Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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3707725603

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.

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[Turn over

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 = £0.71 .
The exchange rate between euros (€) and pounds (£) is €1 = £0.87 .

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

$1 = € ..... [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.

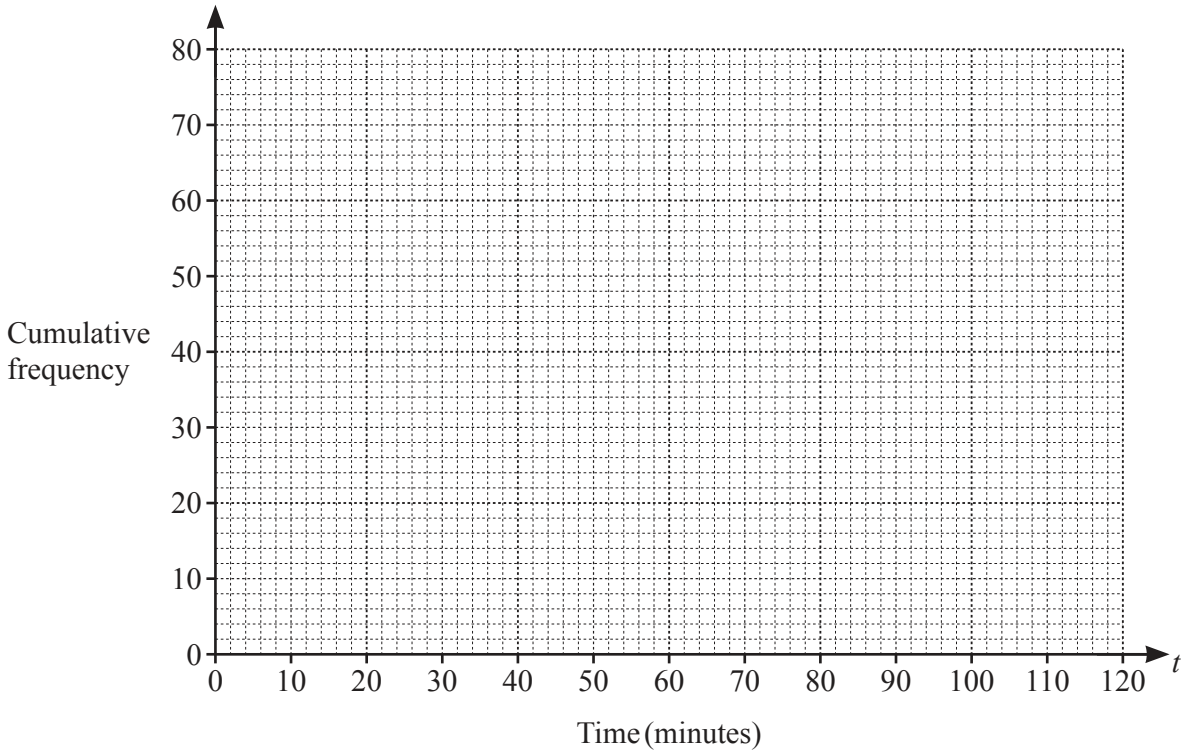
At the end of 5 years, how much more money does Samuel have in his account than Nina has in hers?

$ ..... [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)	$20 < t \leqslant 40$	$40 < t \leqslant 60$	$60 < t \leqslant 80$	$80 < t \leqslant 100$	$100 < t \leqslant 120$
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]

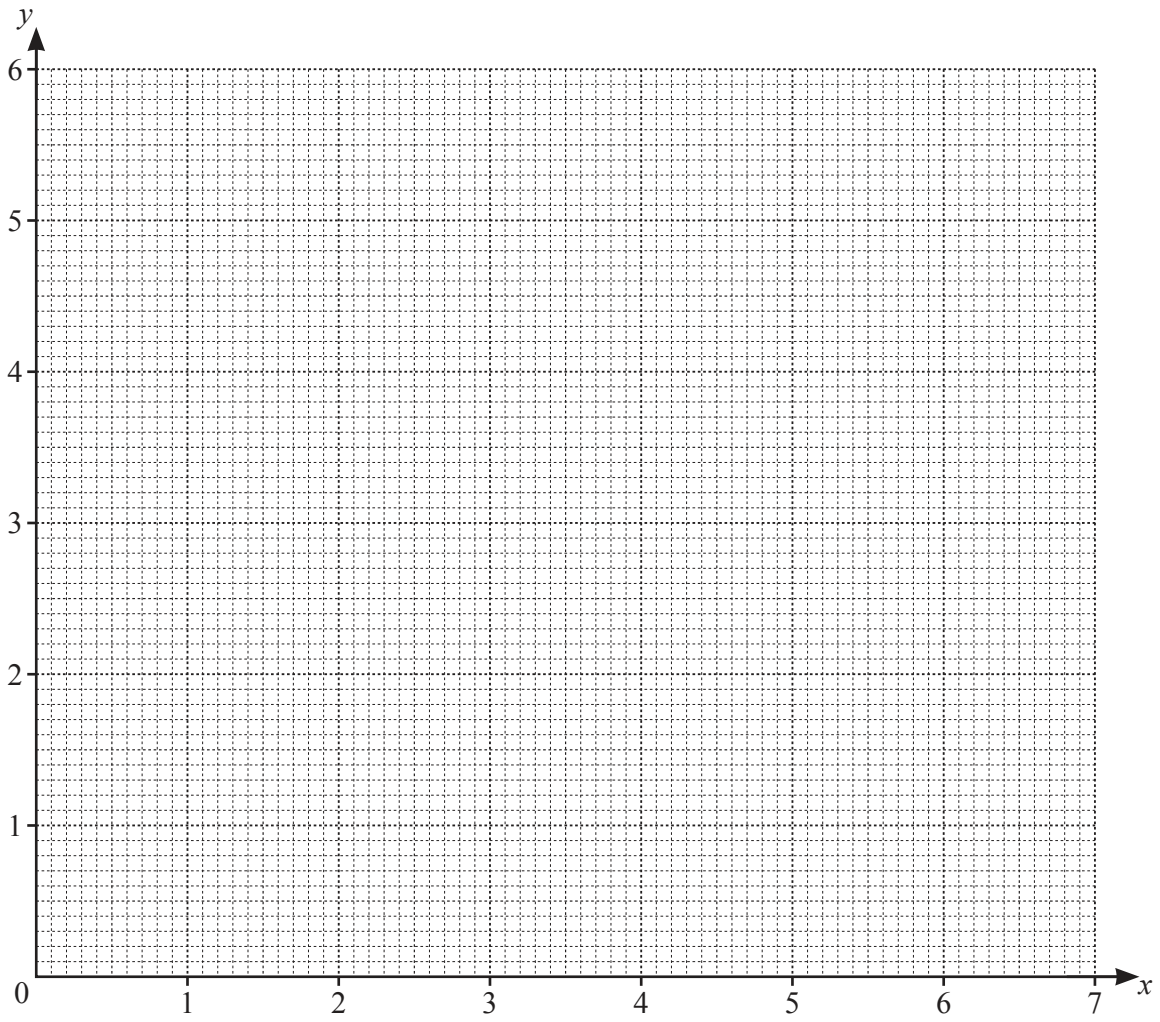
3 **(a)** Complete the table for $y = \frac{x}{4} + \frac{2}{x}$.

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 $0.5 \leqslant x \leqslant 7$.



[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 $y = \frac{x}{4} + \frac{2}{x}$.

$x =$ ..... and $x =$ ..... [2]

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

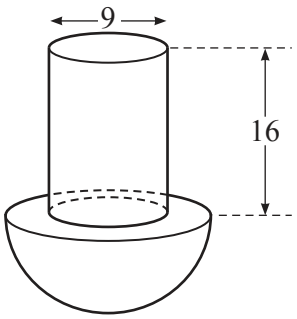
Use $2y + x = 6$ and $y = \frac{x}{4} + \frac{2}{x}$ to find the value of A and the value of B.

$A =$ .....

$B =$ ..... [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.

..... cm^2 [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.

..... cm^3 [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 $f(x) = 4(2-x)$ $\quad$ $g(x) = 7 - \frac{3x}{5}$

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

..... [1]

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

..... [2]

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

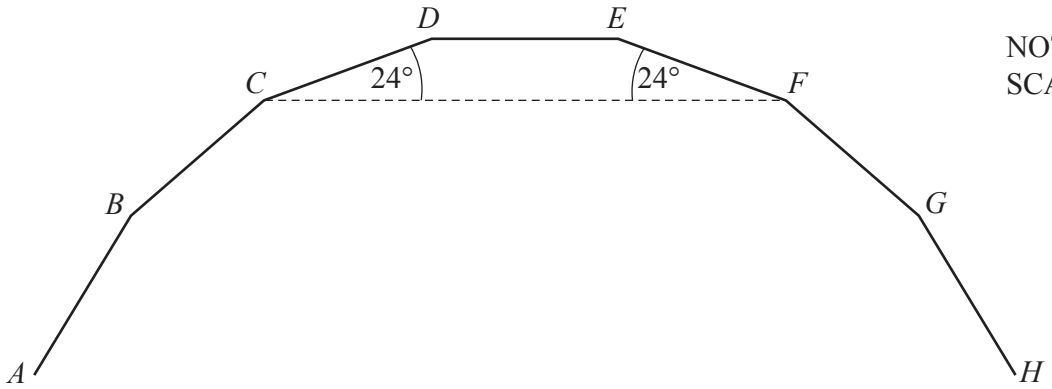
$f^{-1}(x) =$ ..... [2]

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

Find the value of p.

$p =$ ..... [3]

7 (a)



NOT TO SCALE

The diagram shows part of an n-sided regular polygon $ABCDEFGH\ldots$
$D\hat{C}F = E\hat{F}C = 24°$.

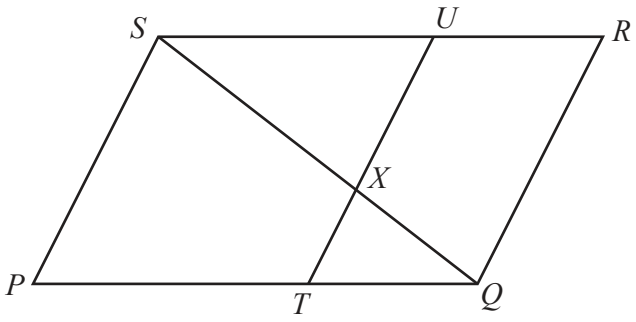
(i) Find the value of n.

$n =$ ..... [2]

(ii) Find $H\hat{F}G$.

$H\hat{F}G =$ ..... [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 $\overrightarrow{HJ} = \begin{pmatrix} 10 \\ -6 \end{pmatrix}$.

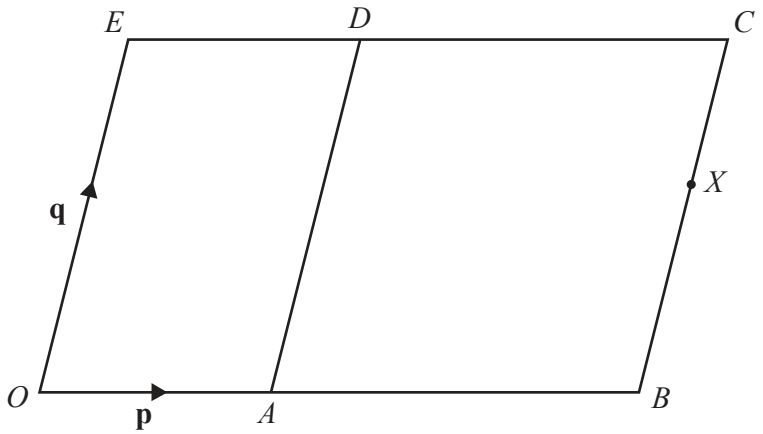
(i) Calculate the magnitude of $\overrightarrow{HJ}$.

..... [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 $OBCE$.
$\overrightarrow{OA} = \mathbf{p}$ and $\overrightarrow{OE} = \mathbf{q}$.
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 **p** and/or **q**

(i) $\overrightarrow{OC}$,

$\overrightarrow{OC} =$ ..... [1]

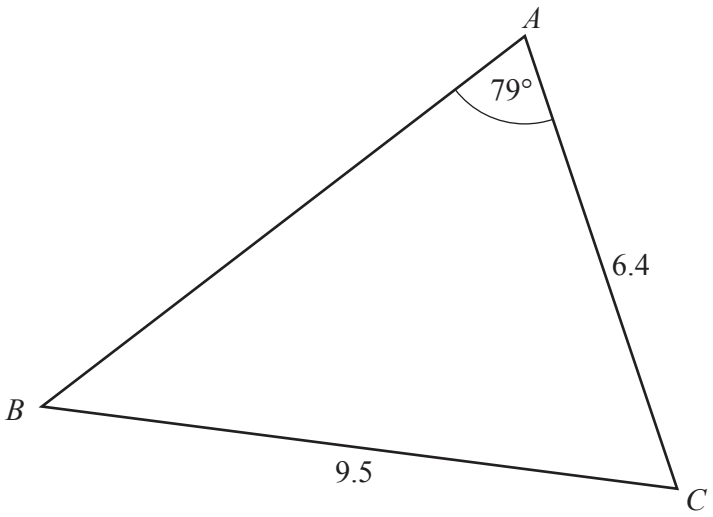
(ii) $\overrightarrow{AX}$,

$\overrightarrow{AX} =$ ..... [2]

(iii) $\overrightarrow{EX}$.

$\overrightarrow{EX} =$ ..... [2]

9



NOT TO SCALE

In triangle ABC, $AC = 6.4\,\text{cm}$, $BC = 9.5\,\text{cm}$ and $B\hat{A}C = 79°$.

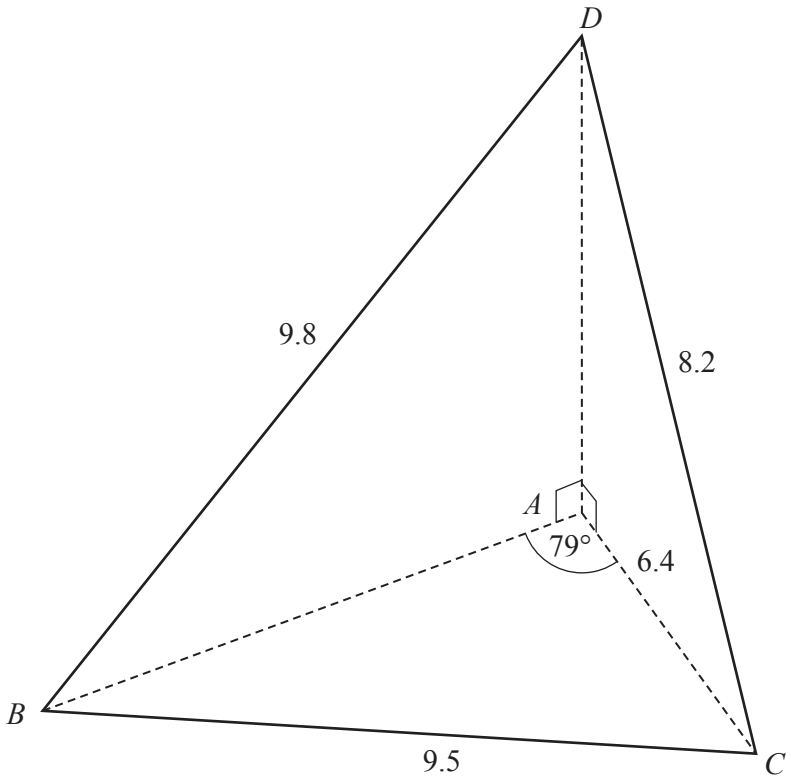
(a) (i) Calculate $A\hat{B}C$.

$A\hat{B}C =$ ..... [3]

(ii) Calculate the area of triangle ABC.

..... 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.
$B\hat{A}D = C\hat{A}D = 90°$.

(i) Calculate $B\hat{D}C$.

$B\hat{D}C =$ ..... [3]

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

..... [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.

$x =$ ..... or $x =$ ..... [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.

..... km/h [3]

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