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MATHEMATICS (US)

0444/41

Paper 4 (Extended)

May/June 2022

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, center 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 work 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 130.
- The number of marks for each question or part question is shown in parentheses [].

This document has **20** pages.



Formula List

For the equation

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Lateral surface area, A , of cylinder of radius r , height h .

$$A = 2\pi rh$$

Lateral surface area, A , of cone of radius r , sloping edge l .

$$A = \pi rl$$

Surface area, A , of sphere of radius r .

$$A = 4\pi r^2$$

Volume, V , of pyramid, base area A , height h .

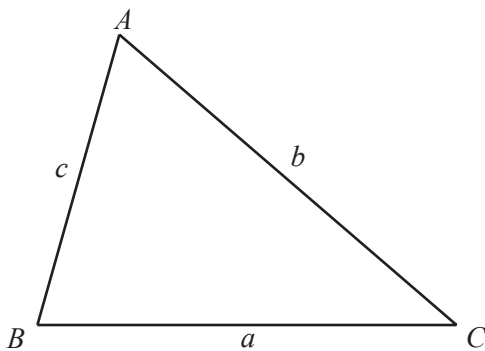
$$V = \frac{1}{3}Ah$$

Volume, V , of cone of radius r , height h .

$$V = \frac{1}{3}\pi r^2 h$$

Volume, V , of sphere of radius r .

$$V = \frac{4}{3}\pi r^3$$



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{Area} = \frac{1}{2}bc \sin A$$

- 1 (a) Geeta buys x apples, $(x + 7)$ oranges and $(2x - 1)$ bananas.
The total number of pieces of fruit Geeta buys is 30.

(i) Find the number of apples Geeta buys.

..... [3]

- (ii) The cost of one apple is 15 cents.
The cost of one orange is 18 cents.
The total cost of all the fruit is \$5.55 .

Find the cost, in cents, of one banana.

..... cents [3]

- (b) (i) Solve.

$$\frac{3w}{16} - 1 = \frac{1}{2}$$

$w =$ [2]

(ii)
$$\frac{3(2^{-y})}{16} - 1 = \frac{1}{2}$$

Find the value of y .

$y =$ [2]

2 (a) Write down an example of continuous data.

..... [1]

(b) A class of 24 students takes a test.
The table shows their marks.

Mark	6	7	8	9	10
Frequency	1	3	8	3	9

(i) Find

(a) the range,

..... [1]

(b) the mode,

..... [1]

(c) the median.

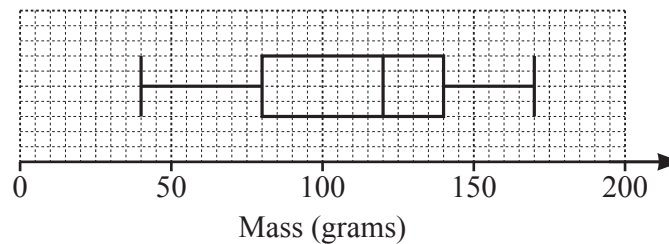
..... [1]

(ii) A pie chart is drawn to show the information in the table.

Calculate the sector angle for the number of students who scored 10 marks.

..... [2]

(c)



The box plot shows information about the masses, in grams, of some apples.

(i) Find the median.

..... g [1]

(ii) Find the range.

..... g [1]

(iii) Find the interquartile range.

..... g [1]

- (d) (i) The time, t minutes, spent on homework in one week by each of 200 students is recorded. The table shows the results.

Time (t minutes)	$40 < t \leq 60$	$60 < t \leq 80$	$80 < t \leq 90$	$90 < t \leq 100$	$100 < t \leq 150$
Frequency	6	10	70	84	30

Calculate an estimate of the mean.

..... min [4]

- (ii) A new table with different class intervals is completed.

Time (t minutes)	$40 < t \leq 90$	$90 < t \leq 150$
Frequency	86	114

On a histogram the height of the bar for the $40 < t \leq 90$ interval is 17.2 cm.

Calculate the height of the bar for the $90 < t \leq 150$ interval.

..... cm [2]

- 3 (a) Alex, Bobbie and Chris share strawberries in the ratio Alex : Bobbie : Chris = 3 : 2 : 2.
Chris receives 12 strawberries.

Calculate the total number of strawberries shared.

..... [2]

- (b) In a sale, a shop reduces all prices by 12%.

- (i) Dina buys a book which has an original price of \$6.50 .

Calculate how much Dina pays for the book.

\$ [2]

- (ii) Elu pays \$11 for a toy.

Calculate the original price of the toy.

\$ [2]

- (c) Feri invests some money.
The rate of interest for the first year is 2.5%.
At the end of the second year the overall percentage increase of Feri's investment is 6.6%.

Find the rate of interest for the second year.

..... % [2]

(d) Each day the mass of a radioactive substance decays at a rate of 2% of its mass on the previous day.

The initial mass is 80 g.

(i) Find the mass at the end of 5 days.

..... g [2]

(ii) Find how many **more** whole days, after day 5, it takes for the mass to reduce to less than 67 g.

..... [3]

8

4 $f(x) = 2x - 1$ $g(x) = 3x - 2$ $h(x) = \frac{1}{x}, x \neq 0$ $j(x) = 5^x$

(a) Find

(i) $f(2)$,

..... [1]

(ii) $gf(2)$.

..... [1]

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

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

(c) Find x when $h(x) = j(-2)$.

$x =$ [2]

(d) Write $f(x) - h(x)$ as a single fraction.

..... [2]

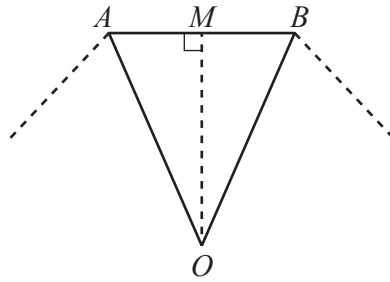
(e) Find the value of $jj(2)$.

..... [1]

(f) Find x when $j^{-1}(x) = 4$.

$x =$ [2]

- 5 (a) $ABCDEFGH$ is a regular octagon with sides of length 6 cm. The diagram shows part of the octagon. O is the center of the octagon and M is the midpoint of AB .



NOT TO SCALE

- (i) (a) Show that angle OAM is 67.5° .

[2]

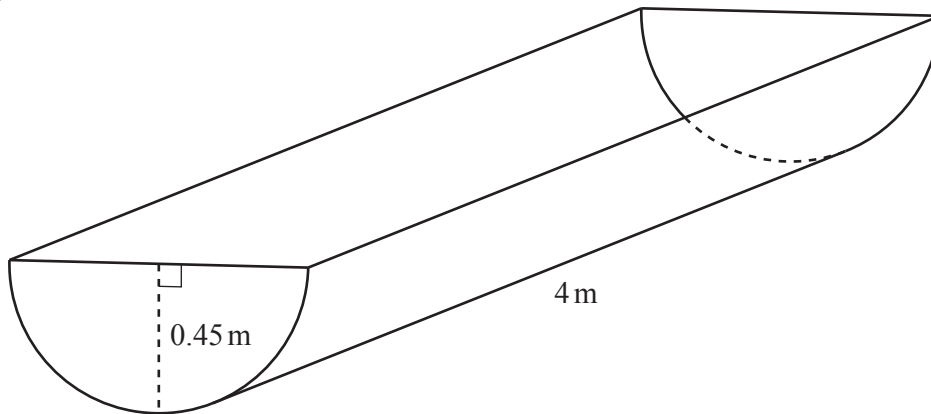
- (b) Calculate the area of the octagon.

..... cm^2 [4]

- (ii) Find the area of the circle that passes through the vertices of the octagon.

..... cm^2 [3]

(b)



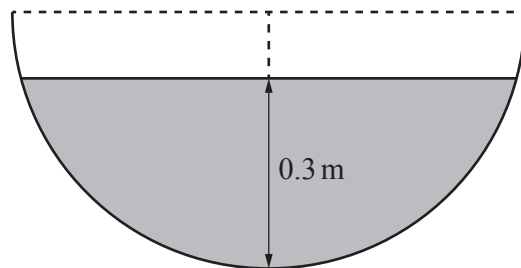
NOT TO SCALE

The diagram shows a horizontal container for water with a uniform cross-section. The cross-section is a semicircle. The radius of the semicircle is 0.45 m and the length of the container is 4 m.

(i) Calculate the volume of the container.

..... m³ [2]

(ii)



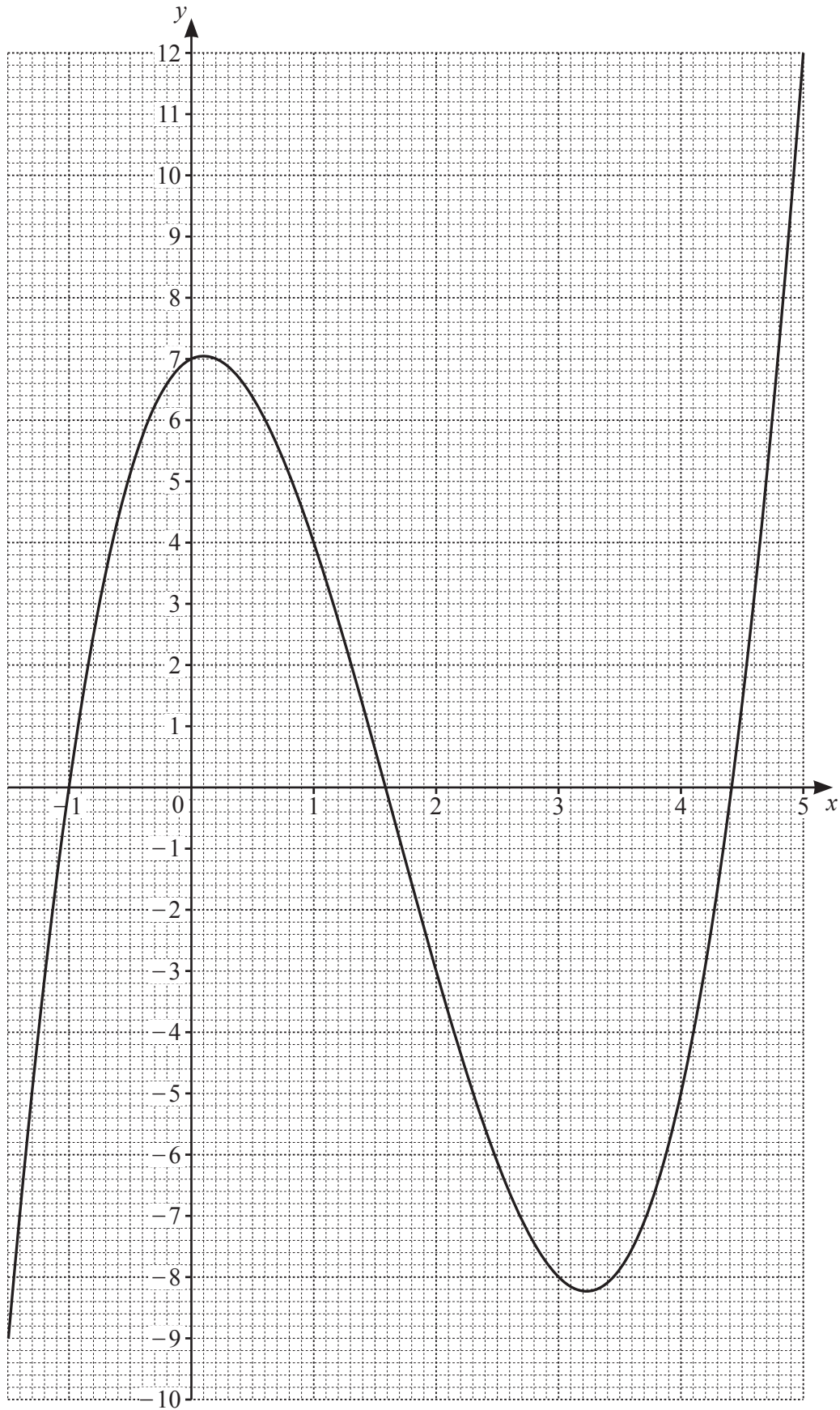
NOT TO SCALE

The greatest depth of the water in the container is 0.3 m. The diagram shows the cross-section.

Calculate the number of liters of water in the container. Give your answer correct to the nearest integer.

..... liters [6]

6 (a)



The diagram shows the graph of $y = f(x)$ for $-1.5 \leq x \leq 5$.

(i) Find $f(2)$.

..... [1]

(ii) Solve the equation $f(x) = 0$ for $-1.5 \leq x \leq 5$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

(iii) $f(x) = k$ has three solutions for $-1.5 \leq x \leq 5$ where k is an integer.

Find the smallest possible value of k .

$k = \dots\dots\dots$ [1]

(iv) By drawing a suitable straight line solve the equation $f(x) = 10 - 2x$.

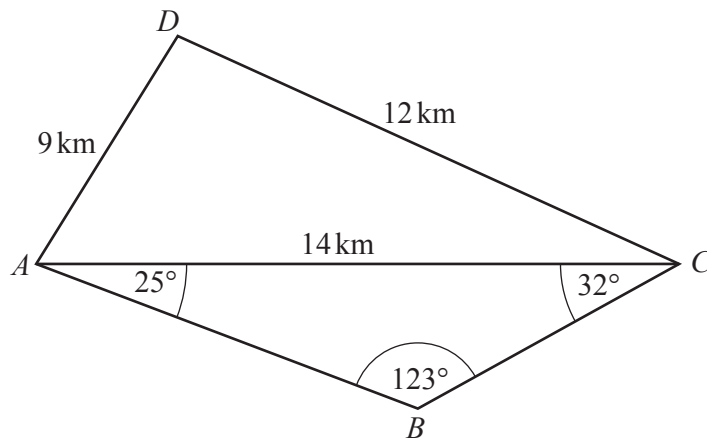
$x = \dots\dots\dots$ [3]

(v) On the grid, draw a line $y = mx$ so that $f(x) = mx$ has exactly one solution for $-1.5 \leq x \leq 5$. [2]

(b) Line L passes through the point $(4, -1)$ and is perpendicular to the line $y = 2x + 5$.

Work out the equation of line L , giving your answer in the form $y = mx + b$.

$y = \dots\dots\dots$ [4]

NOT TO
SCALE

- (a) Calculate angle ACD .

Angle $ACD = \dots\dots\dots$ [4]

- (b) Show that $BC = 7.05$ km, correct to 2 decimal places.

[3]

(c) Calculate the shortest distance from B to AC .

..... km [3]

(d) Calculate the length of the straight line BD .

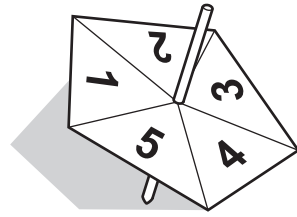
$BD =$ km [4]

(e) C is due east of A .

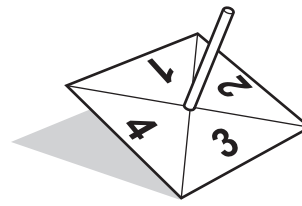
Find the bearing of D from C .

..... [2]

8 (a)



Spinner A



Spinner B

The diagram shows two fair spinners.
 Spinner A is numbered 1, 2, 3, 4, 5 and spinner B is numbered 1, 2, 3, 4.
 The two spinners are spun and the two scores are added.

(i) Draw a possibility diagram to show all the possible totals.

[2]

(ii) Find the probability that the total of the two numbers is

(a) 7,

..... [1]

(b) a square number,

..... [1]

(c) less than 10.

..... [1]

(iii) The two spinners are spun 60 times.

Calculate the expected number of times the total is 7.

..... [1]

- (b) When a coin is tossed it is equally likely to show heads or tails.
When a die is rolled it is equally likely to show a 1, 2, 3, 4, 5 or 6.

- (i) The die is rolled.

Find the probability that the die shows 4.

..... [1]

- (ii) The coin is tossed and the die is rolled.

- (a) Find the probability that the coin shows tails **and** the die shows 4.

..... [2]

- (b) Find the probability that the coin shows tails **or** the die shows 4.

..... [2]

- (c) When the weather is fine, the probability that Jodie goes swimming is $\frac{4}{5}$.

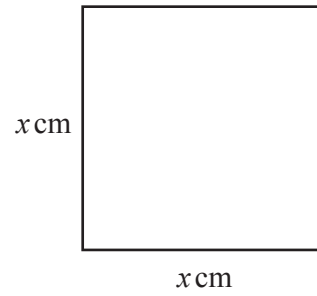
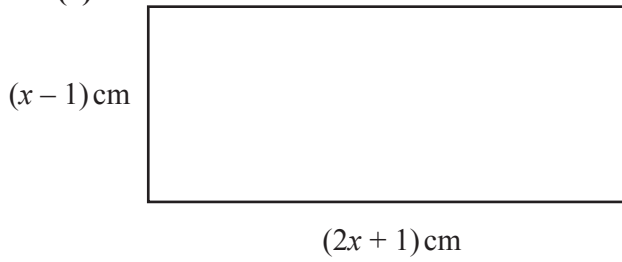
When the weather is not fine, the probability that Jodie goes swimming is $\frac{1}{10}$.

The probability that the weather will be fine tomorrow is $\frac{2}{3}$.

Find the probability that Jodie goes swimming tomorrow.

..... [3]

9 (a)

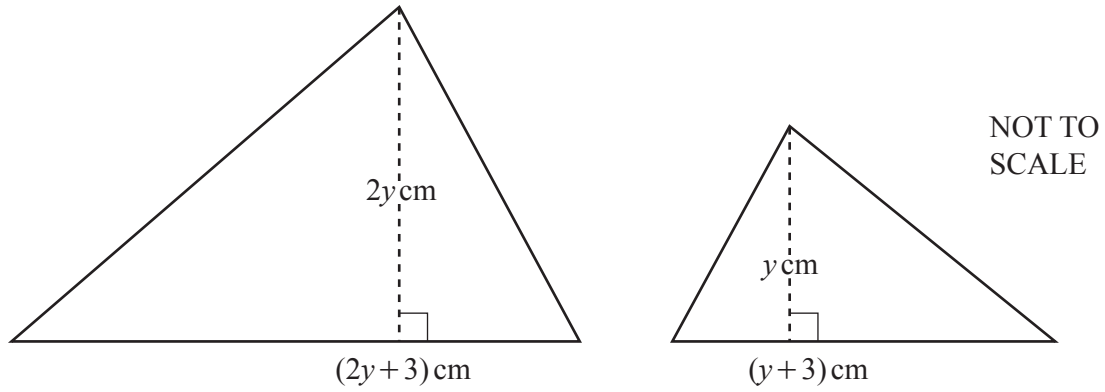
NOT TO
SCALE

The area of the rectangle is 29 cm^2 greater than the area of the square.
The difference between the perimeters of the two shapes is $k \text{ cm}$.

Find the value of k .
You must show all your work.

$k = \dots\dots\dots$ [6]

(b)



The area of the larger triangle is 2 cm^2 greater than the area of the smaller triangle.

(i) Show that $3y^2 + 3y - 4 = 0$.

[4]

(ii) Find the area of the smaller triangle.
You must show all your work.

..... cm^2 [4]

Question 10 is printed on the next page.

10 (a) Solve the system of linear equations.

$$\begin{aligned} 2p + q &= 2 \\ p - q &= -\frac{1}{2} \end{aligned}$$

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots [2]$$

(b) Hence, for $0^\circ \leq u \leq 360^\circ$ and $0^\circ \leq v \leq 360^\circ$, solve this system of equations.

$$\begin{aligned} 2 \sin u + \cos v &= 2 \\ \sin u - \cos v &= -\frac{1}{2} \end{aligned}$$

$$u = \dots\dots\dots \text{ or } u = \dots\dots\dots$$

$$v = \dots\dots\dots \text{ or } v = \dots\dots\dots [4]$$

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