Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

2303984016

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **May/June 2021**

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. Any blank pages are indicated.

1 **(a)** The price of an electric drill is $78.
In a sale, the price is reduced by 15%.

Calculate the sale price.

$ ..... [2]

(b) The exchange rate between dollars ($) and euros (€) is $1 = €0.85.
Michael changes $100 to euros.
He buys a clock costing €58.99.
He changes the remaining money back to dollars.

Calculate the amount, in dollars, he has left.

$ ..... [2]

(c)

ACE SIMPLE	COOL COMPOUND
Simple interest at 2.1% per year	Compound interest at 2% per year

Pietro invests $3500 in the Ace Simple account for 4 years.
Eliana invests $3500 in the Cool Compound account for 4 years.

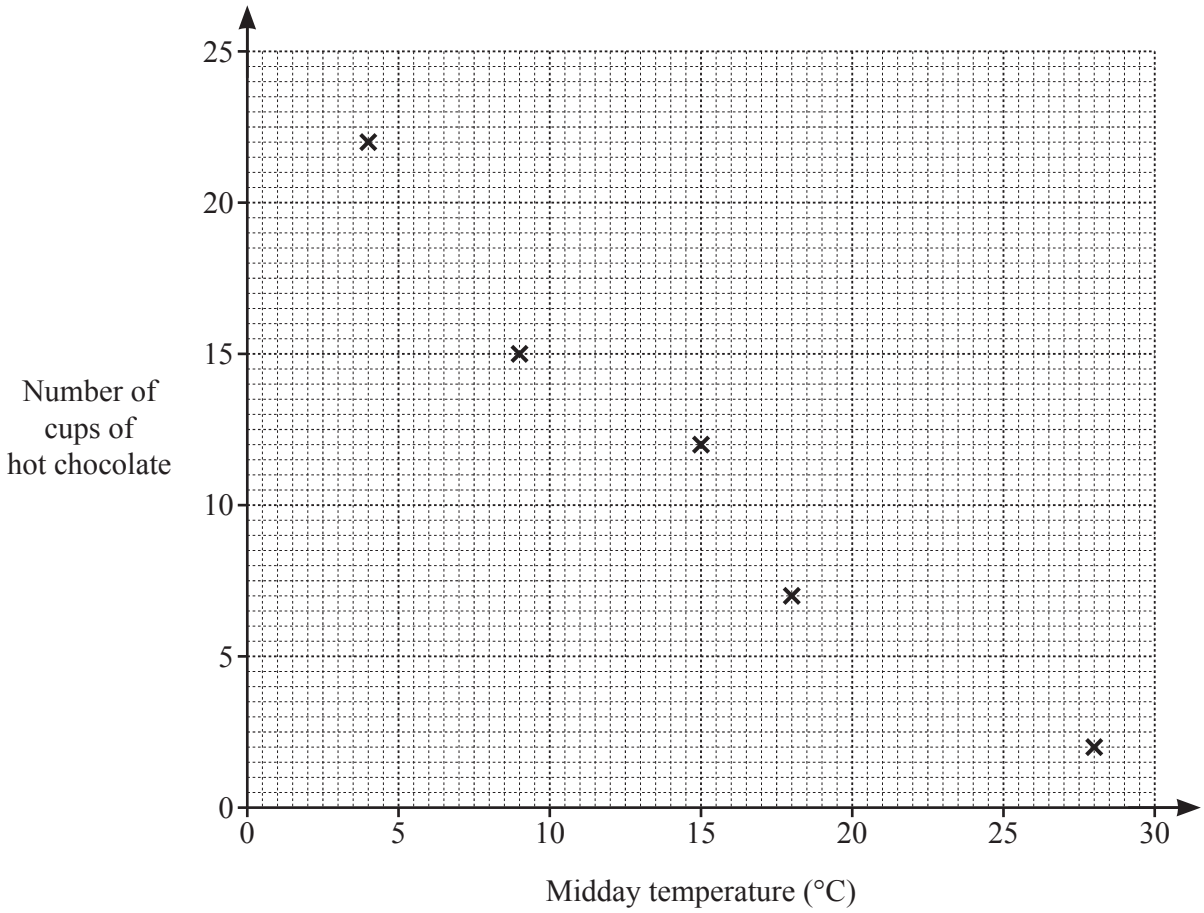
At the end of the 4 years, who has more money in their account and by how much?

..... by $ ..... [4]

2 The table shows the midday temperature and the number of cups of hot chocolate Natcha sells on eacn of ten days.

Midday temperature (°C)	18	9	4	28	15	21	6	5	12	23
Number of cups of hot chocolate	7	15	22	2	12	8	17	21	16	6

(a) Complete the scatter diagram.
The first 5 points have been plotted for you.



[2]

(b) Describe the relationship between the midday temperature and the number of cups of hot chocolate Natcha sells.

.....

..... [1]

(c) By drawing a line of best fit, estimate the number of cups of hot chocolate sold when the midday temperature is 17 °C.

..... [2]

3 **(a)** Simplify $4a - b + 6b - 7a$.

..... [2]

(b) Solve $\frac{m}{2} - 4 = 5$.

$m =$ ..... [2]

(c) Rearrange $u = \frac{t+4}{3}$ to make t the subject.

$t =$ ..... [2]

(d) Expand $3y(2y^2 + 5)$.

..... [2]

4 100 adults in a town were surveyed about the number of emails they each received one day.
The table shows the results.

Number of emails	1	2	3	4	5	6	7	8
Number of adults	8	10	22	28	15	9	5	3

(a) Find the mode.

..... [1]

(b) Calculate the mean.

..... [2]

(c) One of these adults is chosen at random.

Find the probability that they received **fewer than** 4 emails that day.
Give your answer as a fraction in its simplest form.

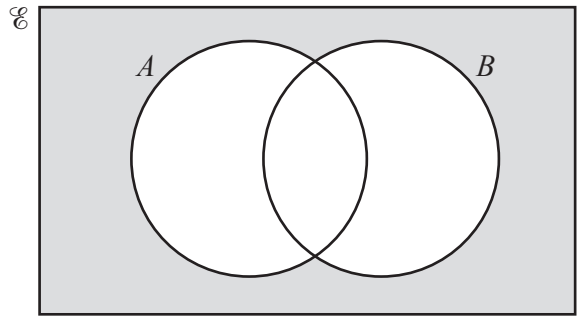
..... [2]

(d) The town has 18 000 adults.

Use the survey results to estimate the number of adults in the town who received exactly 5 emails that day.

..... [2]

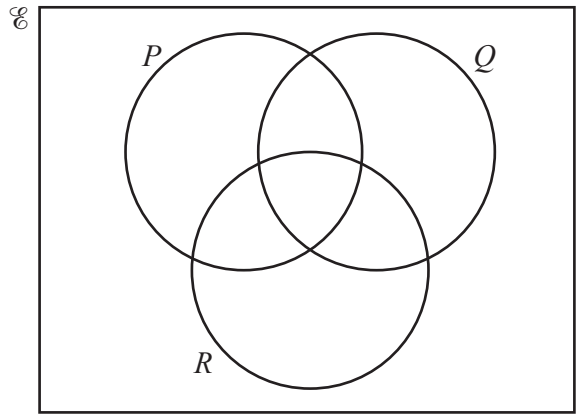
5 **(a)** Use set notation to describe the subset shaded in the Venn diagram.



..... [1]

(b) $\mathscr{E} = \{ 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 \}$
$P = \{ x : x \text{ is a factor of } 36 \}$
$Q = \{ x : x \text{ is a multiple of } 4 \}$
$R = \{ x : 3 \leqslant x \leqslant 6 \}$

(i) Complete the Venn diagram.



[3]

(ii) List the elements of $P \cap (Q \cup R)'$.

..... [1]

(iii) Find $\mathrm{n}(P \cup Q)$.

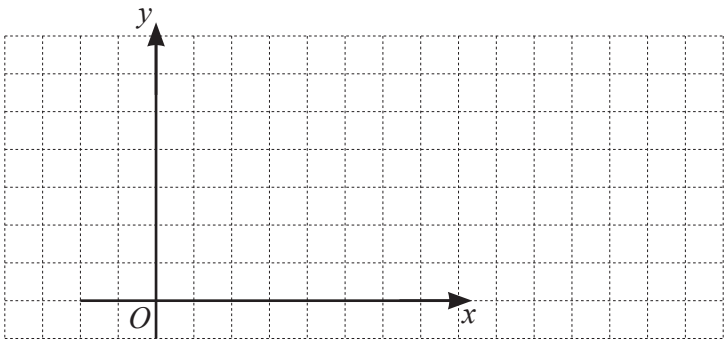
..... [1]

(iv) Use set notation to complete the statement.

..... $= \varnothing$ [1]

6 **(a)** PQR is an isosceles triangle with $PR = QR$.
P is the point (1, 5) and Q is the point (5, 1).
Angle PRQ is **not** a right angle.

Find the coordinates for one possible position of R.
You may use the grid to help you.



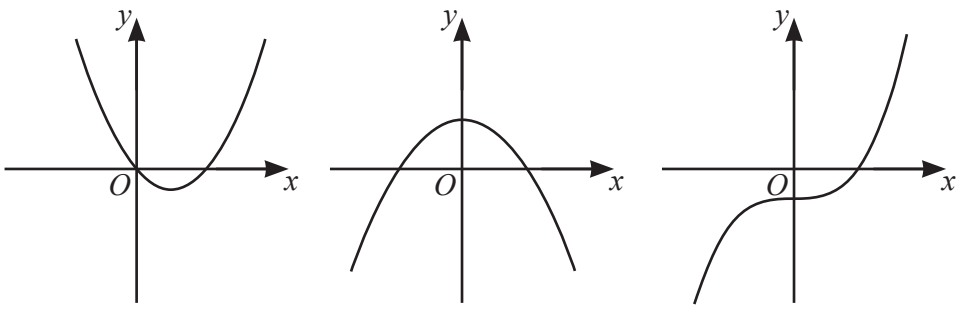
(..... , ...) [2]

(b) Here are the equations of five curves.

$y = 2 - x^2$ $y = x^3 - 2$ $y = x^2 + 2x - 8$ $y = x^3 - 3x$ $y = x^2 - 3x$

Sketches of three of these curves are drawn below.

Write the correct equation underneath each sketch.



.... [3]

(c) A is the point $(-1, -5)$ and B is the point $(3, 3)$.

Find the equation of the line perpendicular to AB which passes through the midpoint of AB.

..... [5]

7 **(a)** A rectangular field measures 30 m by 45 m.

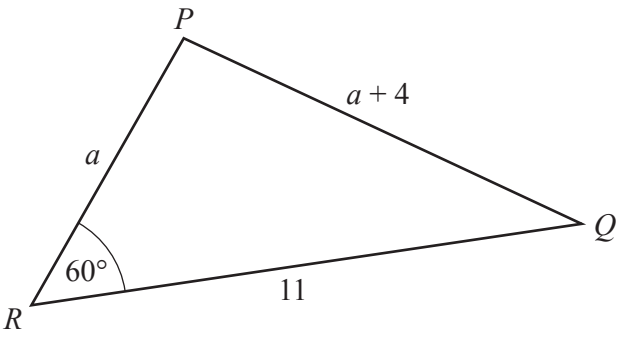
(i) Calculate the perimeter.

..... m [1]

(ii) Calculate the length of a diagonal.

..... m [2]

(b)



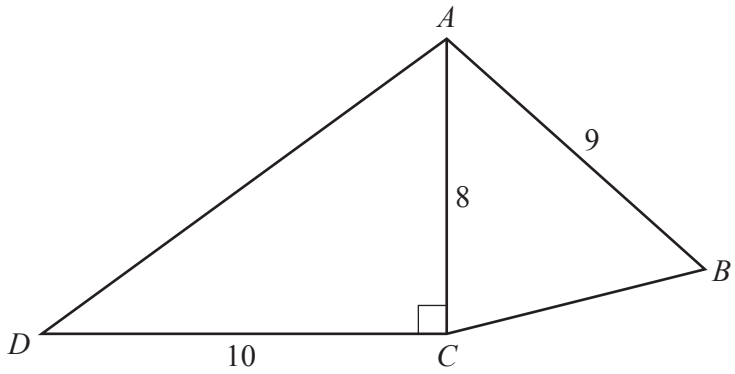
NOT TO SCALE

The diagram shows a sketch of triangle PQR.
All lengths are given in centimetres.

Calculate the length a.

$a =$ ..... cm [4]

(c) The diagram shows a sketch of quadrilateral $ABCD$.
All lengths are given in centimetres.



NOT TO SCALE

The area of quadrilateral $ABCD$ is $70\,\text{cm}^2$.

Calculate $D\hat{A}B$.

$D\hat{A}B =$ ..... [6]

8 $f(x) = 3x - 5 \quad g(x) = \dfrac{4x+4}{3}$

(a) Find $f(-2)$.

..... [1]

(b) Find the largest integer satisfying $f(x) > 3g(x)$.

..... [3]

(c) Solve $f(x) = g(3x-5)$.

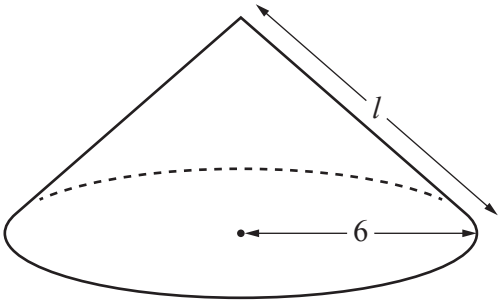
$x =$ ..... [3]

(d) Solve $g^{-1}(x) = 5$.

$x =$ ..... [1]

9 **[Volume of a cone = $\frac{1}{3}\pi r^2 h$]**

[Curved surface area of a cone = πrl]



A cone has radius 6 cm and slant height l cm.
The **total** surface area of the cone is 84π cm^2.

(a) Show that $l = 8$.

[2]

(b) Calculate the volume of the cone.

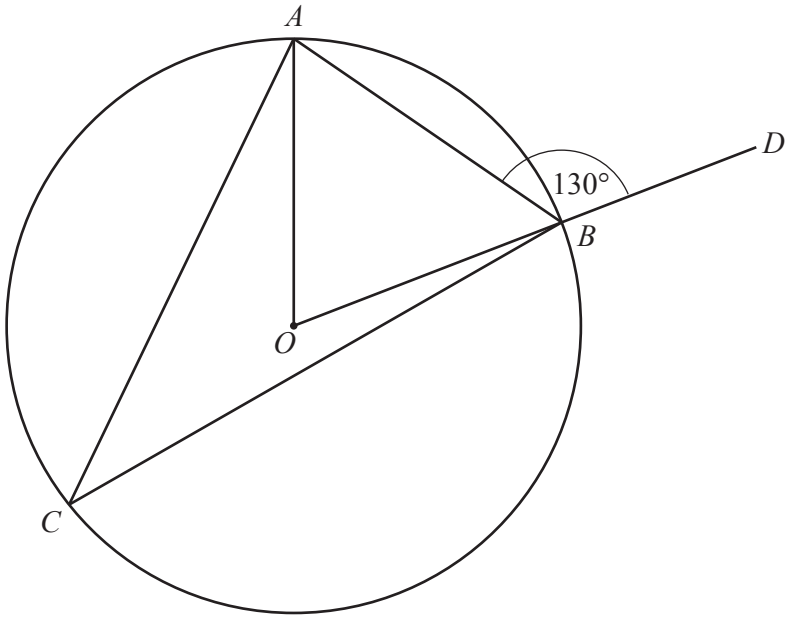
..... cm^3 [3]

(c) A similar cone has a **total** surface area of 47.25π cm^2.

Find the radius of this cone.

..... cm [2]

10 (a)



NOT TO SCALE

A, B and C are points on the circumference of a circle, centre O.
OBD is a straight line and angle $ABD = 130°$.

Find angle ACB, giving a reason for each step of your working.

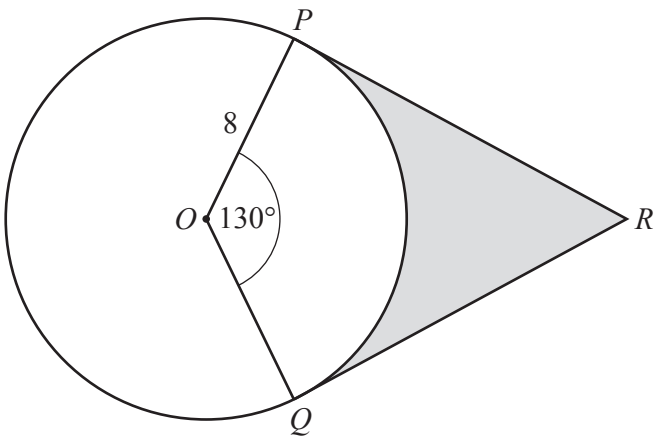
.....

.....

.....

Angle $ACB =$ ..... [3]

(b)



NOT TO SCALE

P and Q are points on the circumference of a different circle, centre O.
PR and QR are tangents to the circle at P and Q respectively.
$OP = 8$ cm and $P\hat{O}Q = 130°$.

(i) Find PR.

$PR =$ ..... cm [2]

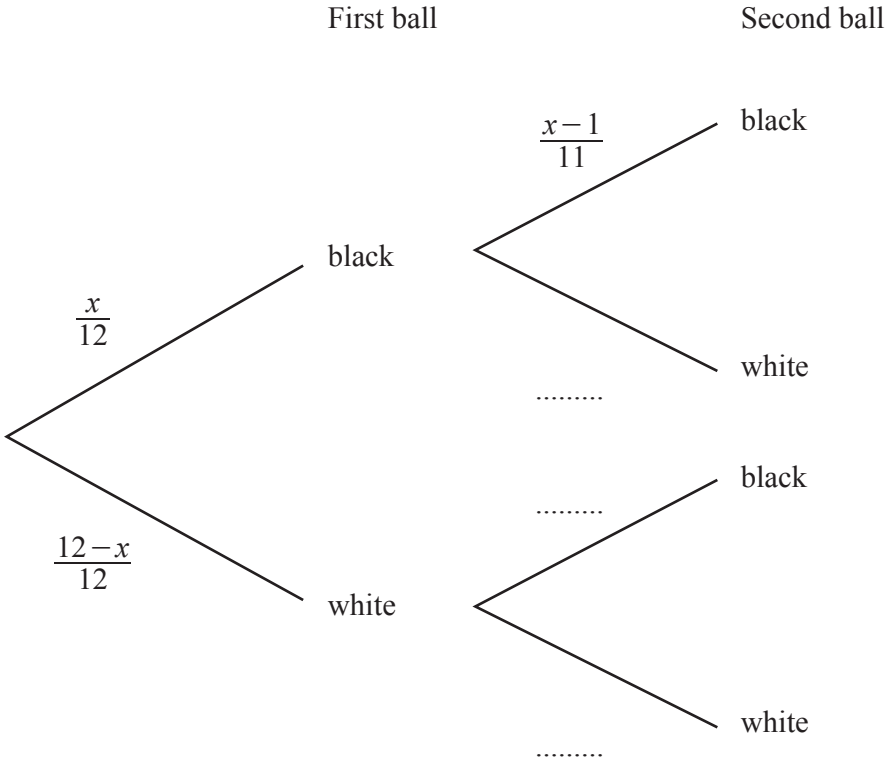
(ii) Calculate the percentage of quadrilateral $OPRQ$ that is shaded.

..... % [4]

11 A bag contains 12 balls.
There are x black balls in the bag and the other balls are white.

Two balls are taken at random from the bag without replacement.

(a) Complete the tree diagram.



[2]

(b) Find an expression for the probability of taking one ball of each colour.
Write your answer as a single fraction in terms of x.

..... [3]

(c) The probability that both balls are black is $\frac{14}{33}$.

Form an equation in x and solve it to find the number of black balls in the bag.
Show your working.

..... [4]

12 **(a)** A is the point (2, 3) and B is the point (3, −5).

(i) Find $\overrightarrow{AB}$.

$\overrightarrow{AB} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(ii) $\overrightarrow{BC} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$

Find the coordinates of C.

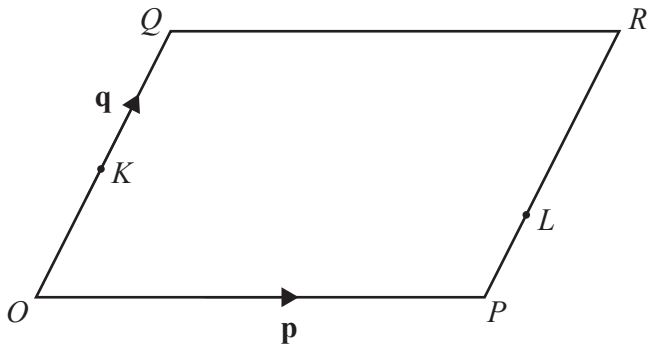
(..... , ...) [1]

(iii) $\left|\overrightarrow{AD}\right| = \sqrt{74}$ and $D = (-3, n)$.

Find the possible values of n.

n = ... or n = ... [3]

(b)



NOT TO SCALE

$OQRP$ is a parallelogram.
$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.
K is the midpoint of OQ and L is a point on PR.
$\overrightarrow{KL} = \mathbf{p} - \frac{1}{10}\mathbf{q}$.

Find $PL : LR$.

..... : ..... [3]

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