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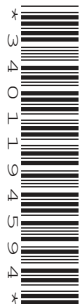
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MATHEMATICS (US)

0444/43

Paper 4 (Extended)

October/November 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, 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 . $A = 2\pi rh$

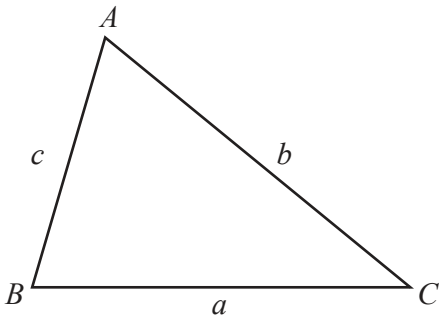
Lateral surface area, A , of cone of radius r , sloping edge l . $A = \pi rl$

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

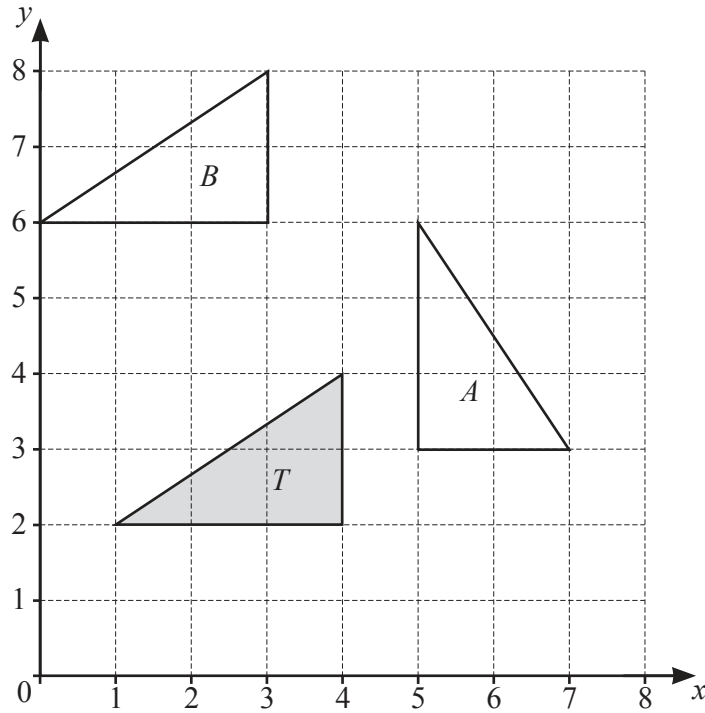


$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

1 The diagram shows three triangles, T , A , and B , drawn on a 1 cm^2 grid.



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

.....
 [3]

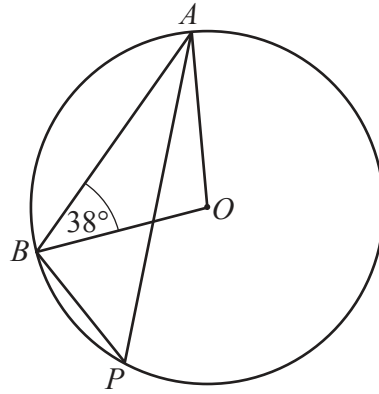
(b) (i) Describe fully the **single** transformation that maps triangle T onto triangle B .

.....
 [2]

(ii) Calculate the distance that each point of triangle T moves when it is mapped onto triangle B .

..... cm [2]

2 (a)



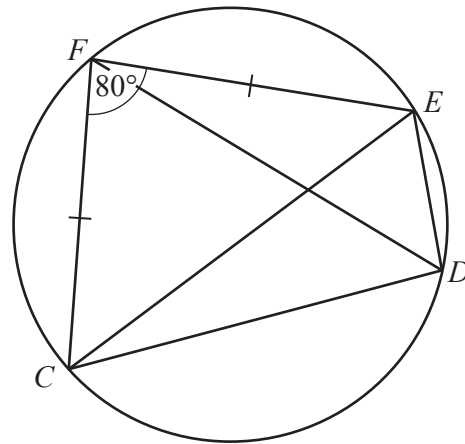
NOT TO SCALE

$A, B,$ and P are points on a circle, center O and angle $OBA = 38^\circ$.

Find angle APB .

Angle $APB = \dots\dots\dots$ [3]

(b)



NOT TO SCALE

$CDEF$ is a cyclic quadrilateral and $FC = FE$.
Angle $CFE = 80^\circ$.

Find

(i) angle CDE ,

Angle $CDE = \dots\dots\dots$ [1]

(ii) angle CDF .

Angle $CDF = \dots\dots\dots$ [2]

- 3 (a) \$500 is invested at a rate of 3% per year.

Calculate the total interest earned at the end of 7 years when

- (i) simple interest is paid,

\$ [2]

- (ii) compound interest is paid.

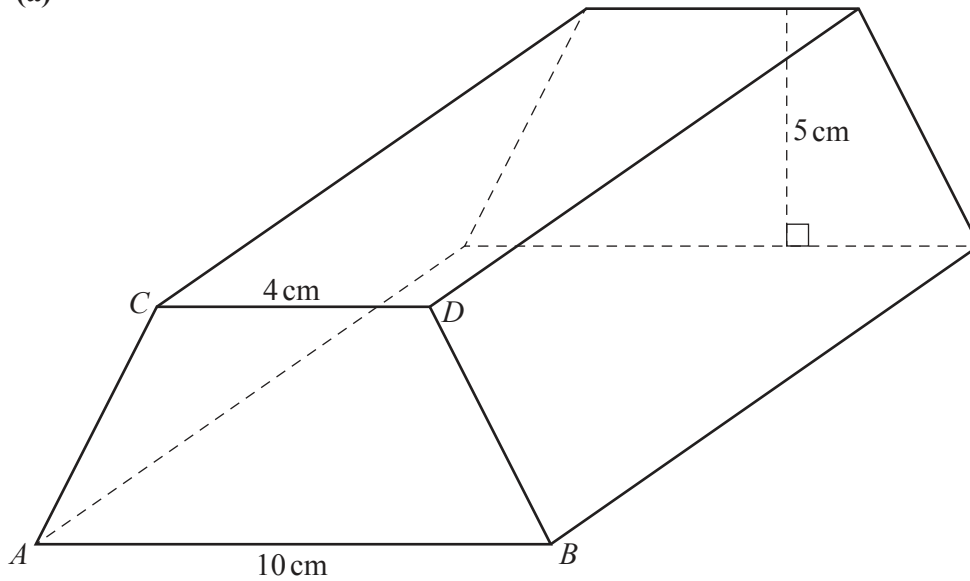
\$ [3]

- (b) Each year the value of a car decreases by 10% of its value at the beginning of the year.
The value now is \$6269.40 .

Calculate the value of the car 3 years ago.

\$ [3]

4 (a)

NOT TO
SCALE

The diagram shows a prism.

The cross-section of the prism is a trapezoid with CD parallel to AB and $AC = BD$.

$AB = 10$ cm, $CD = 4$ cm and the height of the trapezoid is 5 cm.

The volume of the prism is 525 cm³.

- (i) The prism is made of iron.
1 cm³ of iron has a mass of 7.8 g.

Calculate the mass of the prism.
Give your answer in kilograms.

..... kg [2]

- (ii) Calculate the length of the prism.

..... cm [3]

(iii) Calculate the total surface area of the prism.

..... cm^2 [6]

(iv) In a mathematically similar prism, the height of the trapezoid is 10 cm.

Calculate the volume of this prism.

..... cm^3 [3]

(b) A new town is built with a boundary that is a circle of radius R miles.

The population of the town is 50 000.

The population density is 3500 persons per square mile.

Calculate the value of R .

$R =$ [3]

- 5 (a) Solve the system of linear equations.
You must show all your work.

$$5p - 3q = 18$$

$$3p + 2q = 7$$

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

$$q = \dots\dots\dots [4]$$

- (b) Solve the equation.

$$\frac{x}{4} + \frac{2x}{3} = 1$$

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

- (c) $-8 < 3x - 2 \leq 7$

- (i) Solve the inequality.

$$\dots\dots\dots [3]$$

- (ii) Find the integer values of x that satisfy the inequality.

$$\dots\dots\dots [1]$$

(d) Factorize completely.

$$16a - 4a^2$$

..... [2]

(e) Write each of the following as a single fraction, in its simplest form.

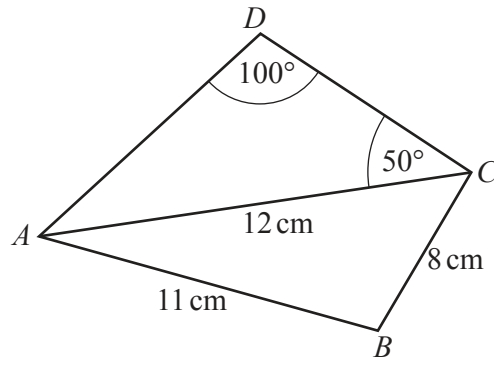
(i) $\frac{1}{2a} \div \frac{3}{4b}$

..... [2]

(ii) $2 - \frac{x}{x-1}$

..... [2]

6



NOT TO SCALE

(a) Calculate AD .

$AD = \dots\dots\dots$ cm [3]

(b) Calculate angle BAC and show that it rounds to 40.42° , correct to 2 decimal places.

[4]

(c) Calculate the area of the quadrilateral $ABCD$.

$\dots\dots\dots$ cm^2 [3]

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

$\dots\dots\dots$ cm [3]

- 7 (a) Amir buys 3 cakes that cost c cents each and 2 loaves of bread that cost $(2c - 11)$ cents each. He spends a total of \$5.87.

Find the value of c .

$$c = \dots\dots\dots [3]$$

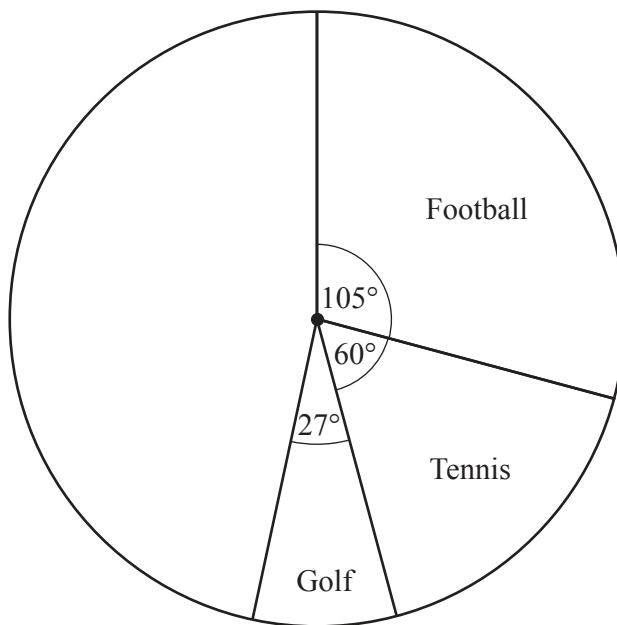
- (b) A bottle of water costs \$ w .
A bottle of juice costs \$ $(w + 1)$.

Alex spends \$22 on bottles of water and \$42 on bottles of juice.
The number of bottles of water is equal to the number of bottles of juice.

Find the value of w .

$$w = \dots\dots\dots [3]$$

- 8 (a) Jean asks 600 people to choose their favorite sport. The pie chart shows some of this information.



- (i) Show that 100 people choose tennis.

[1]

- (ii) Work out how many people choose golf.

..... [2]

- (iii) 125 people choose baseball and the rest choose swimming.

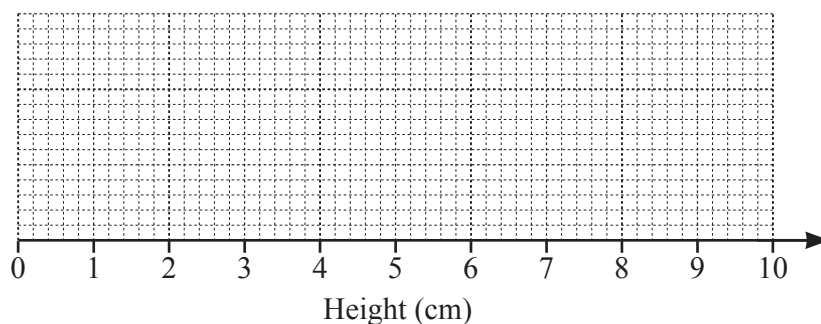
Complete the pie chart to show this information.

[2]

- (b) The heights of some plants are measured:

- smallest height = 0.6 cm
- range = 8.1 cm
- median = 5.2 cm
- lower quartile = 3.4 cm
- interquartile range = 4.1 cm.

On the grid, draw a box-and-whisker plot to show this information.



[3]

- (c) A dice is rolled 100 times.
The frequency table shows the results.

Score	1	2	3	4	5	6
Frequency	16	25	17	19	8	15

Find

- (i) the range,

..... [1]

- (ii) the mode,

..... [1]

- (iii) the median.

..... [1]

- (d) 50 students answer a mathematics question.
The table shows the time, t seconds, taken by each student to answer the question.

Time (t seconds)	$10 < t \leq 20$	$20 < t \leq 25$	$25 < t \leq 30$	$30 < t \leq 50$	$50 < t \leq 80$
Frequency	2	8	12	16	12

Calculate an estimate of the mean.

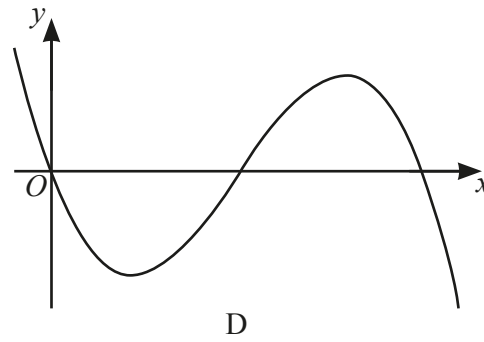
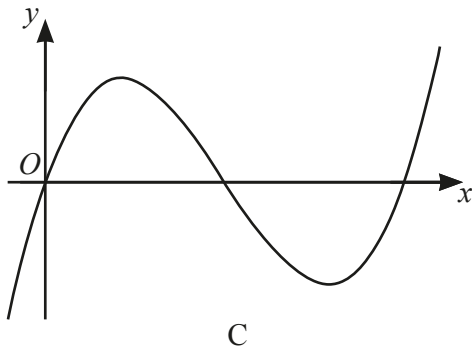
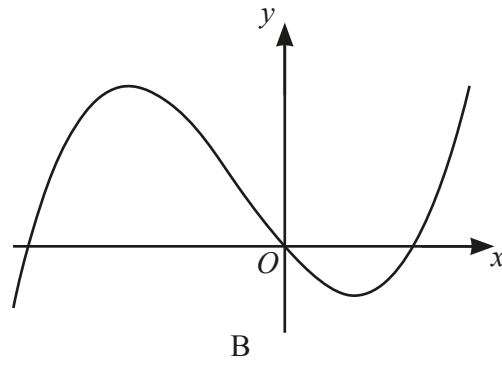
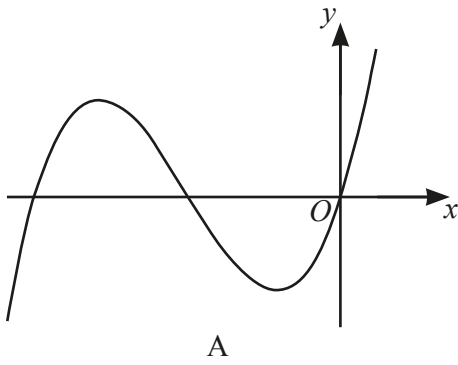
..... s [4]

9 (a) $f(x) = x(x-1)(x-2)$

(i) Find the coordinates of the points where the graph of $y = f(x)$ crosses the x -axis.

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

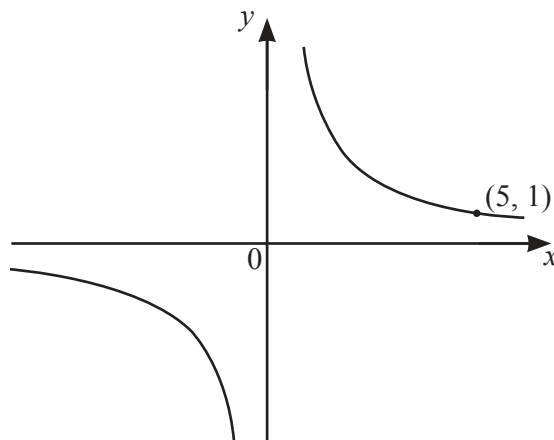
(ii)



Which of the sketches shows the graph of $y = f(x)$?

..... [1]

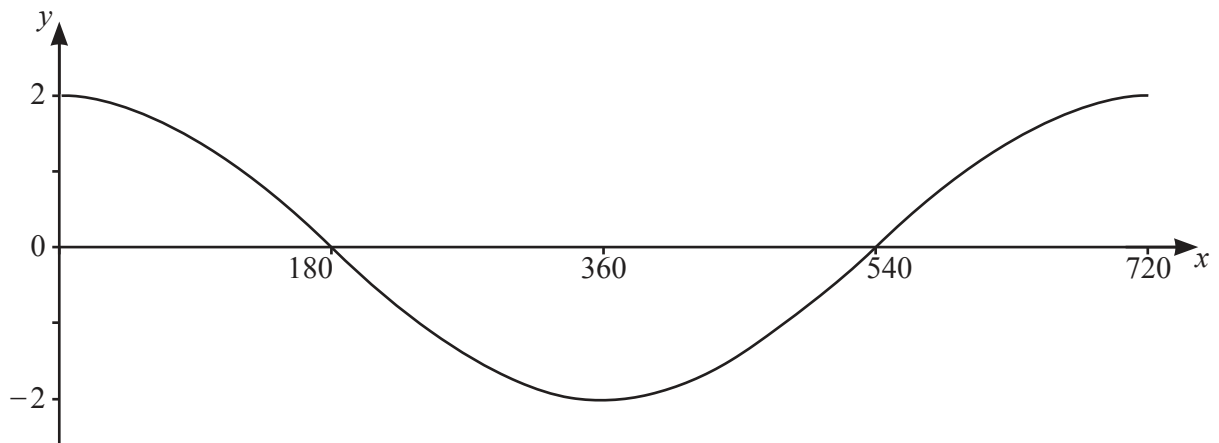
(b) The diagram shows a sketch of the graph of $y = g(x)$.



Find $g(x)$.

$g(x) =$ [2]

(c)



The graph shows the function $h(x) = a \cos(bx)$ for $0^\circ \leq x \leq 720^\circ$.

(i) Complete the range of $h(x)$.

..... $\leq h(x) \leq$ [1]

(ii) Find the value of a and the value of b .

$a =$

$b =$ [2]

(d) Describe fully the **single** transformation that maps the graph of $y = j(x)$ onto the graph of

(i) $y = j(x - 5)$,

.....
 [2]

(ii) $y = 5j(x)$.

.....
 [3]

10 (a) Sarah spins a fair four-sided spinner numbered 0, 1, 1 and 3.

(i) What number is the spinner most likely to land on?

..... [1]

(ii) Sarah spins the spinner twice.

Find the probability that it lands on the number 1 both times.

..... [2]

(iii) Sarah spins the spinner until it lands on the number 3.

The probability that this happens on the n th spin is $\frac{729}{16384}$.

Find the value of n .

$n =$ [2]

(b) Scott takes an examination.

The examination is in two parts, a theory test and a practical test.
Both parts must be passed to pass the examination.

The probability that Scott passes the theory test is 0.9 .

The probability that Scott passes the practical test is 0.8 .

Find the probability that

(i) Scott passes the examination,

..... [2]

(ii) Scott passes the theory test or the practical test but not both.

..... [3]

11 $f(x) = 2x - 1$ $g(x) = x^2 + 2x$ $h(x) = 4^x$ $j(x) = 2^x$

(a) Find the value of

(i) $h(3)$,

..... [1]

(ii) $f(h(3))$.

..... [1]

(b) Solve the equation $g(f(x)) = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

(c) $p^{-1}(x) = f(x)$

Find $p(x)$.

..... [2]

(d) $h(x)j(x) = \frac{1}{\sqrt{2}}$

Find the value of x .

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

Question 12 is printed on the next page.

- 12 Alicia walks a distance of 9 km at a speed of x km/h.
 She then runs a distance of 5 km at a speed of $(2x + 1)$ km/h.

The total time Alicia takes is 2.5 hours.

- (a) Show that $10x^2 - 41x - 18 = 0$.

[4]

- (b) Work out Alicia's running speed.
 You must show all your work.

..... km/h [4]

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