the money in their account for 5 years.

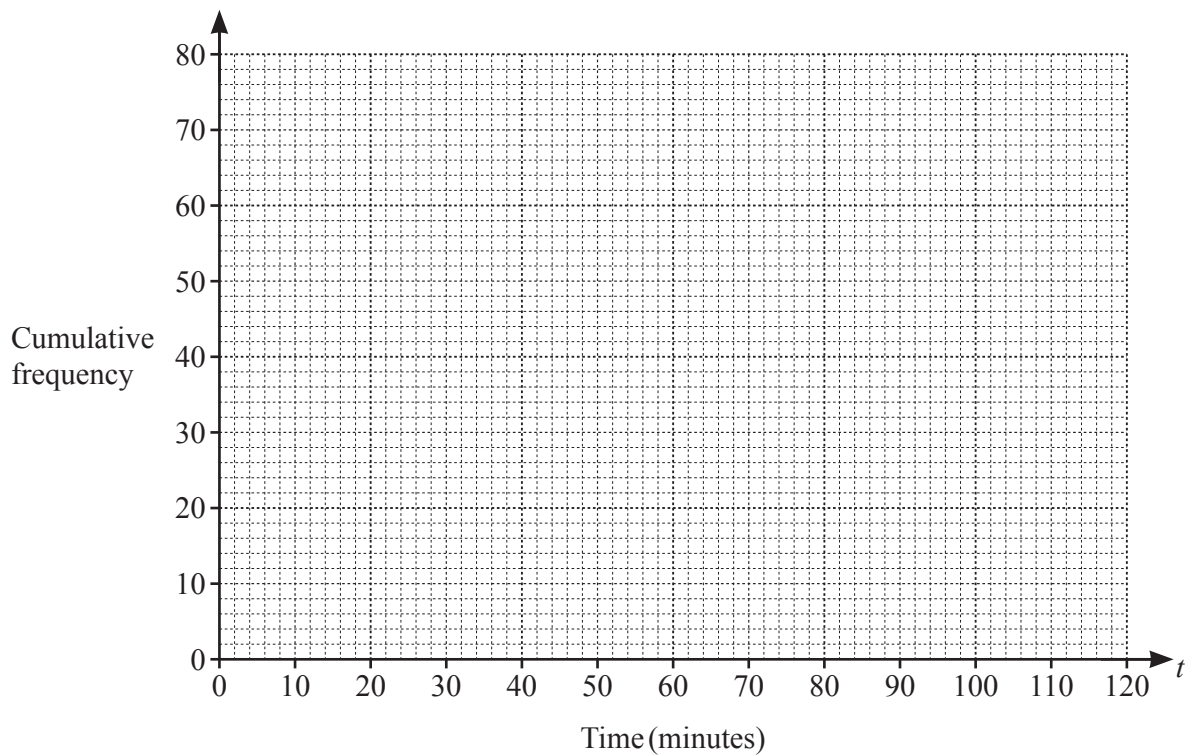
At the end of 5 years, how much more money does Samuel have in his account than Nina has in hers?

\$ [4]

- 2 (a) A group of 80 students each completed a task.
The table shows the time, t minutes, each student took to complete the task.

Time (t minutes)	$20 < t \leq 40$	$40 < t \leq 60$	$60 < t \leq 80$	$80 < t \leq 100$	$100 < t \leq 120$
Frequency	10	20	34	12	4

- (i) On the grid, draw a cumulative frequency diagram to represent this information.



[3]

- (ii) Use your diagram to estimate

(a) the median,

..... minutes [1]

(b) the interquartile range.

..... minutes [2]

- (b) A group of 160 adults each completed the same task.
 The table shows the number of errors made by each of these adults.

Number of errors	0	1	2	3	4	5
Frequency	24	30	50	32	16	8

- (i) Calculate the mean.

..... [2]

- (ii) One of the adults is selected at random.

Find the probability that this adult made more than 3 errors.

..... [1]

- (iii) Two of the adults are selected at random.

Find the probability that they each made exactly one error.

..... [2]

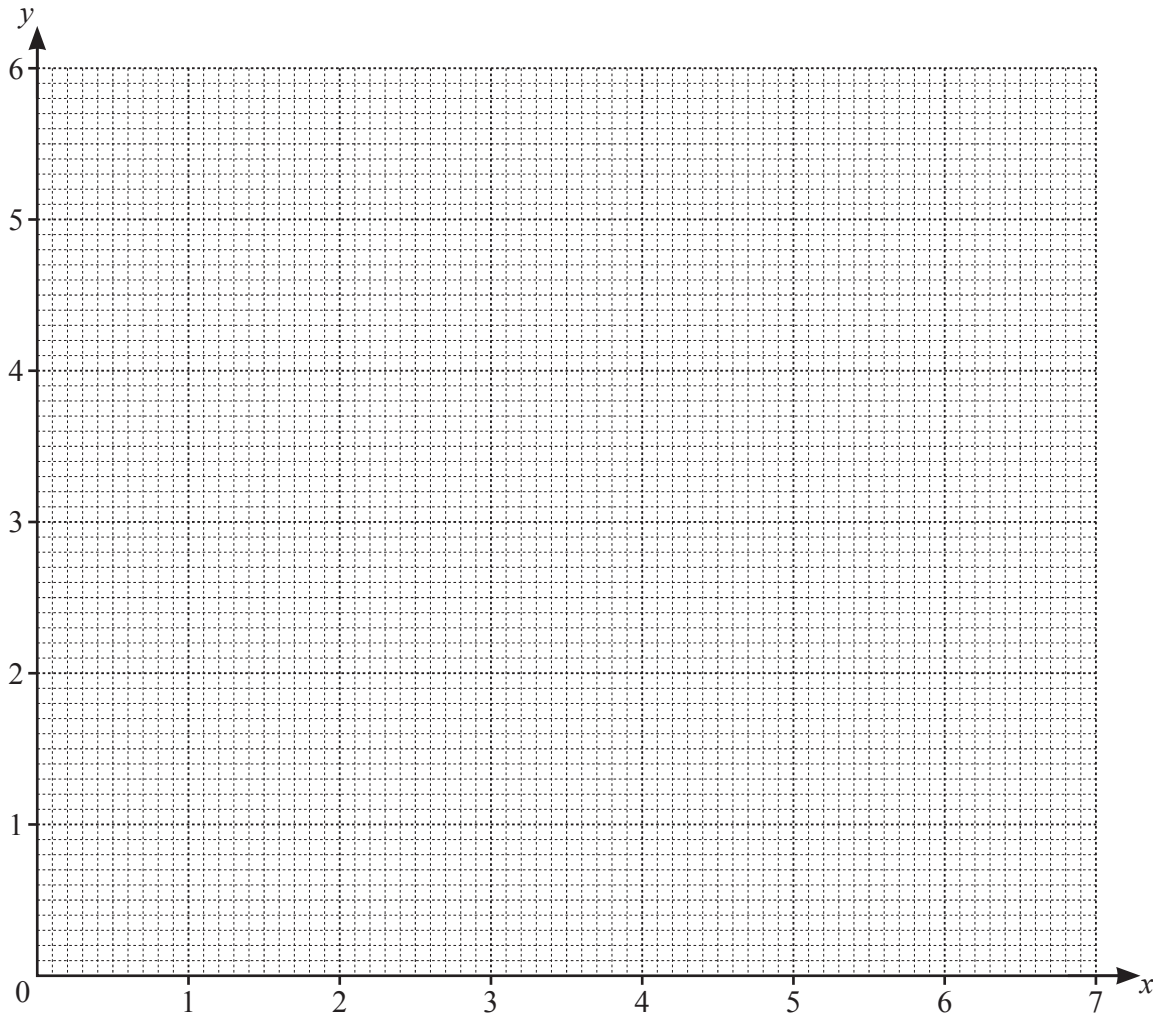
- 3 (a) Complete the table for $y = \frac{x}{4} + \frac{2}{x}$.

The values of y are given correct to 2 decimal places where appropriate.

x	0.5	1	1.5	2	3	4	5	6	7
y	4.13	2.25	1.71	1.5	1.42	1.5	1.65	1.83	

[1]

- (b) On the grid, draw the graph of $y = \frac{x}{4} + \frac{2}{x}$ for $0.5 \leq x \leq 7$.



[3]

(c) By drawing a tangent, estimate the gradient of $y = \frac{x}{4} + \frac{2}{x}$ when $x = 1$.

..... [2]

(d) (i) On the grid, draw the graph of $2y + x = 6$.

[2]

(ii) Write down the x -coordinates of the points of intersection of the graphs of $2y + x = 6$ and $y = \frac{x}{4} + \frac{2}{x}$.

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

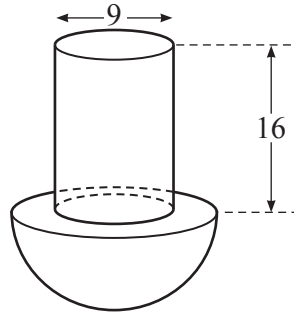
(iii) These x -coordinates are the solutions of the equation $3x^2 + Ax + B = 0$.

Use $2y + x = 6$ and $y = \frac{x}{4} + \frac{2}{x}$ to find the value of A and the value of B .

$A = \dots\dots\dots$

$B = \dots\dots\dots$ [3]

- 4 (a) [Volume of a sphere = $\frac{4}{3}\pi r^3$]
[Surface area of a sphere = $4\pi r^2$]



The diagram shows a solid formed by joining a cylinder to a hemisphere.
The diameter of the cylinder is 9 cm and its height is 16 cm.

- (i) The volume of the hemisphere is equal to the volume of the cylinder.

Show that the radius of the hemisphere is 7.86 cm, correct to 2 decimal places.

[4]

- (ii) Calculate the total surface area of the solid.

..... cm² [3]

- (b) A different solid is in the shape of a cuboid.
The cuboid measures 8 cm by 4 cm by 6 cm.
These measurements are given correct to the nearest centimetre.

Calculate the lower bound of the volume of the cuboid.

..... cm³ [2]

- 5 (a) Gita has n stamps.
 Ravi has twice as many stamps as Gita.
 Sanjay has 7 fewer stamps than Ravi.

Altogether, the three children have 108 stamps.

Form an equation in n and solve it to find the number of stamps Sanjay has.

..... [3]

(b) Simplify $\frac{6t^2v^3}{5} \div \frac{3t^2}{v^2}$.

..... [2]

(c) Simplify $\frac{x^2 - 16}{3x^2 + 10x - 8}$.

..... [3]

6 $f(x) = 4(2 - x)$ $g(x) = 7 - \frac{3x}{5}$

(a) Find $f(-5)$.

..... [1]

(b) Solve the inequality $f(x) > 3$.

..... [2]

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

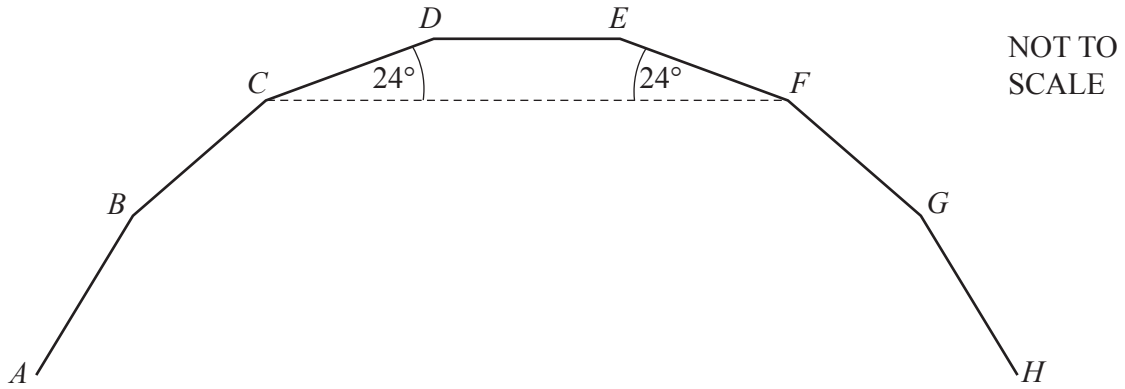
$f^{-1}(x) =$ [2]

(d) $f(p) = g(2p + 1)$

Find the value of p .

$p =$ [3]

7 (a)



The diagram shows part of an n -sided regular polygon $ABCDEFGH\dots$
 $\widehat{DCF} = \widehat{EFC} = 24^\circ$.

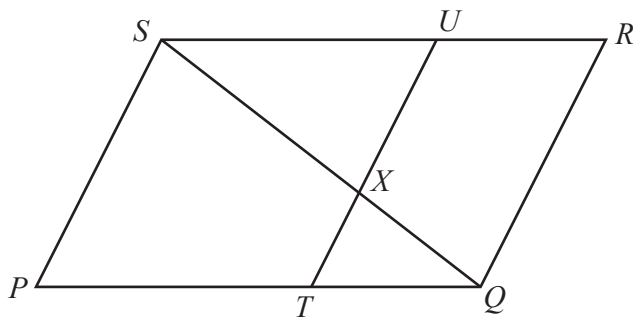
(i) Find the value of n .

$n = \dots\dots\dots$ [2]

(ii) Find \widehat{HFG} .

$\widehat{HFG} = \dots\dots\dots$ [2]

(b)



NOT TO SCALE

PQRS is a parallelogram.

TU and *SQ* intersect at *X* and *TU* is parallel to *QR*.

$$\frac{TQ}{PT} = \frac{UR}{SU} = \frac{1}{2}$$

- (i) Show that triangle *PQS* is similar to triangle *TQX*.
Give a reason for each statement you make.

.....

 [3]

- (ii) Find the ratio *SX* : *SQ*.

..... : [1]

- (iii) Find the ratio area of triangle *TQX* : area of parallelogram *PQRS*.

..... : [2]

8 (a) H is the point $(-7, 4)$ and $\overrightarrow{HJ} = \begin{pmatrix} 10 \\ -6 \end{pmatrix}$.

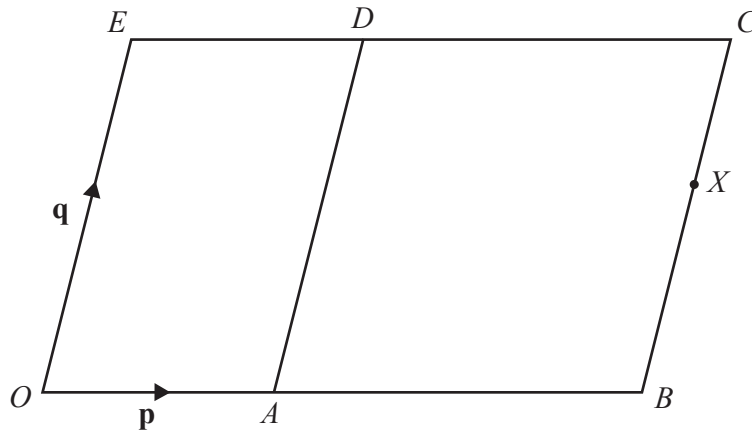
(i) Calculate the magnitude of \overrightarrow{HJ} .

..... [2]

(ii) Given that $\overrightarrow{HK} = 3\overrightarrow{HJ}$, find the coordinates of point K .

(..... ,) [2]

(b)

NOT TO
SCALE

The diagram shows a parallelogram $OBCE$.

$\vec{OA} = \mathbf{p}$ and $\vec{OE} = \mathbf{q}$.

AD is parallel to OE and $OA : AB = 1 : 3$.

X is a point on BC such that $BX : XC = 3 : 2$.

Express, as simply as possible, in terms of \mathbf{p} and/or \mathbf{q}

(i) \vec{OC} ,

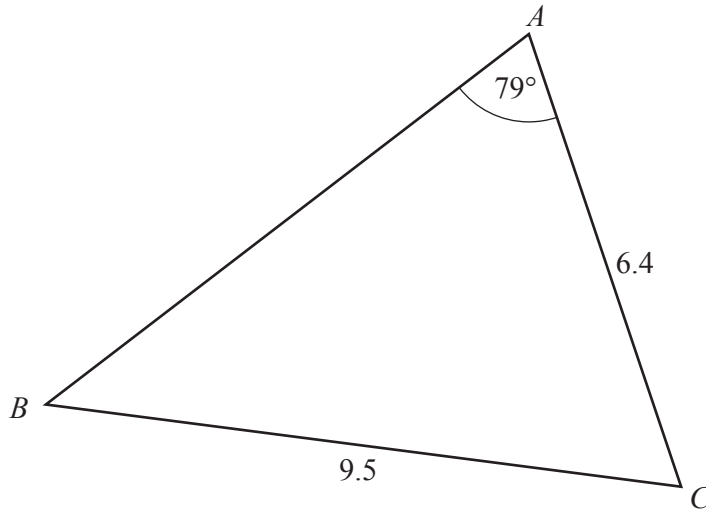
$$\vec{OC} = \dots\dots\dots [1]$$

(ii) \vec{AX} ,

$$\vec{AX} = \dots\dots\dots [2]$$

(iii) \vec{EX} .

$$\vec{EX} = \dots\dots\dots [2]$$



NOT TO SCALE

In triangle ABC , $AC = 6.4$ cm, $BC = 9.5$ cm and $\hat{BAC} = 79^\circ$.

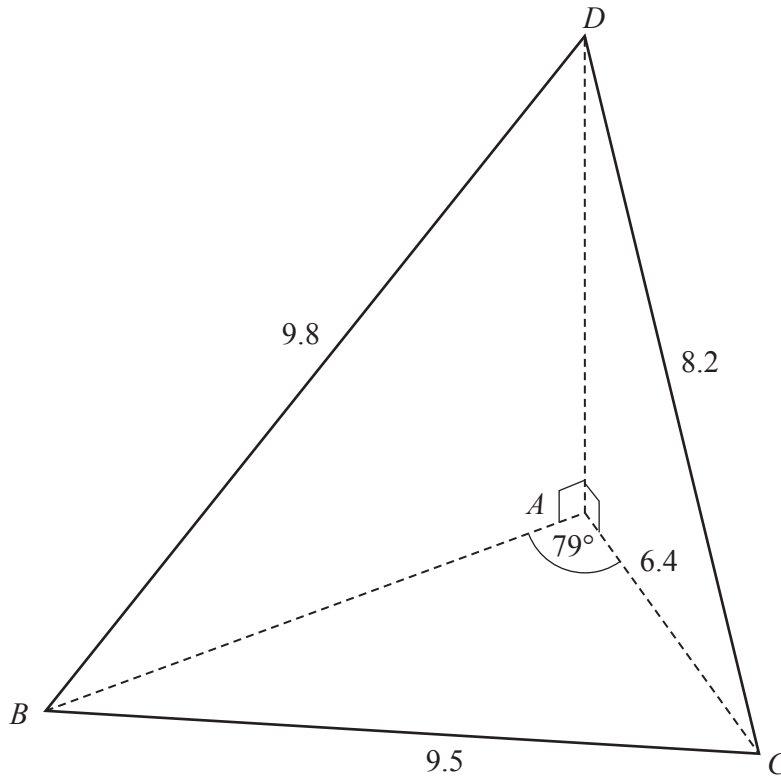
(a) (i) Calculate \hat{ABC} .

$\hat{ABC} = \dots\dots\dots$ [3]

(ii) Calculate the area of triangle ABC .

$\dots\dots\dots \text{cm}^2$ [3]

(b)



The same triangle ABC forms the horizontal base of a pyramid $ABCD$.
 $BD = 9.8$ cm and $CD = 8.2$ cm.
 $\hat{BAD} = \hat{CAD} = 90^\circ$.

(i) Calculate \hat{BDC} .

$\hat{BDC} = \dots\dots\dots$ [3]

(ii) Calculate the angle of elevation of D from C .

$\dots\dots\dots$ [2]

10 Amira drives 40 km to work.

- (a) Amira takes x minutes to drive the first 30 km of the journey.

Show that her average speed in km/h for the first 30 km of the journey is $\frac{1800}{x}$.

[1]

- (b) Amira's average speed in km/h for the final 10 km of the journey is $\frac{600}{x-25}$.

Her average speed for the first 30 km of the journey is 8 km/h slower than her average speed for the final 10 km.

Form an equation in x and show that it simplifies to $x^2 + 125x - 5625 = 0$.

[3]

- (c) Solve the equation $x^2 + 125x - 5625 = 0$.
Show your working and give each answer correct to 1 decimal place.

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [3]$$

- (d) It takes Amira 25 minutes less to drive the final 10 km than it takes for the first 30 km.
Calculate Amira's average speed, in km/h, for the whole journey.

$$\dots\dots\dots \text{ km/h } [3]$$

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