Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE

Thursday 16 May 2024

Morning (Time: 2 hours)

Paper reference **4MA1/1H**

Mathematics A
PAPER 1H
Higher Tier

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.

Turn over ▶

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P 7 3 9 9 0 A 0 1 2 8

Pearson

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

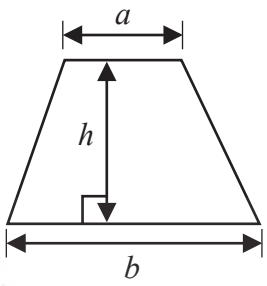
Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

The quadratic equation

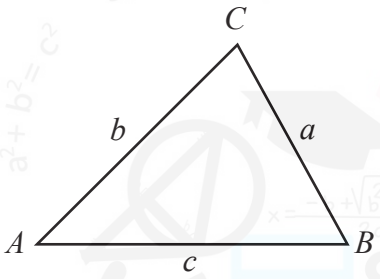
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

Area of trapezium $= \frac{1}{2}(a+b)h$



Trigonometry



In any triangle ABC

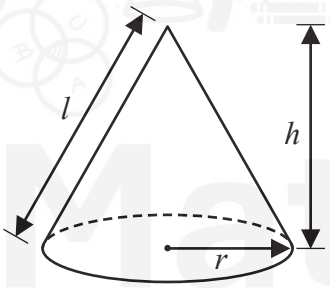
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

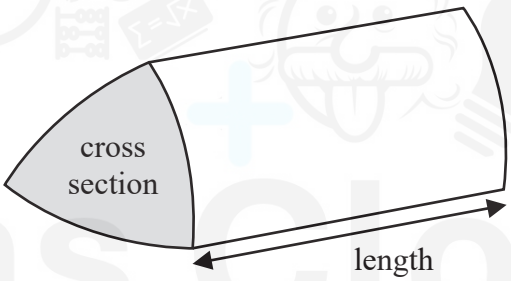
Area of triangle $= \frac{1}{2}ab\sin C$

Volume of cone $= \frac{1}{3}\pi r^2 h$

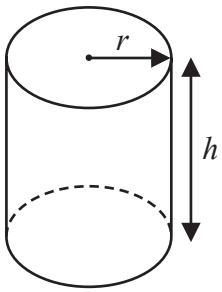
Curved surface area of cone $= \pi r l$



Volume of prism
= area of cross section × length

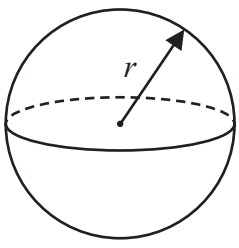


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi r h$



Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$



Answer ALL TWENTY FIVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Here are the first four terms of an arithmetic sequence.

1 4 7 10

(a) Find an expression, in terms of n, for the nth term of this sequence.

Formula: $a_n = a_1 + (n-1)d$

a_1 = first term = 1

d = difference between 2 terms

$= 7 - 4 = 3$

put it all together:

$1 + (n-1) \times 3$

$= 1 + 3n - 3$

$= 3n - 2$

$3n - 2$

(2)

The nth term of a different arithmetic sequence is $5n + 17$

(b) Find the 12th term of this sequence.

So $n = 12$

$5n + 17$

$5(12) + 17$

$= 77$

77

(1)

(Total for Question 1 is 3 marks)

2 450 students were asked how they travelled to school on Monday.
Each student walked or travelled by bus or travelled by car or travelled by bicycle.
Each student used just one method of travel.

One of these students is chosen at random.
The table shows information about the probability of each method of travel.

Method of travel	walk	bus	car	bicycle
Probability	0.20	x	$2x$	0.26

Work out how many of the 450 students travelled by car.

How many students:

Walk: $450 \times 0.2 = 90$

bicycle: $450 \times 0.26 = 117$

Students remaining: $450 - 90 - 117 = 243$

$x + 2x = 3x$

$3x = 243$

$x = 243 \div 3$

$x = 81$

So 81 students travel by bus

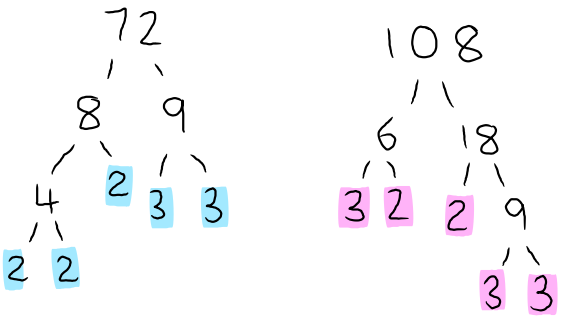
Car $= 2x = 2 \times 81 = 162$

162

(Total for Question 2 is 4 marks)

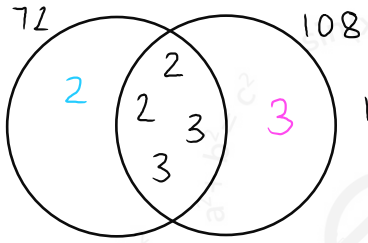
3 Find the highest common factor (HCF) of 72 and 108
Show your working clearly.

Factor trees:



$72 = 2 \times 2 \times 2 \times 3 \times 3$

$108 = 2 \times 2 \times 3 \times 3 \times 3$



$HCF = 2 \times 2 \times 3 \times 3$
$= 36$

Using ladder method:

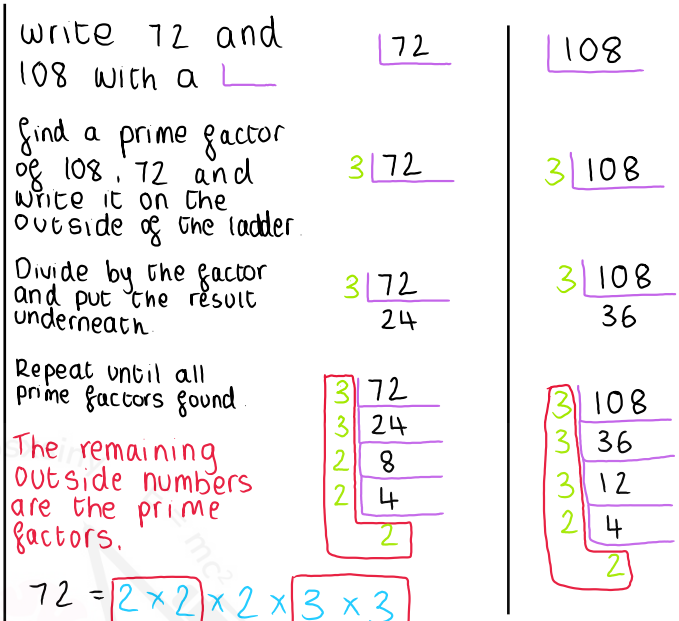
Write 72 and 108 with a ladder

Find a prime factor of 108, 72 and write it on the outside of the ladder

Divide by the factor and put the result underneath

Repeat until all prime factors found

The remaining outside numbers are the prime factors.



$72 = 2 \times 2 \times 2 \times 3 \times 3$
$108 = 2 \times 2 \times 3 \times 3 \times 3$

$HCF = 2 \times 2 \times 3 \times 3 = 36$

36

(Total for Question 3 is 2 marks)

4 Ava records the number of kilometres she drives each month.

In April, Ava drove 943 kilometres.
This is 15% more than the number of kilometres she drove in March.

Work out the number of kilometres Ava drove in March.

We can express 15% more as 1·15
i.e. 100% would = 1, so 15% is like 115%, (1·15)

$943 = 1{\cdot}15$
$820 = 1$) ÷1·15

∴ Ava drove 820 km in March

820 kilometres

(Total for Question 4 is 3 marks)

5 In the diagram, *ABCDE* is a regular pentagon.

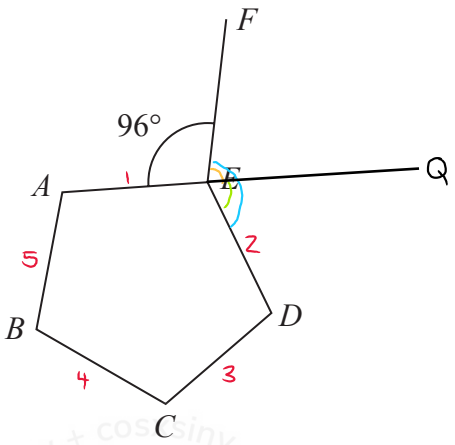


Diagram **NOT** accurately drawn

Angle *AEF* = 96°

Work out the size of the obtuse angle *FED*
Show your working clearly.

Exterior angle of polygon : 360 ÷ number of sides

360 ÷ 5 = 72°

So $D\hat{E}Q$ = 72°

$F\hat{E}Q$ = 180° - 96° = 84°

$F\hat{E}D$ = $D\hat{E}Q$ + $F\hat{E}D$

= 72° + 84°

= 156°

156 °

(Total for Question 5 is 4 marks)

6 (a) Expand and simplify $(m + 5)(m - 8)$

	m	5
m	m^2	$5m$
-8	$-8m$	-40

$= m^2 + 5m - 8m - 40$

$= m^2 - 3m - 40$

$m^2 - 3m - 40$

(2)

(b) Solve $3n - 4 = \dfrac{5n + 6}{3}$

Show clear algebraic working.

$3n - 4 = \dfrac{5n + 6}{3}$ ×3

$9n - 12 = 5n + 6$ +12

$9n = 5n + 18$ -5n

$4n = 18$ ÷4n

$n = \dfrac{9}{2}$

$n = 9 \frac{1}{2}$

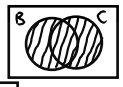
(3)

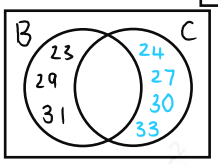
(Total for Question 6 is 5 marks)

7 $\mathscr{E}$ = {23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34}
A = {even numbers} = {24, 26, 28, 30, 32, 34}
B = {23, 29, 31}
C = {multiples of 3} = {24, 27, 30, 33}

(a) List the members of the set

(i) $B \cup C$ =



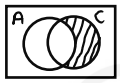


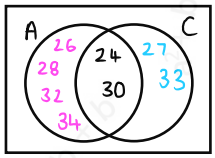
= {23, 24, 27, 29, 30, 31, 33}

{23, 24, 27, 29, 30, 31, 33}

(1)

(ii) $A' \cap C$ =





= {24, 30}

{24, 30}

(1)

(b) Is it true that $B \cap C = \varnothing$?

Tick (✓) one of the boxes below.

Yes	No
✓	

Give a reason for your answer.

There are no multiples of 3 in set B.
(any statement which indicates correct meanings of intersection and empty set are accepted).

(1)

The set D has 4 members and is such that $D \cap (A \cup C) = \varnothing$

(c) List the members of set D

$A \cup C$ = {24, 26, 27, 28, 30, 32, 33, 34}

4 elements remaining: 23, 25, 29, 31
(not included in $A \cup C$)

23, 25, 29, 31

(2)

(Total for Question 7 is 5 marks)

8 A cylinder is placed on a table.

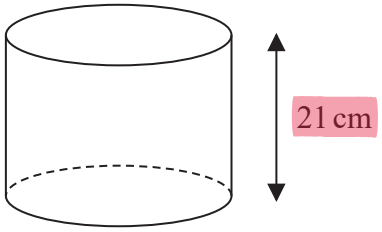


Diagram **NOT** accurately drawn

The volume of the cylinder is $1575\,cm^3$
The force exerted by the cylinder on the table is 84 newtons.

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Work out the pressure on the table due to the cylinder.

volume = area x height
1575 = area x 21
area = $75\,cm^2$

pressure = $\frac{84}{75}$

pressure = 1·12 N/cm²

1·12 newtons/cm²

(Total for Question 8 is 3 marks)

9 The table gives the amount of rice produced by each of two countries in 2020

Country	Amount of rice (tonnes)
Indonesia	3.5×10^7
Argentina	8.2×10^5

(a) Write 3.5×10^7 as an ordinary number.

Decimal point moves 7 places to the right.

3.5 0 0 0 0 0 0 0

= 35,000,000

35,000,000

(1)

In 2020, Japan produced 6 780 000 more tonnes of rice than Argentina.

(b) Work out the amount of rice Japan produced in 2020
Give your answer in standard form.

$8.2 \times 10^5 = 820,000$ (using same approach as above).

$6,780,000 + 820,000 = 7,600,000$

reverse technique to put back into standard form:

7,600,000

$= 7.6 \times 10^7$

7.6×10^7 tonnes

(2)

(Total for Question 9 is 3 marks)

10 (a) Simplify $(2p)^0$ where $p > 0$

The key idea is that anything to the power of 0 is 1

So $(2p)^0 = 1$

1

(1)

$y^9 \times y^{-3} = y^n$

(b) Find the value of n

Add the powers as we are multiplying the y's:

$y^9 \times y^{-3} = y^{9+(-3)} = y^6$

$\therefore n = 6$

$n =$ 6

(1)

(c) Simplify fully $(5a^4c^2)^3$

Multiply the powers as we are expanding the brackets:

$4 \times 3 = 12$

$2 \times 3 = 6$

$5^3 = 125$

$= 125a^{12}c^6$

$125a^{12}c^6$

(2)

(Total for Question 10 is 4 marks)

11 The diagram shows a roof support.

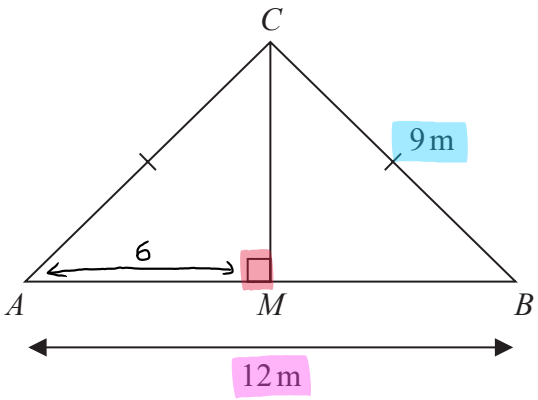


Diagram **NOT** accurately drawn

The roof support is made from four lengths of wood, AB, AC, BC and MC

$AC = BC = 9$ m $AB = 12$ m

angle $AMC = 90°$

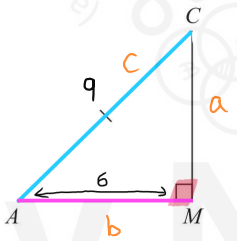
Lewis is going to buy lengths of wood to make the roof support.

The wood costs 21.50 euros per metre.
Each length of wood he buys has to be a whole number of metres.

Work out the total cost of the wood Lewis needs to buy.
Show your working clearly.

Using pythagoras to calculate CM:

$a^2 + b^2 = c^2$



$CM^2 = 9^2 - 6^2$

$CM = \sqrt{9^2 - 6^2}$

$CM = 3\sqrt{5}$ cm

Total lengths $= 3\sqrt{5} + 12 + 9 + 9$

$= 36.7 \approx 37$ m

Cost: 37×21.50

$= 795.5$ euros

795.5 euros

(Total for Question 11 is 4 marks)

12 (a) Factorise fully $6y^2 - 5y - 4$

$= y^2 - \frac{5}{6}y - \frac{4}{6}$

what multiplies to get $-\frac{4}{6}$, and adds to get $-\frac{5}{6}$?

consider $+\frac{1}{2}$ and $-\frac{4}{3}$:

$(y + \frac{1}{2})(y - \frac{4}{3})$) $\times 2$ $\times 3$

$(2y + 1)(3y - 4)$

$(2y + 1)(3y - 4)$

(2)

(b) Express $\frac{2x + 1}{4x} + \frac{7 - 5x}{3x}$ as a single fraction in its simplest form.

Cross multiply:

$\frac{3x(2x + 1) + 4x(7 - 5x)}{12x^2}$

Expand the brackets:

$\frac{6x^2 + 3x + 28x - 20x^2}{12x^2}$

collect like terms:

$\frac{-14x^2 + 31x}{12x^2}$

$\div x$:

$\frac{-14x + 31}{12x}$

$\frac{-14x + 31}{12x}$

(3)

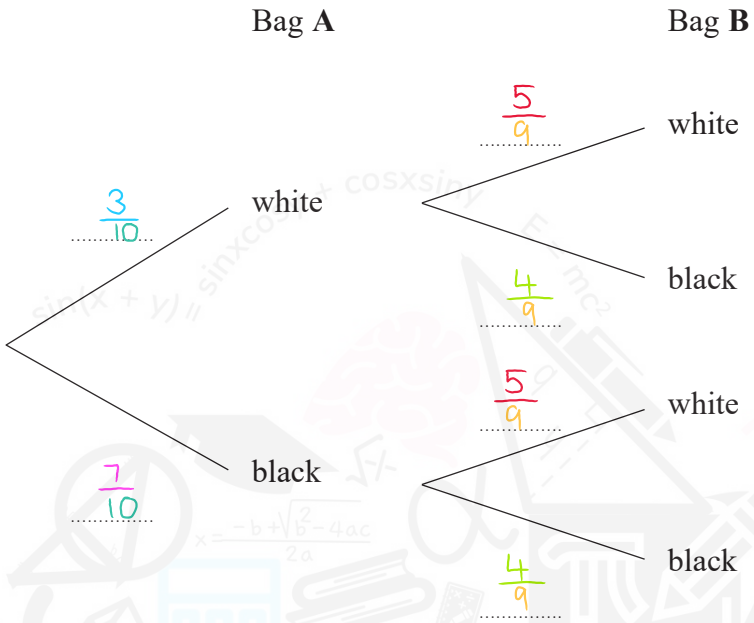
(Total for Question 12 is 5 marks)

13 Harman has two bags of beads.

In bag **A**, there are 3 white beads and 7 black beads. = 10 total
In bag **B**, there are 5 white beads and 4 black beads. : 9 total

Harman takes at random a bead from bag **A** and a bead from bag **B**

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Harman takes two beads of the same colour.

(white × white) + (black × black)

$\left(\frac{3}{10} \times \frac{5}{9}\right) + \left(\frac{7}{10} \times \frac{4}{9}\right) = \frac{43}{90}$

43/90

(3)

(Total for Question 13 is 5 marks)

14 The combined savings of Abel and Bahira are 15 435 dinars.

The savings of Bahira are 45% more than the savings of Abel.

The savings of Bahira are $\frac{3}{2}$ times the savings of Chanda.

Work out the savings of Chanda.

A + B = 15435

Let A = 1, B = 1.45
(As B's 45% more than A)

2.45 = 15435
1 = 6300) ÷ 2.45

As savings = 6300
Bs savings = 15435 − 6300 = 9135

1.5 = 9135
Cs savings = 9135 ÷ 1.5 = 6090

6090 dinars

(Total for Question 14 is 5 marks)

15 The function f is defined as

$$f: x \mapsto \frac{3x+1}{x-2}$$

(a) State the value of x that cannot be included in any domain of the function f

$x = 2$

As denominator becomes $2-2=0$, we cannot $\div$ by 0.

$x = 2$

(1)

(b) Express the inverse function f^{-1} in the form $f^{-1}(x) = ...$

$y = \frac{3x+1}{x-2}$

$\times (x-2)$

$y(x-2) = 3x+1$

expand brackets

$yx - 2y = 3x + 1$

$-3x$

$yx - 3x - 2y = 1$

$+2y$

$yx - 3x = 1 + 2y$

factorise x

$x(y-3) = 1+2y$

$\div y-3$

$x = \frac{1+2y}{y-3}$

swap y's for x's

$f^{-1}(x) = \frac{1+2x}{x-3}$

$f^{-1}(x) = \frac{1+2x}{x-3}$

(3)

(Total for Question 15 is 4 marks)

16 There are 20 sweets in a box.

15 of the sweets are red
5 of the sweets are yellow

Fred takes at random 3 sweets from the box.

Work out the probability that Fred takes at least one sweet of each colour from the box.

Try reversing the problem, for an easier calculation:

1 - sweets all the same colour

$1 - (\text{red} \times \text{red} \times \text{red}) + (\text{yellow} \times \text{yellow} \times \text{yellow})$

$1 - \left(\frac{15}{20} \times \frac{14}{19} \times \frac{13}{18}\right) + \left(\frac{5}{20} \times \frac{4}{19} \times \frac{3}{18}\right)$

$1 - \left(\frac{91}{228}\right) + \left(\frac{1}{114}\right)$

$1 - \frac{31}{76}$

$= \frac{45}{76}$

$\frac{45}{76}$

(Total for Question 16 is 4 marks)

17 Show that $\frac{1+\sqrt{5}}{3-\sqrt{5}}$ can be written in the form $a+\sqrt{b}$ where a and b are integers.

Show each stage of your working clearly.

multiply by $3+\sqrt{5}$:

$$\frac{1+\sqrt{5}}{3-\sqrt{5}} \times \frac{3+\sqrt{5}}{3+\sqrt{5}}$$

	1	$\sqrt{5}$
3	3	$3\sqrt{5}$
$\sqrt{5}$	$\sqrt{5}$	5

$= 8+4\sqrt{5}$

	3	$-\sqrt{5}$
3	9	$-3\sqrt{5}$
$\sqrt{5}$	$3\sqrt{5}$	-5

$= 4$

$$= \frac{8+4\sqrt{5}}{4}$$

$= 2+\sqrt{5}$ as required

(Total for Question 17 is 3 marks)

18 A curve C has equation $y = x^3 - 40x + 1$

Find the coordinates of both the points on C at which the gradient is 8

Differentiation is the gradient of the tangent to the curve.
"Times by the power, minus 1 from the power."

$\frac{dy}{dx} = 3x^2 - 40$

$\therefore 3x^2 - 40 = 8$

$3x^2 = 48$

$x^2 = 16$

$x = \pm 4$

when $x = 4$:
$y = (4)^3 - 40(4) - 1$
$y = -95$
$(4, -95)$

when $x = -4$
$y = (-4)^3 - 40(-4) + 1$
$y = 97$
$(-4, 97)$

(4 , -95)

(-4 , 97)

(Total for Question 18 is 5 marks)

19 Here is quadrilateral *ABCD*

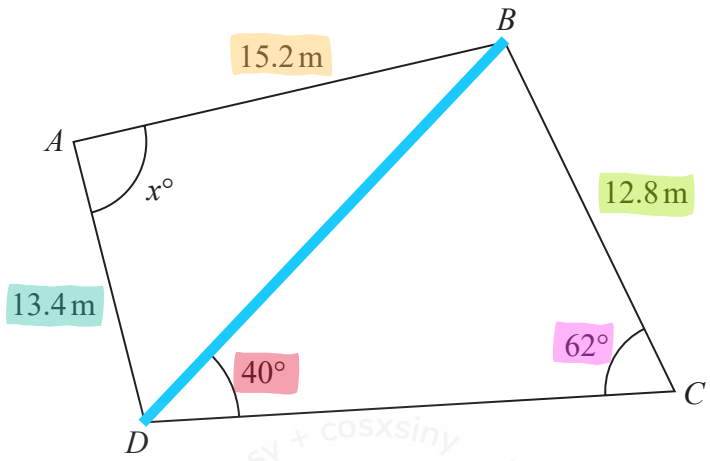


Diagram **NOT** accurately drawn

Work out the value of x
Give your answer correct to 3 significant figures.

First, calculate BD using Sine rule, since we have matching sides.

$$\frac{a}{\sin(A)} = \frac{b}{\sin(B)}$$

$$\frac{BD}{\sin 62} = \frac{12.8}{\sin 40}$$

$$BD = \frac{12.8}{\sin 40} \times \sin 62$$

$$BD = 17.58\ldots$$

Now use cosine rule to find x:

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

$$17.58\ldots^2 = 13.4^2 + 15.2^2 - 2(13.4)(15.2)\cos(x)$$

Rearranging gives:

$$\cos(x) = \frac{13.4^2 + 15.2^2 - 17.58\ldots^2}{2(13.4)(15.2)}$$

$$x = \cos^{-1}\left(\frac{13.4^2 + 15.2^2 - 17.58\ldots^2}{2(13.4)(15.2)}\right)$$

$x = 75.6°$ To 3 significant figures

$x =$ 75.6

(Total for Question 19 is 5 marks)

20 The diagram shows a sector $OABC$ of a circle centre O

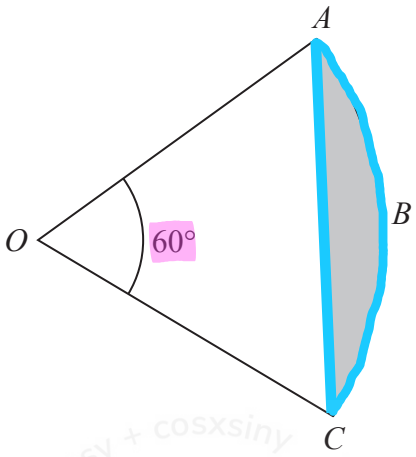


Diagram **NOT** accurately drawn

Angle $AOC = 60°$

The area of the shaded segment ABC is $38\,cm^2$

Work out the perimeter of the shaded segment ABC
Give your answer correct to one decimal place.

Area of Segment $= \frac{\theta}{360}\pi r^2 - \frac{1}{2}r^2\sin\theta$

$38 = \frac{60}{360}\pi r^2 - \frac{1}{2}r^2\sin 60$

$38 = r^2\left(\frac{60}{360}\pi - \frac{1}{2}\sin 60\right)$

$r = \sqrt{\frac{38}{\frac{60}{360}\pi - \frac{1}{2}\sin 60}}$

$r = 20.48\ldots cm$

Arc length $= 2\pi r\left(\frac{\theta}{360}\right)$

$= 2\pi(20.48..)\left(\frac{60}{360}\right)$

$= 21.45\,cm$

Total perimeter $= 21.45 + 20.48$

$= 41.9\,cm$ to one decimal place

41.9 cm

(Total for Question 20 is 4 marks)

21 A curve has equation $y = f(x)$

There is one minimum point on this curve.
The coordinates of this minimum point are (5, –4)

Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x + 7)$

x, inside, opposite
-7 from x value
(5, -4) -> (-2, -4)

(-2 , -4)

(1)

(ii) $y = f(x) – 6$

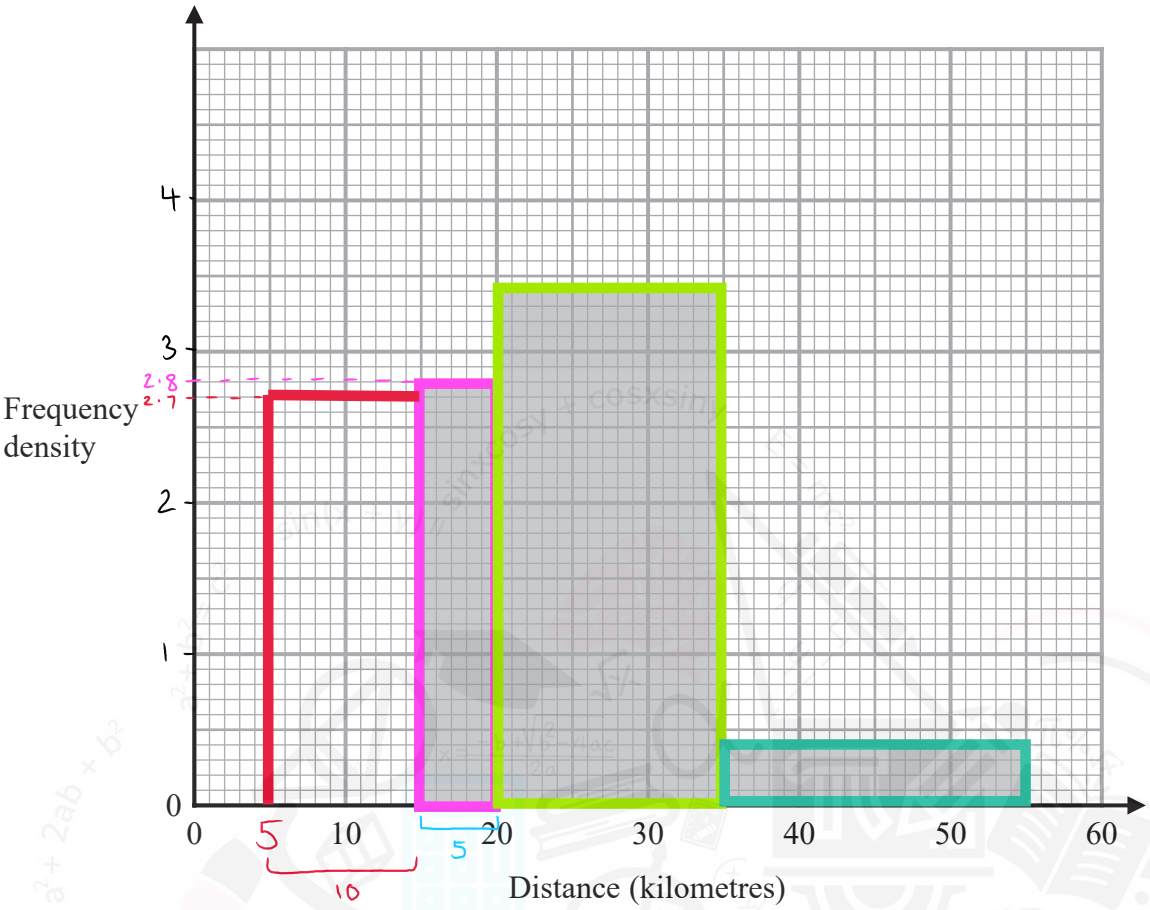
y, outside, expect
-6 from y value
(5, -4) -> (5, -10)

(5 , -10)

(1)

(Total for Question 21 is 2 marks)

22 The incomplete histogram shows some information about the distances, in kilometres, that 100 adults ran last week.



All of the adults ran at least 5 kilometres.
None of the adults ran more than 55 kilometres.
14 adults ran between 15 kilometres and 20 kilometres.

Complete the histogram.

FD = 14 ÷ 5 = 2·8

Areas:

5 × 2·8 = 14
15 × 3·4 = 51
20 × 0·4 = 8
} = 73

100 − 73 = 27

$\frac{27}{10}$ = 2·7

so bar is drawn from 5km - 10km, up to FD of 2·7.

(Total for Question 22 is 3 marks)

23 A solid shape is made by removing a hemisphere, shown shaded, from a cone as shown in the diagram.

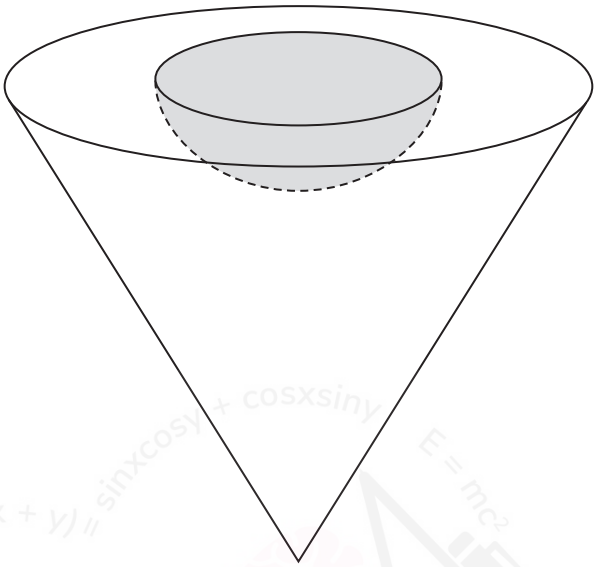


Diagram **NOT** accurately drawn

The radius of the hemisphere is $2x$ cm
The radius of the base of the cone is $5x$ cm
The vertical height of the cone is $6x$ cm

The volume of the solid shape is 6948π cm^3

Work out the **total** surface area of the solid hemisphere that has been removed from the cone.
Give your answer correct to the nearest integer.

Volume of hemisphere: $\frac{1}{2} \times \frac{4}{3}\pi r^3$

$= \frac{1}{2} \times \frac{4}{3}\pi(2x)^3$

$= \frac{32}{3}\pi x^3$

Volume of cone: $\frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi(5x)^2(6x)$

$= 150\pi x^3$

Volume of shape:

$150\pi x^3 + \frac{32}{3}\pi x^3 = 6948\pi \text{ cm}^3$

$\frac{482}{3}\pi x^3 = 6948\pi \text{ cm}^3$

$x = \sqrt[3]{\frac{6948\pi}{482/3\,\pi}}$

$x = 5.37\ldots$

SA of hemisphere:

$3 \times \pi \times (2 \times 5{\cdot}37..)^2$

$= 1090 \text{cm}^2$

1090 ..... cm^2

(Total for Question 23 is 5 marks)

24 A polygon has n sides, where $n > 5$

The interior angles of the polygon form an arithmetic sequence.

The smallest angle of the polygon is $84°$
The common difference of the sequence is $4°$

Work out the sum of the interior angles of the polygon.
Show clear algebraic working.

$a = 84°$

$d = 4°$

formula: $\frac{n}{2}[2a + (n-1)d]$

$= \frac{n}{2}[2(84) + (n-1)4]$

$= \frac{n}{2}[168 + 4n - 4]$

$= \frac{n}{2}[164 + 4n]$

$= 82n + 2n^2$

interior angles: $(n-2) \times 180$

so $82n + 2n^2 = (n-2) \times 180$

$82n + 2n^2 = 180n - 360$

$2n^2 + 98n - 360 = 0$

$-n^2 + 49n + 180 = 0$

factorising:

$(n-45)(n-4) = 0$

$n = 45$ or $n = 4$

given $n \geq 5$, so $n = 45$

Sum of interior angles:

$(n-2) \times 180$

$(45-2) \times 180$

$= 7740°$

7740 °

(Total for Question 24 is 6 marks)

Turn over for Question 25

25 $f(x) = 17 - 3x^2 + 12x$

Write $f(x)$ in the form $a - b(x - c)^2$ where a, b and c are constants.

This is completing the square:

$= -3x^2 + 12x + 17$) factorise 3

$= -3(x^2 + 4x) + 17$) complete the square

$2 = 4 \div 2$

$4 = 2^2$

$= -3((x+2)^2 - 4) + 17$

$= -3(x+2)^2 + 12 + 17$) multiply by -3

$= -3(x+2)^2 + 29$) simplify

$f(x) = -3(x+2)^2 + 29$

(Total for Question 25 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS