Pearson Edexcel
International GCSE

Centre Number

Candidate Number

Mathematics A
Level 1/2
Paper 1H

Higher Tier

Specimen Paper	Paper Reference
Time: 2 hours	**4MA1/1H**

You must have:
Ruler graduated in centimetres and millimetres, protractor, 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.
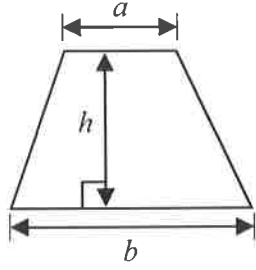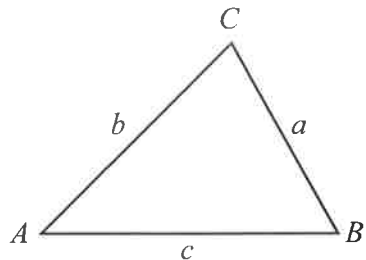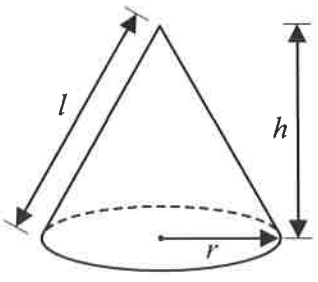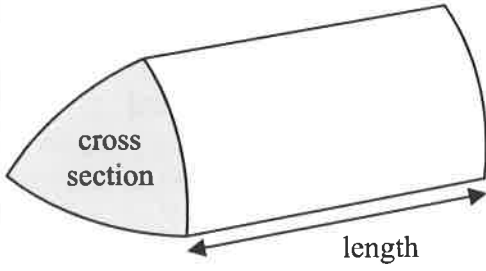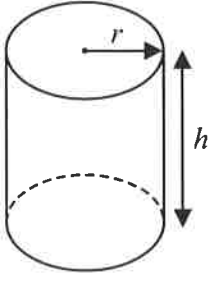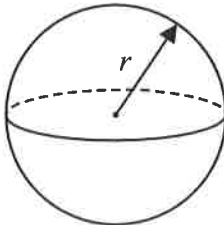
Turn over ▶

Pearson

International GCSE Mathematics
Formulae sheet – Higher Tier

Arithmetic series

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

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 $= \dfrac{1}{2}(a + b)h$

Trigonometry

In any triangle ABC

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

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

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

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

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 $= \dfrac{4}{3}\pi r^3$

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

S 5 6 2 8 3 A 0 2 2 4

Answer ALL TWENTY THREE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1   Aiko, Max and Pau share 5400 yen in the ratios $5:3:4$

How much money does each of them get?

$5+3+4=12$

$\dfrac{5400}{12}=450$

$450\times5=2250$

$450\times3=1350$

$450\times4=1800$

Aiko .... 2250 .... yen

Max .... 1350 .... yen

Pau .... 1800 .... yen

(Total for Question 1 is 3 marks)

2   pressure $=\dfrac{\text{force}}{\text{area}}$

Find the pressure exerted by a force of 810 newtons on an area of $120\,cm^2$
Give your answer in newtons/m^2

$cm \xrightarrow{\div100} m$

$cm^2 \xrightarrow{\div100^2} m^2$

$120 \div 100^2 = 0.012\,m^2$

$P=\dfrac{810N}{0.02m^2} = 67500N/m^2$

.... 67500 .... newtons/m^2

(Total for Question 2 is 3 marks)

3 (a) Find the Highest Common Factor (HCF) of 140 and 245

140
20   7
5   4
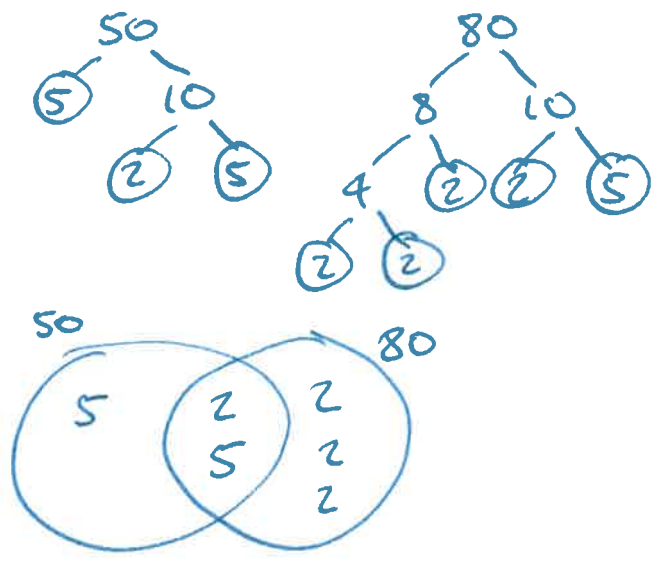2   2

245
5   49
7   7

140   245
2 5 7
2 7
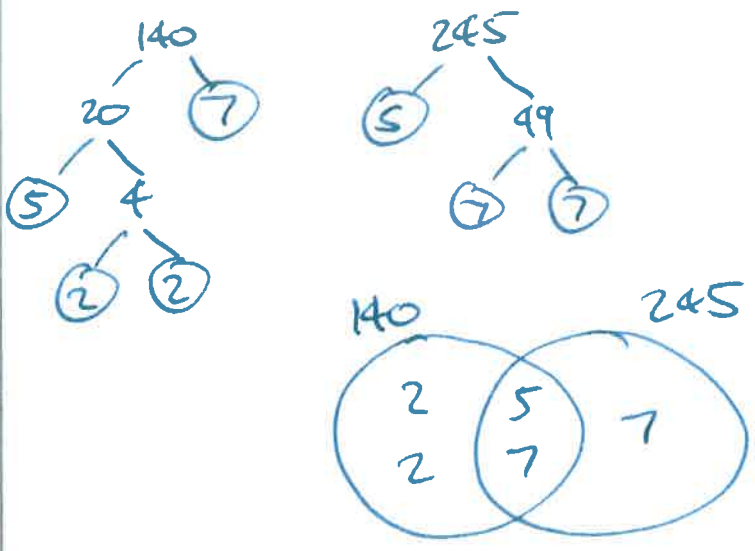
HCF:
5×7=35   35

(2)

A machine has a buzzer that sounds every 50 minutes.
The machine also has a bell that sounds every 80 minutes.

The buzzer and the bell sound together at 10 am.

(b) Find the time at which they next sound together.

50
5   10
2   5

80
8   10
4   2 2   5
2   2

50   80
5 2 2
5 2
2

LCM: 5×2×5×2×2×2 = 400

400 mins = 6h 40 mins
10:00 + 6:40 = 16:40

16:40

(3)

(Total for Question 3 is 5 marks)

4 (a) Factorise fully $6y^2 + 15y$

$3y(2y + 5)$

(2)

(b) Expand and simplify $(m + 9)(m - 5)$

$m^2 + 4m - 45$

(2)

(c) Make t the subject of $s = \dfrac{1}{2}at^2$

$2s = at^2$

$\dfrac{2s}{a} = t^2$

$\pm\sqrt{\dfrac{2s}{a}} = t$

$t = \pm\sqrt{\dfrac{2s}{a}}$

(2)

(d) Solve $\dfrac{6x - 5}{2} = x + 1$

Show clear algebraic working.

$6x - 5 = 2(x + 1)$
$6x - 5 = 2x + 2$
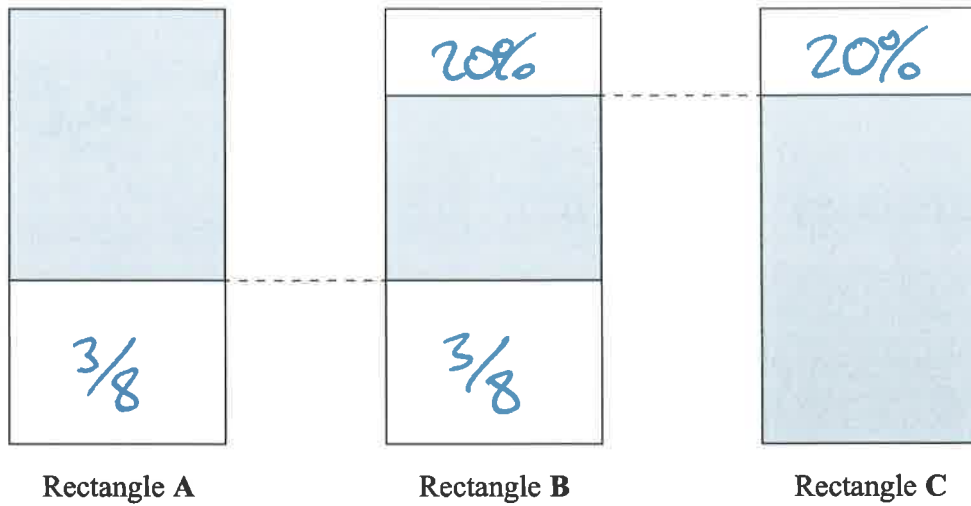$4x - 5 = 2$
$\quad 4x = 7$
$\quad\;\; x = \dfrac{7}{4}$

$x = \underline{\quad 7/4 \quad}$

(3)

(Total for Question 4 is 9 marks)

5 The diagram shows three identical rectangles.

Rectangle **A**   Rectangle **B**   Rectangle **C**

$\frac{5}{8}$ of rectangle **A** is shaded.

80% of rectangle **C** is shaded.

What fraction of rectangle **B** is shaded?

$$\frac{3}{8} + 20\% = \frac{3}{8} + \frac{1}{5} = \frac{15}{40} + \frac{8}{40} = \frac{23}{40}$$

$$1 - \frac{23}{40} = \frac{17}{40}$$

$\frac{17}{40}$

(Total for Question 5 is 3 marks)

6 Lijuan's salary is 180 000 Hong Kong Dollars (HK$).
   She gets a salary increase of 3%

   (a) Work out Lijuan's salary after this increase.

   $$180,000 \times 1.03 = 185,400$$

   HK$ 185, 400

   (3)

   In a sale, all normal prices are reduced by 15%
   The sale price of a camera is HK$6630

   (b) Work out the normal price of the camera.

   $$0.85x = 6630$$
   $$x = \frac{6630}{0.85}$$
   $$= 7800$$

   HK$ 7800

   (3)

   (Total for Question 6 is 6 marks)

7   Ian plays 7 games of cricket.
    His mean score per game for these 7 games is 42 runs.

    Ian is going to play one more game of cricket.
    He wants his mean score per game for the 8 games to be exactly 50 runs.

    How many runs must he score in his 8th game?

    $7 \times 42 = 294$

    $8 \times 50 = 400$

    $400 - 294 = 106$

                                                                    106

(Total for Question 7 is 3 marks)

8   The table shows the population, correct to two significant figures, of each of six countries in April 2016.

Country	Population (April 2016)
Hungary	9.8×10^6
Mexico	1.3×10^8
Thailand	6.8×10^7
Nigeria	1.9×10^8
Singapore	5.7×10^6
Egypt	9.3×10^7

(a) Write 9.3×10^7 as an ordinary number.

93,000,000

(1)

(b) Which of these countries had the least population?

Singapore

(1)

The population of China was 1.382×10^9 in April 2016.
The population of India was 1.327×10^9 in April 2016.

(c) Work out the difference between the population of China and the population of India in April 2016.
Give your answer in standard form.

$(1.382 \times 10^9) - (1.327 \times 10^9)$

$= 0.055 \times 10^9$

$= 5.5 \times 10^7$

5.5×10^7

(2)

(Total for Question 8 is 4 marks)
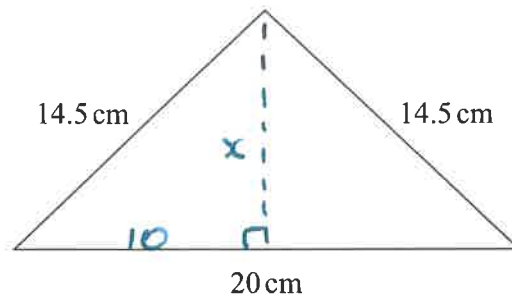
9 The diagram shows an isosceles triangle.

Diagram **NOT** accurately drawn

14.5 cm   14.5 cm

x

10

20 cm

Work out the area of the triangle.

$$x^2 + 10^2 = 14.5^2$$
$$x^2 = 14.5^2 - 10^2$$
$$x^2 = 110.25$$
$$x = \sqrt{110.25}$$
$$x = 10.5$$

$$\text{Area} = \tfrac{1}{2}bh = \tfrac{1}{2}(20)(10.5)$$
$$= 105$$

105 .... cm²

(Total for Question 9 is 4 marks)

10 Solve the simultaneous equations

$$7x + 3y = 20 \quad \times 3 \qquad 21x + 9y = 60 \quad \text{①}$$
$$3x + 5y = 3 \quad \times 7 \qquad 21x + 35y = 21 \quad \text{②}$$

Show clear algebraic working.

~~① − ②:~~

② − ①: $26y = -39$

$$y = -\frac{39}{26} = -1.5$$

$$7x + 3(-1.5) = 20$$
$$7x - 4.5 = 20$$
$$7x = 24.5$$
$$x = 3.5$$

$x = \underline{\quad 3.5 \quad}$

$y = \underline{\quad -1.5 \quad}$

(Total for Question 10 is 4 marks)

11 15 students took an English test.
The same 15 students took a Maths test.
Both tests were marked out of 30

For the English test results
  the median was 21
  the interquartile range was 14

The Maths test results are shown below.

  18   18   19   ⓔ20   24   25   25   ㉖   28   28   29   ㉙   29   30   30

Use the information above to compare the English test results with the Maths test results.
Write down **two** comparisons.

$$29 - 20 = 9$$

1. The students scored higher in the Maths test (Maths median > English median)

2. The students scored more consistently in the Maths test (Maths IQR < ~~Maths~~ English IQR)

(Total for Question 11 is 4 marks)

S 5 6 2 8 3 A 0 1 2 2 4

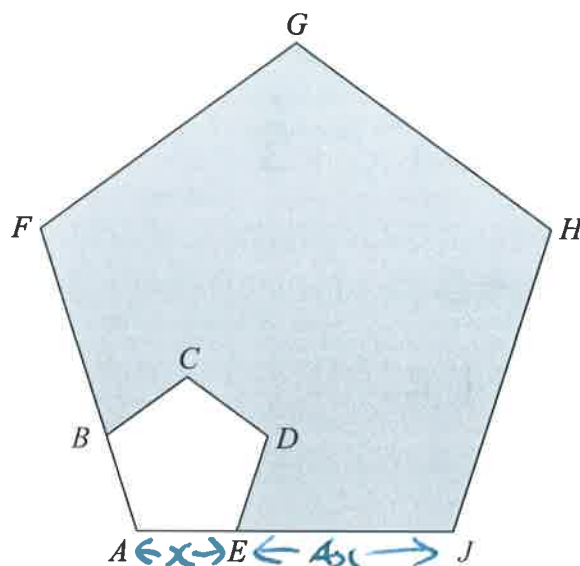**12** *ABCDE* and *AFGHJ* are regular pentagons.

Diagram **NOT** accurately drawn

AEJ and *ABF* are straight lines.

$EJ = 4AE$
The area of *ABCDE* is $8\,cm^2$

Calculate the area of the shaded region.

$AJ = 5x$

$\text{Scale Factor} = \dfrac{AJ}{AE} = \dfrac{5x}{x} = 5$

$\text{Area } SF = 5^2 = 25$

$8 \times 25 = 200$

$200 - 8 = 192$

192 .... cm^2

(Total for Question 12 is 3 marks)

13 The points $(1, -1)$ and $(4, 7)$ lie on the straight line **L**.

Find an equation for **L**.
Give your equation in the form $ax + by = c$ where a, b and c are integers.

$$m = \frac{\Delta y}{\Delta x} = \frac{7--1}{4-1} = \frac{8}{3}$$

$$y = \frac{8}{3}x + c$$

$$(-1) = \frac{8}{3}(1) + c$$

$$-1 - \frac{8}{3} = c$$

$$-\frac{11}{3} = c$$

$$y = \frac{8}{3}x - \frac{11}{3}$$

$$3y = 8x - 11$$

$$11 = 8x - 3y$$

$$8x - 3y = 11$$

(Total for Question 13 is 4 marks)
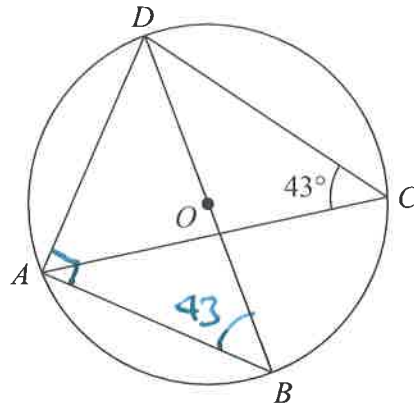
14

Diagram **NOT** accurately drawn

A, B, C and D are points on a circle, centre O.
DOB is a diameter of the circle.
Angle $ACD = 43°$

Work out the size of angle ADB.
Give a reason for each stage in your working.

$D\hat{A}B = 90°$ angle in a semicircle

$D\hat{B}A = 43°$ angles in the same segment are equal

$A\hat{D}B = 180 - 90 - 43 = 47°$ angles in a triangle sum to 180°

47 °

(Total for Question 14 is 5 marks)

15 P is inversely proportional to $\sqrt{q}$

$P = 10$ when $q = 0.0064$

(a) Find a formula for P in terms of q

$$P \propto \frac{1}{\sqrt{q}}$$

$$P = \frac{k}{\sqrt{q}}$$

$$10 = \frac{k}{\sqrt{0.0064}}$$

$$10\sqrt{0.0064} = k$$

$$0.8 = k$$

$$P = \frac{0.8}{\sqrt{q}}$$

(3)

(b) Find the value of q when $P = 20$

$$20 = \frac{0.8}{\sqrt{q}}$$

$$\sqrt{q} = \frac{0.8}{20} = 0.04$$

$$q = 0.04^2 = \frac{1}{625}$$

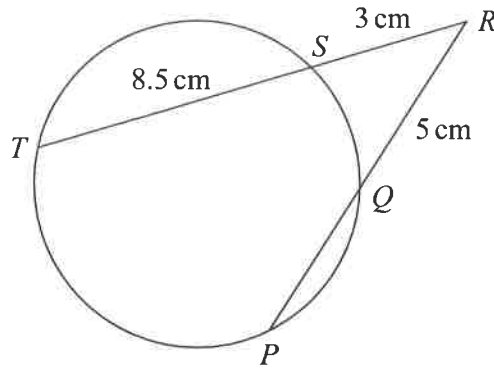$\frac{1}{625}$

(2)

(Total for Question 15 is 5 marks)

16

3 cm
8.5 cm
R
S
T
5 cm
Q
P

Diagram **NOT**
accurately drawn

P, *Q*, *S* and *T* are points on a circle.
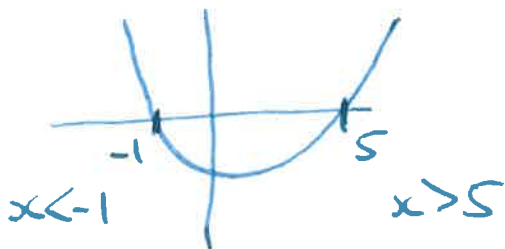*TSR* and *PQR* are straight lines.

Work out the length of *PQ*.

$$3(3+8.5) = 5(5+PQ)$$
$$34.5 = 5(5+PQ)$$
$$6.9 = 5+PQ$$
$$1.9 = PQ$$

..........1.9.......... cm

(Total for Question 16 is 3 marks)

17 (a) Solve $x^2 + 2x > 6x + 5$

$$x^2 - 4x - 5 > 0$$
$$(x-5)(x+1) > 0$$

-1
5

$x < -1$ $x > 5$

..........$x < -1$ or $x > 5$..........
(3)

(b) Represent your solution set to part (a) on the number line below.

(1)

(Total for Question 17 is 4 marks)

18 A container is made from a hemisphere on top of a cylinder, as shown in the diagram.
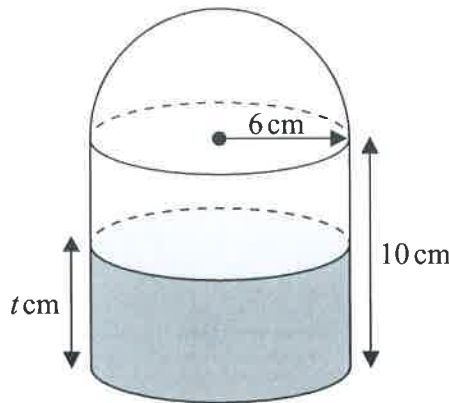

6 cm

Diagram **NOT** accurately drawn

10 cm

t cm

The hemisphere and the cylinder both have radius 6 cm.
The height of the cylinder is 10 cm.

There is water to a depth of t cm in the cylinder.
The volume of water in the container is half the total volume of the container.

Work out the value of t.

Volume of hemisphere $= \frac{1}{2}\left(\frac{4}{3}\pi r^3\right) = \frac{2}{3}\pi r^3$

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

$= 144\pi$

Volume of cylinder $= \pi r^2 h = \pi(6)^2(10)$

$= 360\pi$

$360\pi + 144\pi = 504\pi$

$\frac{504\pi}{2} = 252\pi$ (depth of water)

Depth $= \pi r^2 \times t$

$252\pi = \pi(6)^2 t$

$252\pi = 36\pi \times t$

$\frac{252\pi}{36\pi} = t$

$7 = t$

7

(Total for Question 18 is 4 marks)

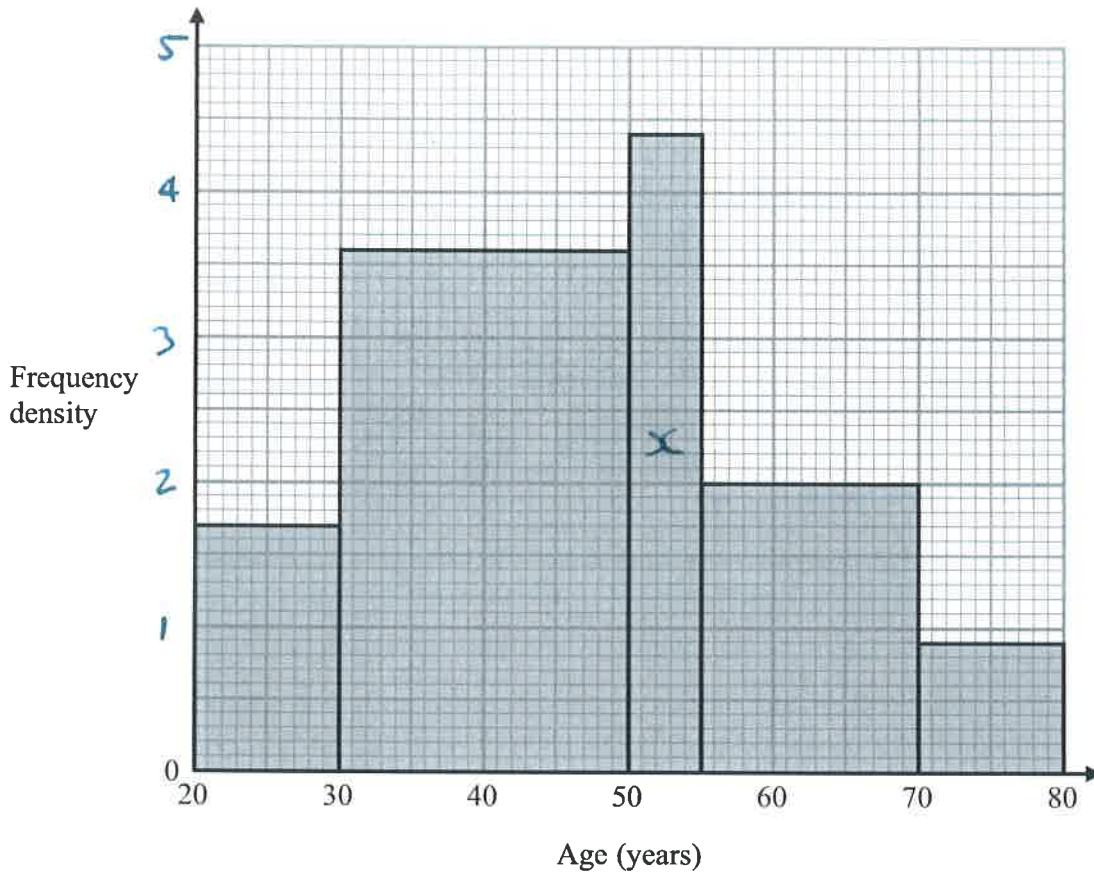**19** 150 people took part in a survey.
The histogram shows information about the ages of these people.

Frequency density

Age (years)

Work out how many of these 150 people are aged between 50 years and 55 years.

$x = 4.4 \times 5 = 22$

Total area $= (1.7 \times 10) + (3.6 \times 20) + 22 + (2 \times 15)$
$\qquad\qquad\qquad\qquad\qquad\qquad + (0.9 \times 10)$

$\qquad = 17 + 72 + 22 + 30 + 9$

$\qquad = 150$

$\dfrac{22}{150} \times 150 = 22$

.... 22

(Total for Question 19 is 4 marks)

20 Prove algebraically that the difference between the squares of any two consecutive odd numbers is always a multiple of 8

$$(2n+3)^2 - (2n+1)^2$$
$$= (2n+3)(2n+3) - (2n+1)(2n+1)$$
$$= (4n^2+12n+9) - (4n^2+4n+1)$$
$$= 8n+8$$
$$= 8(n+1) \text{ which must be a multiple of } 8$$

(Total for Question 20 is 4 marks)

21 The curve C has equation $\quad y = x^2 - 6x + 4$

Using the axes below, sketch the curve C.
On your sketch show clearly

(i) the exact coordinates of any points of intersection of C with the coordinate axes,

(ii) the coordinates of the turning point.

$x = 0$: $\quad y = 0 - 0 + 4 = 4$

$y = 0$: $\quad x^2 - 6x + 4 = 0$

$$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(4)}}{2(1)}$$

$$= \frac{6 \pm \sqrt{20}}{2}$$

$$= \frac{6 \pm 2\sqrt{5}}{2}$$

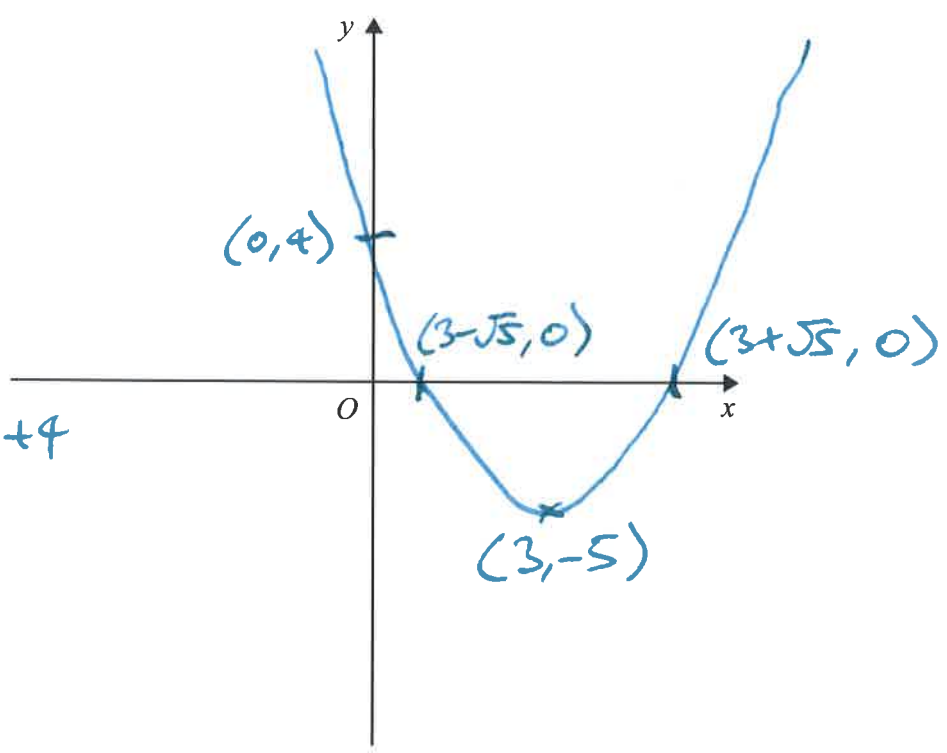$$= 3 \pm \sqrt{5}$$

$\frac{dy}{dx} = 0$

$2x - 6 = 0$

$2x = 6$

$x = 3$

$y = (3)^2 - 6(3) + 4$

$y = -5$

(0, 4)

$(3-\sqrt{5}, 0)$ $(3+\sqrt{5}, 0)$

$(3, -5)$

(Total for Question 21 is 6 marks)

22 There are 7 red counters in a bag.
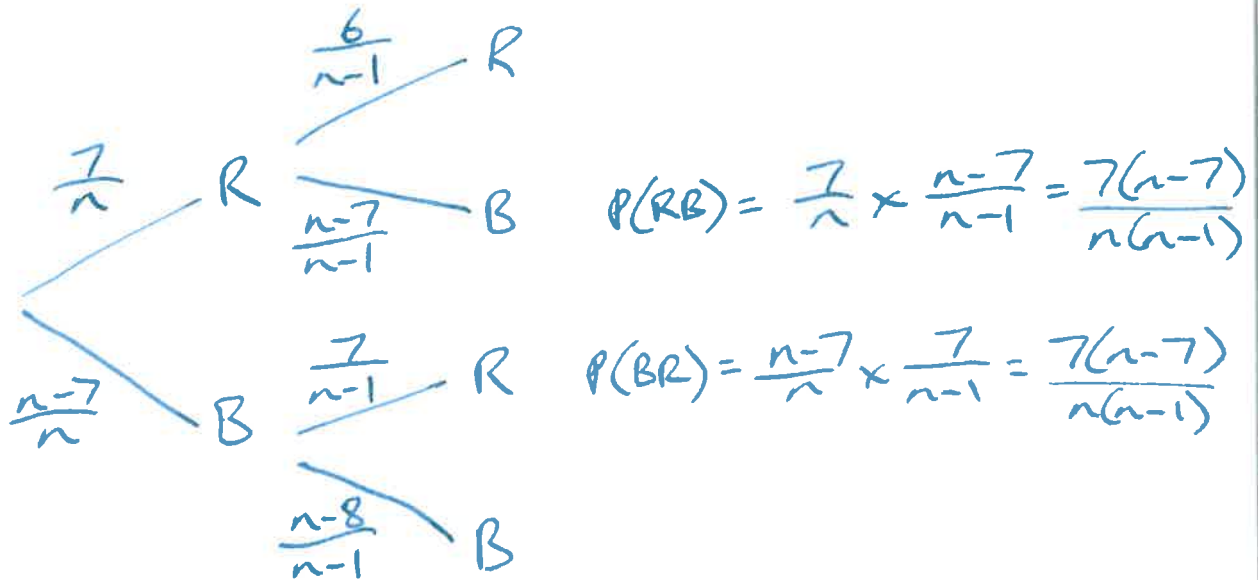The rest of the counters in the bag are blue.

Let n be the total number of counters

There are more blue counters than red counters in the bag.

Two counters are to be taken at random from the bag.

The probability that there will be one counter of each colour is $\frac{7}{15}$

$P(RB \text{ or } BR) = \frac{7}{15}$

Work out the total number of counters in the bag before any counters are taken from the bag.

$$\frac{7}{n} \nearrow R \begin{cases} \frac{6}{n-1} \nearrow R \\ \frac{n-7}{n-1} \searrow B \end{cases} \qquad P(RB) = \frac{7}{n} \times \frac{n-7}{n-1} = \frac{7(n-7)}{n(n-1)}$$

$$\frac{n-7}{n} \searrow B \begin{cases} \frac{7}{n-1} \nearrow R \\ \frac{n-8}{n-1} \searrow B \end{cases} \qquad P(BR) = \frac{n-7}{n} \times \frac{7}{n-1} = \frac{7(n-7)}{n(n-1)}$$

$$P(RB \text{ or } BR) = \frac{7}{15}$$

$$\frac{7(n-7)}{n(n-1)} + \frac{7(n-7)}{n(n-1)} = \frac{7}{15}$$

$$\frac{14(n-7)}{n(n-1)} = \frac{7}{15}$$

$$210(n-7) = 7n(n-1)$$
$$210n - 1470 = 7n^2 - 7n$$
$$0 = 7n^2 - 217n + 1470$$
$$0 = n^2 - 31n + 210$$
$$0 = (n-21)(n-10)$$
$$n = 10 \text{ or } n = 21$$

21

(Total for Question 22 is 5 marks)

23 *A*, *B* and *C* are three towns.
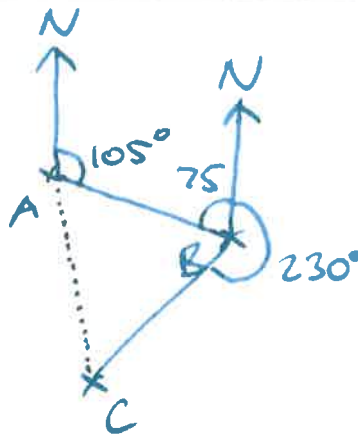
The bearing of *B* from *A* is 105°
The bearing of *C* from *B* is 230°

The distance of *C* from *A* is 180 km.
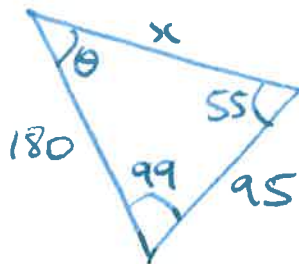The distance of *C* from *B* is 95 km.

Calculate the distance of *B* from *A*.
Give your answer correct to 3 significant figures.

$$180 - 105 = 75°$$
$$360 - 230 - 75 = 55$$

$$\frac{\sin 55}{180} = \frac{\sin \theta}{95}$$

$$\frac{95 \sin 55}{180} = \sin \theta$$

$$0.432330 = \sin \theta$$

$$\theta = \sin^{-1}(0.432330)$$

$$\theta = 25.6155°$$

$$180 - 55 - 25.6155 = 99.3845°$$

$$\frac{55}{\sin 180} = \frac{x}{\sin 99} \qquad \frac{180}{\sin 55} = \frac{x}{\sin 99}$$

$$\frac{55 \sin 99}{\sin 180} = x \qquad \frac{180 \sin 99}{\sin 55} = x$$

$$x = 216.799$$

.................217................. km

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

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International GCSE Mathematics
Formulae sheet – Higher Tier
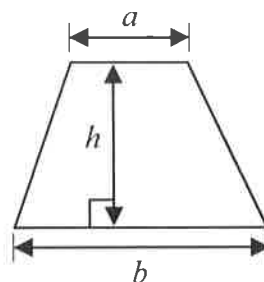
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Sum to n terms, $S_n = \dfrac{n}{2}\,[2a + (n-1)d]$
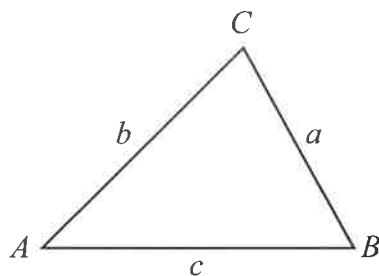
The quadratic equation

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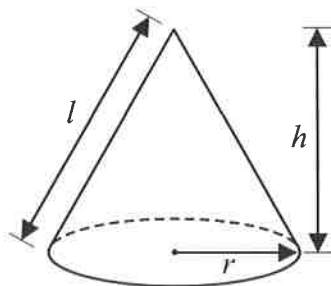

Trigonometry

In any triangle ABC

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

Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$
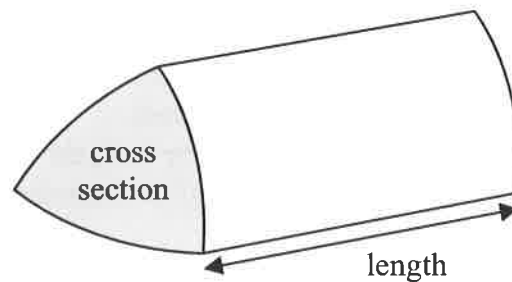
Area of triangle $= \dfrac{1}{2}ab\sin C$

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

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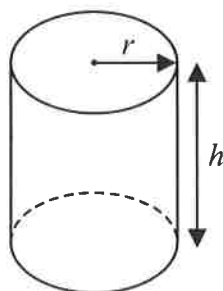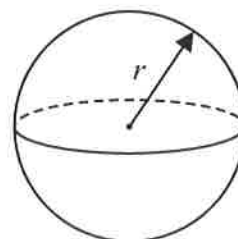

Volume of prism
= area of cross section × length

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

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

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

Answer ALL TWENTY TWO questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Simplify $3e^7f \times 4e^2f$

$12e^9f^2$

(2)

(b) Simplify fully $(27a^{12})^{\frac{2}{3}}$

$(3a^4)^2$

$9a^8$

(2)

(c) Solve the inequality $2q \geqslant 31 - 3q$

$5q \geqslant 31$

$q \geqslant \frac{31}{5}$

$q \geqslant \frac{31}{5}$

(2)

$-2 \leqslant n < 3$
n is an integer

(d) Write down all the possible values of n.

$-2, -1, 0, 1, 2$

(2)

(Total for Question 1 is 8 marks)

2 The diagram shows a circle and a trapezium.

8.5 cm

20 cm

h cm
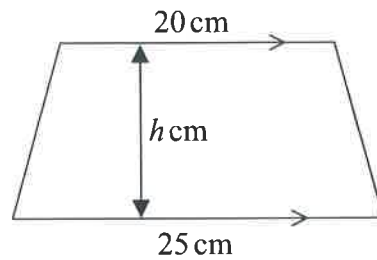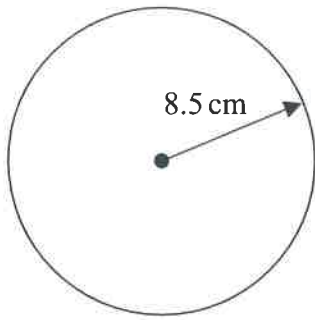
25 cm

The height of the trapezium is h cm.

The area of the circle is equal to the area of the trapezium.

Work out the value of h.
Give your answer correct to 1 decimal place.

$$\pi r^2 : \quad \pi (8.5)^2 = 72.25\pi$$

$$\tfrac{1}{2}(a+b)h : \tfrac{1}{2}(20+25)h = 22.5h$$

$$72.25\pi = 22.5h$$

$$\frac{72.25\pi}{22.5} = h$$

$$h = 10.0880$$

10.1

(Total for Question 2 is 4 marks)

4

3 In a bag there are only red bricks, blue bricks, green bricks and orange bricks.

The number of green bricks in the bag is the same as the number of orange bricks.

Jiao takes at random a brick from the bag.
The table gives the probability that Jiao takes a red brick and the probability that he takes a blue brick.

Colour	red	blue	green	orange
Probability	0.26	0.3		

(a) Work out the probability that Jiao takes an orange brick.

$$0.26 + 0.3 = 0.56$$
$$1 - 0.56 = 0.44$$
$$\frac{0.44}{2} = 0.22$$

.......................**0.22**.......................

(3)

Jiao puts the brick back into the bag.
There are 91 red bricks in the bag.

Jiao is going to build a tower using all the red bricks and all the blue bricks but no other bricks.
The tower will be in the shape of a cuboid.
There will be 4 bricks in each layer of the tower.

(b) Work out how many layers the tower will have.

$$0.26x = 91$$
$$x = \frac{91}{0.26} = 350$$
$$0.3 \times 350 = 105 \ (blue)$$
$$105 + 91 = 196 \ (red + blue)$$
$$\frac{196}{4} = 49$$

.......................**49**.......................

(3)

(Total for Question 3 is 6 marks)

4 Here are the first five terms of a number sequence.

<p style="text-align:center">7   11   15   19   23</p>

+4   +4   +4   +4

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

$$4n + 3$$

(2)

The nth term of a different number sequence is given by $80 - 2n$

(b) Write down the first 3 terms of this sequence.

78 , 76 , 74

(2)

Yuen says there are no numbers that are in both of the sequences.
Yuen is correct.

(c) Explain why.

One sequence is all odd numbers and the other is all even numbers.

(1)

(Total for Question 4 is 5 marks)

5 Aayush invests 18 000 rupees for 3 years at a rate of 4% per year compound interest.

Work out the total amount of interest Aayush has received by the end of 3 years.
Give your answer correct to the nearest rupee.

$$18000 \times 1.04^3 = 20247.552$$

$$20247.552 - 18000 = 2247.552$$
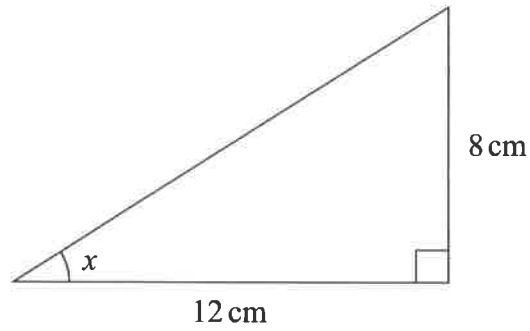
2248 .... rupees

(Total for Question 5 is 3 marks)

6

Diagram **NOT** accurately drawn

8 cm

x

12 cm

Calculate the size of angle x.
Give your answer correct to 1 decimal place.

$$\tan x = \frac{8}{12}$$

$$x = \tan^{-1}\left(\frac{8}{12}\right)$$

$$x = 33.6901$$

...........33.7...........°
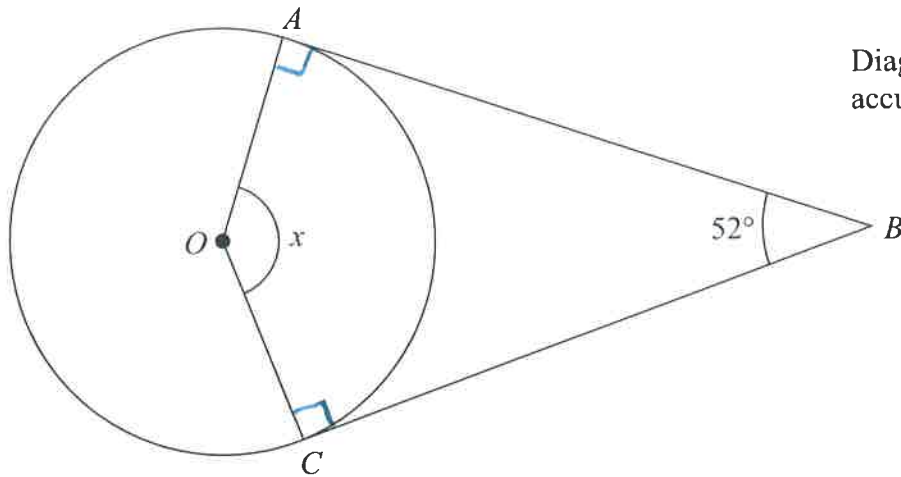
(Total for Question 6 is 3 marks)

7

Diagram **NOT** accurately drawn

A and C are points on a circle, centre O.
AB and CB are tangents to the circle.
Angle ABC = 52°

Work out the size of angle x.
Give a reason for each stage of your working.

$O\hat{A}B = O\hat{C}B = 90°$ tangent meets radius at 90°

$x = 360 - 90 - 90 - 52 = 128°$ angles in a quadrilateral add up to 360°

x = __128__ °

(Total for Question 7 is 4 marks)

8   Ahmed, Behnaz and Carmen each have some money.

Ahmed has 20% more money than Behnaz.

Carmen has $\frac{7}{8}$ of the amount of money that Behnaz has.

Carmen has 31.50 euros.

Work out how much money Ahmed has.

$$\frac{7}{8}b = 31.50$$

$$b = \frac{31.50}{7} \times 8$$

$$b = 36$$

$$a = 1.2b$$

$$a = 1.2 \times 36$$

$$a = 43.2$$

........43.20........ euros

9 The frequency table shows information about the ages of 60 people on a train.

Age (*a* years)	Frequency
$0 < a \leqslant 10$	4
$10 < a \leqslant 20$	14
$20 < a \leqslant 30$	17
$30 < a \leqslant 40$	13
$40 < a \leqslant 50$	7
$50 < a \leqslant 60$	3
$60 < a \leqslant 70$	2

(a) Complete the cumulative frequency table.

Age (*a* years)	Cumulative frequency
$0 < a \leqslant 10$	4
$0 < a \leqslant 20$	18
$0 < a \leqslant 30$	35
$0 < a \leqslant 40$	48
$0 < a \leqslant 50$	55
$0 < a \leqslant 60$	58
$0 < a \leqslant 70$	60

(1)

(b) On the grid, draw a cumulative frequency graph for your table.

Age (a years)
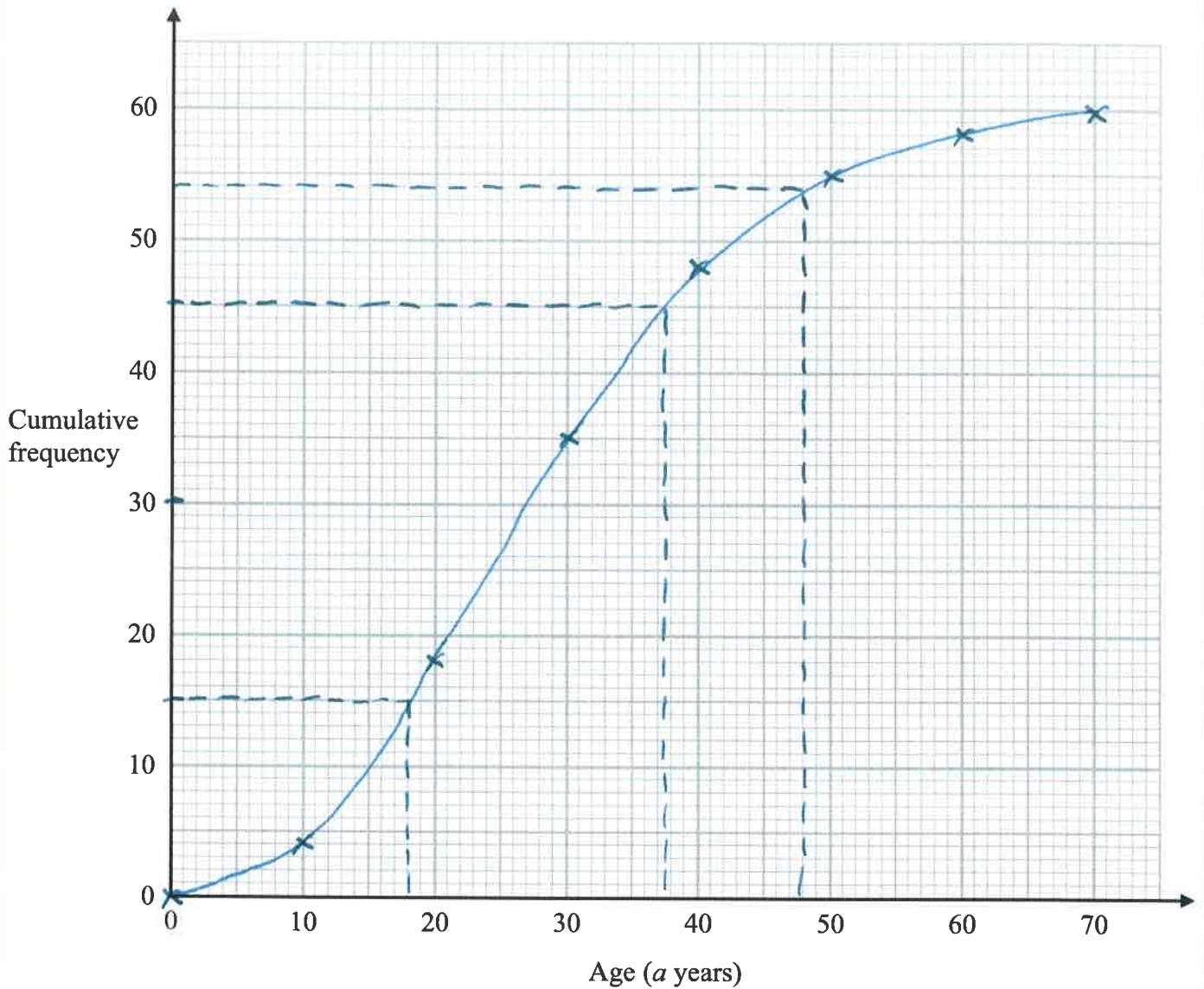
(2)

(c) Use your graph to find an estimate for the interquartile range of the ages of the 60 people.

$37.5 - 18 = 19.5$

19.5 years

(2)

(d) Use your graph to find an estimate for how many of the 60 people are more than 48 years of age.

$60 - 54 = 6$

6

(2)

(Total for Question 9 is 7 marks)

10 The diagram shows two congruent regular pentagons drawn inside a regular octagon.
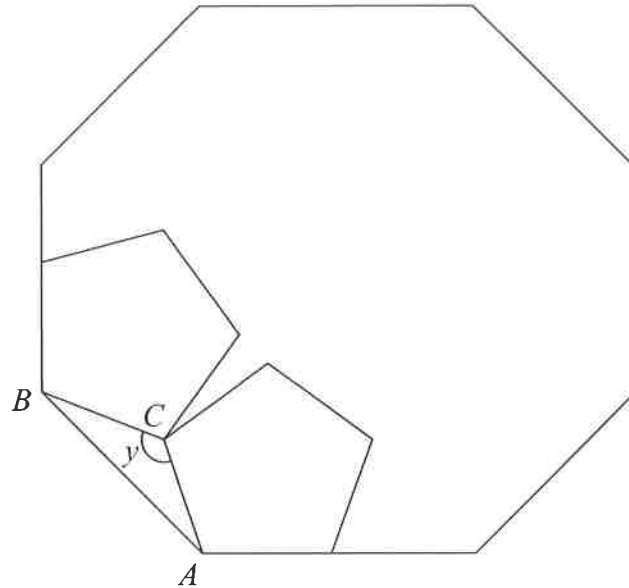

Diagram **NOT**
accurately drawn

One side of each pentagon lies along a side of the octagon.

AB is a side of the octagon.
AC is a side of one of the pentagons.
BC is a side of the other pentagon.

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

Pentagon: $\frac{360}{5} = 72$

$180 - 72 = 108$

Octagon: $\frac{360}{8} = 45$

$180 - 45 = 135$

$A\hat{B}C = B\hat{A}C = 135 - 108 = 27°$

$y = 180 - 27 - 27 = 126°$

126 °

(Total for Question 10 is 5 marks)

11 Solve $\dfrac{3x-2}{5} - \dfrac{3-4x}{2} = 2$

Show clear algebraic working.

$$2(3x-2) - 5(3-4x) = 2(2)(5)$$
$$(6x-4) - (15-20x) = 20$$
$$26x - 19 = 20$$
$$26x = 39$$
$$x = 1.5$$

$x = \underline{1.5}$

(Total for Question 11 is 4 marks)

12 $y = x^3 - 6x^2 - 15x$

(a) Find $\dfrac{dy}{dx}$

$$\dfrac{dy}{dx} = 3x^2 - 12x - 15$$

(2)

The curve with equation $y = x^3 - 6x^2 - 15x$ has two stationary points.

(b) Work out the coordinates of these two stationary points.

$3x^2 - 12x - 15 = 0$

$x^2 - 4x - 5 = 0$

$(x-5)(x+1) = 0$

$x = 5 \quad x = -1$

$x = -1 : \quad y = (-1)^3 - 6(-1)^2 - 15(-1)$

$y = 8$

$x = 5 : \quad y = (5)^3 - 6(5)^2 - 15(5)$

$y = -100$

(-1 , 8)

(5 , -100)

(4)

(Total for Question 12 is 6 marks)

**13** In a school, students must study at least one language from German, French and Spanish.

There are 30 students in a class of this school.
Of these students

       7 study all three of the languages
    10 study both German and French
    12 study both Spanish and German
     9 study both French and Spanish
    16 study Spanish
    18 study German

Work out the total number of the students in the class who study French.
You may use the Venn diagram to help with your calculations.

German — 3, 3, 8 — French
5, 7, 2
2
Spanish
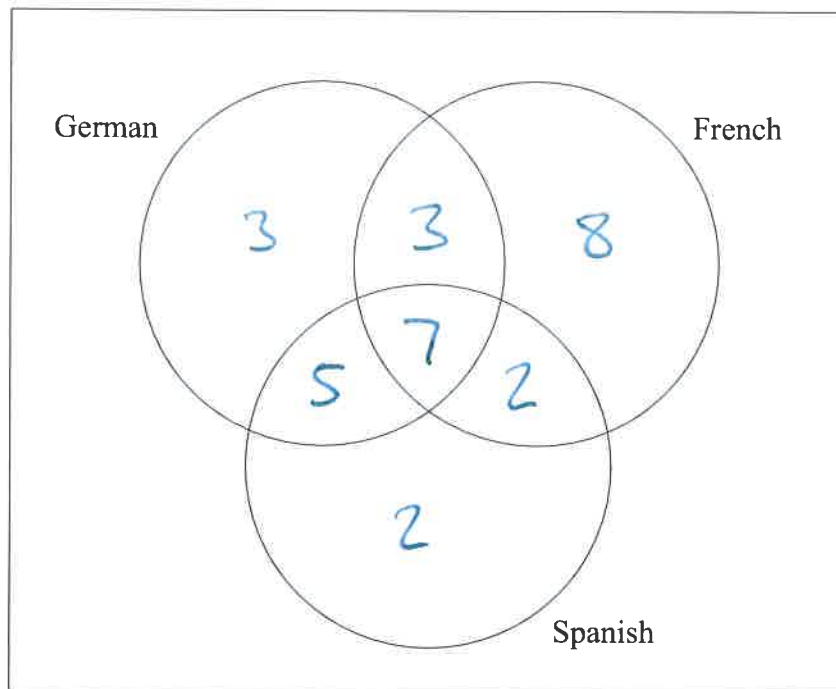
$$3+3+5+7+2+2 = 22$$
$$30-22 = 8$$

$$3+7+8+2 = 20$$

.... 20

(Total for Question 13 is 3 marks)

14 (a) Use algebra to show that $0.3\overset{..}{2}\overset{.}{4} = \dfrac{107}{330}$

$$100x = 32.42424$$
$$\underline{\qquad x = 0.32424}$$
$$99x = 32.1$$

$$x = \frac{32.1}{99} = \frac{321}{990} = \frac{107}{330}$$

(2)

(b) Rationalise the denominator of $\dfrac{4}{7 - \sqrt{5}}$

Show each stage of your working.

Give your answer in the form $a + b\sqrt{5}$ where a and b are fractions in their simplest forms.

$$\frac{4}{7-\sqrt{5}} \times \frac{7+\sqrt{5}}{7+\sqrt{5}} = \frac{4(7+\sqrt{5})}{(7-\sqrt{5})(7+\sqrt{5})}$$

$$= \frac{28+4\sqrt{5}}{49-7\sqrt{5}+7\sqrt{5}-5}$$

$$= \frac{28+4\sqrt{5}}{44}$$

$$= \frac{28}{44} + \frac{4}{44}\sqrt{5}$$

$$= \frac{7}{11} + \frac{1}{11}\sqrt{5}$$

(3)

(Total for Question 14 is 5 marks)

15 Sophie takes an examination.
If she fails the examination, she will resit.

The probability that Sophie passes the examination on her first attempt is 0.7
If she fails the examination on any attempt, the probability she passes on the next attempt is 0.9

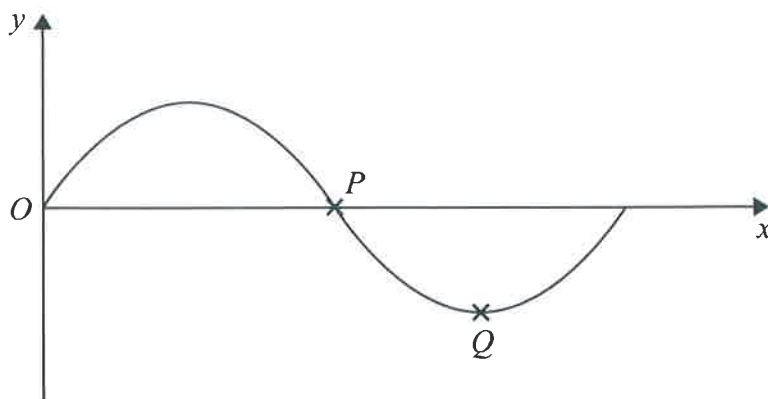Work out the probability that Sophie takes at most 2 attempts to pass the examination.
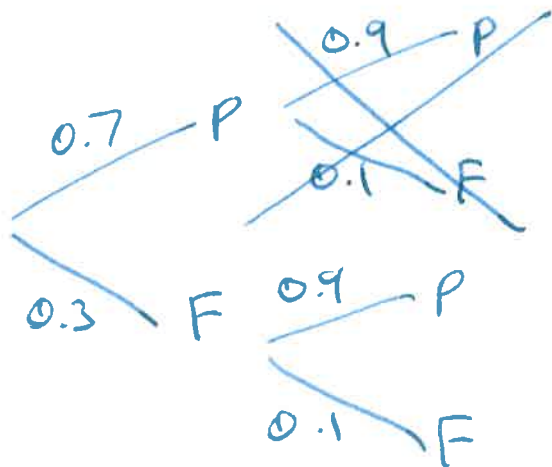
$P(\text{at most 2 attempts})$

$= P(1 \text{ attempt or } 2 \text{ attempts})$

$= 0.7 + (0.3 \times 0.9)$

$= 0.7 + 0.27$

$= 0.97$

0.97

(Total for Question 15 is 3 marks)

16 The diagram shows part of a sketch of the curve $y = \sin x°$

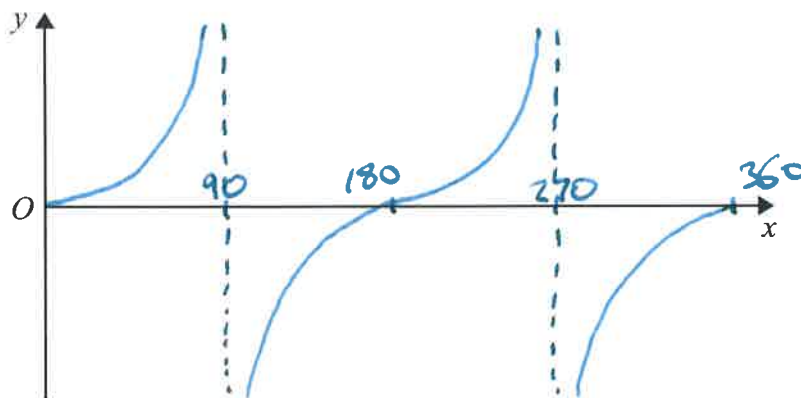(a) Write down the coordinates of

   (i) the point P

   (180 , 0)

   (ii) the point Q

   (270 , −1)

   (2)

(b) Sketch the graph of $y = \tan x$ for $0° \leqslant x \leqslant 360°$

   Show the coordinates of any points of intersection with the coordinate axes.

   (2)

(Total for Question 16 is 4 marks)

17 A solid metal cube has sides of length 125 mm, correct to 3 significant figures.

The cube is melted down and the metal used to make solid spheres.
The volume of each sphere is to be 140 cm³, correct to the nearest 10 cm³

Work out the greatest number of spheres that could be made from the metal.
Show your working clearly.

12.4   12.5   ↑ 12.6
        (cm) 12.55

130 ↑ 140   150
    135

$12.55^3 = 1976.66$

$\dfrac{1976.66}{135} = 14.6419$

14

(Total for Question 17 is 4 marks)

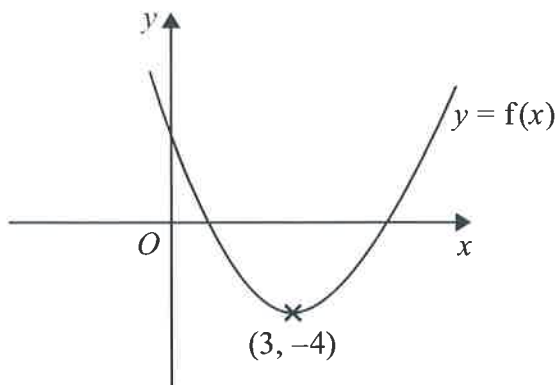**18** The diagram shows part of the curve with equation $y = f(x)$

Diagram **NOT** accurately drawn

The coordinates of the minimum point on this curve are $(3, -4)$

(a) Write down the coordinates of the minimum point on the curve with equation

    (i) $y = f(x - 4)$

(....7.... , ...-4....)

    (ii) $y = 3f(x)$

(....3.... , ...-12....)

    (iii) $y = f(\frac{1}{2}x)$

(....6.... , ...-4....)

(3)

The curve with equation $y = f(x)$ is translated to give curve C.

C has a minimum at the point with coordinates $(3, 5)$
The equation of C is $y = f(x) + k$

(b) Write down the value of k

$(3, -4) \rightarrow (3, 5)$

up 9

$k = $ ....9....

(1)

(Total for Question 18 is 4 marks)
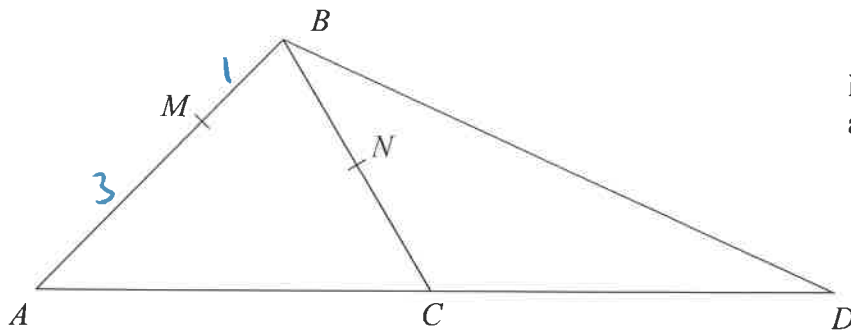
19 The diagram shows triangle ABD.

Diagram **NOT** accurately drawn

N is the midpoint of BC.
C is the midpoint of AD.
M is the point on AB such that $AM:MB = 3:1$

$\vec{AB} = \mathbf{p}$ and $\vec{AC} = \mathbf{q}$

(a) Express, in terms of $\mathbf{p}$ and $\mathbf{q}$,

(i) $\vec{BD}$ $\vec{BD} = \vec{BA} + \vec{AC} + \vec{CD}$
$$= -p + q + q$$

$\underline{2q - p}$

(ii) $\vec{MN}$ $\vec{BC} = \vec{BA} + \vec{AC}$
$$= -p + q$$
$$\vec{BN} = \tfrac{1}{2}\vec{BC} = \tfrac{1}{2}(q-p)$$
$$\vec{MN} = \tfrac{1}{4}\vec{AB} + \vec{BN} = \tfrac{1}{4}p + \tfrac{1}{2}(q-p)$$

$\underline{\tfrac{1}{2}q - \tfrac{1}{4}p}$

(3)

(b) State, giving reasons, two different geometric facts relating MN and BD.

$$\vec{BD} = 2q - p$$
$$\vec{MN} = \tfrac{1}{2}q - \tfrac{1}{4}p$$

$$4\vec{MN} = 4(\tfrac{1}{2}q - \tfrac{1}{4}p) = 2q - p$$

1. MN and BD are parallel

2. $BD = 4MN$ so BD is 4 times longer than MN
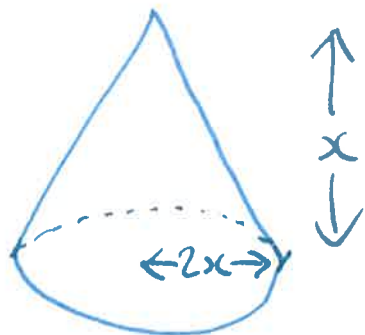
(2)

(Total for Question 19 is 5 marks)

20 A cone has a volume of 562.5π cm³ $\frac{1}{3}\pi r^2 h = 562.5\pi$

The radius of the base of the cone is equal to twice the height of the cone.

Work out the curved surface area of the cone.
Give your answer correct to 3 significant figures.

$$\frac{1}{3}\pi(2x)^2(x) = 562.5\pi$$

$$\frac{1}{3}\pi(4x^2)(x) = 562.5\pi$$
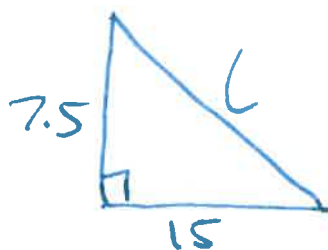
$$\frac{4x^3}{3}\pi = 562.5\pi$$

$$4x^3 = 3 \times 562.5$$
$$4x^3 = 1687.5$$
$$x^3 = 421.875$$
$$x = \sqrt[3]{421.875}$$
$$x = 7.5$$

$$l^2 = 7.5^2 + 15^2$$
$$l^2 = 281.25$$
$$l = \sqrt{281.25}$$
$$l = 16.7705$$

$$\pi r l = \pi(15)(16.7705)$$
$$= 790.292$$

790   cm²

(Total for Question 20 is 5 marks)

21 Write $\dfrac{5}{4x^2 - 25} - (2x + 3) \div \left(\dfrac{4x^2 + 16x + 15}{7} \right)$ as a single fraction in its simplest form.

Show clear algebraic working.

$$\frac{5}{4x^2 - 25} - \frac{(2x+3) \times 7}{4x^2 + 16x + 15}$$

$$= \frac{5}{(2x+5)(2x-5)} - \frac{7(2x+3)}{(2x+3)(2x+5)}$$

$$= \frac{5}{(2x+5)(2x-5)} - \frac{7}{2x+5}$$

$$= \frac{5}{(2x+5)(2x-5)} - \frac{7(2x-5)}{(2x+5)(2x-5)}$$

$$= \frac{5 - (14x - 35)}{(2x+5)(2x-5)}$$

$$= \frac{40 - 14x}{(2x+5)(2x-5)}$$

$$= \frac{2(20 - 7x)}{(2x+5)(2x-5)}$$

$$\frac{2(20-7x)}{(2x+5)(2x-5)}$$

(Total for Question 21 is 4 marks)

22 The 3rd term of an arithmetic series, A, is 19
The sum of the first 10 terms of A is 290

Find the 10th term of A.

$a + 2d = 19 \implies a = 19 - 2d$

$S_{10} = 290$

$$\frac{10}{2}\left[2a + (n-1)d\right] = 290$$

$$\frac{10}{2}\left[2a + (10-1)d\right] = 290$$

$$5\left[2a + 9d\right] = 290$$

$$5\left[2(19-2d) + 9d\right] = 290$$

$$5\left[(38-4d) + 9d\right] = 290$$

$$38 + 5d = 58$$

$$5d = 20$$

$$d = 4$$

$a = 19 - 2d$
$ = 19 - 2(4)$
$ = 11$

10th term: $a + 9d : 11 + 9(4) = 11 + 36$
$\phantom{10^{th} term: a + 9d : 11 + 9(4)} = 47$

47

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

24