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GCSE MATHS

Algebra

Edexcel 1MA1 | Subtopic collection Topic 11

Algebraic notation, substitution and identities

Higher tier

Past paper question booklet

160	2003-2025	Higher
question groups	available papers	tier

Before you begin

1. Show working and use units where appropriate.
2. Use extra paper if you need more space.
3. Print at actual size (100%) for measurement questions.

Name _____ **Date** _____

Whole questions are retained for context; some parts cover other points. Legacy sources are labelled.

8. This table shows some expressions.

The letters x, y and z represent lengths.

Place a tick in the appropriate column for each expression to show whether the expression can be used to represent a length, an area, a volume or none of these.

Expression	Length	Area	Volume	None of these
$x + y + z$				
xyz				
$xy + yz + xz$				

(3)

Page Total

17. The force, F, between two magnets is inversely proportional to the square of the distance, x, between them.

Leave blank

When $x = 3$, $F = 4$.

(a) Find an expression for F in terms of x.

$F =$ .....

(3)

(b) Calculate F when $x = 2$.

.....

(1)

(c) Calculate x when $F = 64$.

.....

(2)

20. Simplify fully

Leave blank

(a) $2(3x+4)-3(4x-5)$

.....

(2)

(b) $(2xy^3)^5$

.....

(2)

(c) $\frac{n^2-1}{n+1}\times\frac{2}{n-2}$

.....

(3)

Page Total

16.

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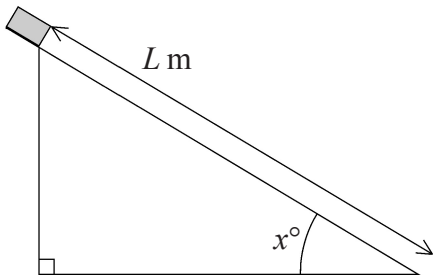

Elliot did an experiment to find the value of g m/s^2, the acceleration due to gravity. He measured the time, T seconds, that a block took to slide L m down a smooth slope of angle $x°$.

He then used the formula $$g = \frac{2L}{T^2 \sin x°}$$

to calculate an estimate for g.

$T = 1.3$ correct to 1 decimal place.
$L = 4.50$ correct to 2 decimal places.
$x = 30$ correct to the nearest integer.

(a) Calculate the lower bound and the upper bound for the value of g.
Give your answers correct to 3 decimal places.

Lower bound .....

Upper bound.....

(4)

(b) Use your answers to part (a) to write down the value of g to a suitable degree of accuracy. Explain your reasoning.

.....

.....

.....

(1)

Page Total

6. Here are some expressions.

$\frac{1}{2}ac$	πc	$2b$	$2ab^2$	abc	$a(b + c)$	$\frac{ab}{c}$	πa^2

The letters a, b and c represent lengths.
π, 2 and $\frac{1}{2}$ are numbers which have no dimensions.
Three of the expressions could represent areas.
Tick (✓) the boxes underneath the **three** expressions which could represent areas.

(3)

19.

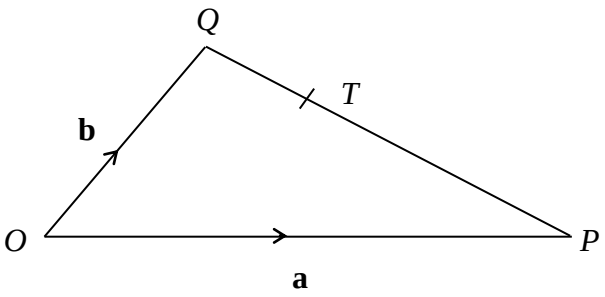

Diagram **NOT** accurately drawn

OPQ is a triangle.
T is the point on PQ for which $PT : TQ = 2 : 1$.
$\overrightarrow{OP} = \mathbf{a}$ and $\overrightarrow{OQ} = \mathbf{b}$.

(a) Write down, in terms of **a** and **b**, and expression for $\overrightarrow{PQ}$.

$\overrightarrow{PQ}$ = ...

(1)

(b) Express $\overrightarrow{OT}$ in terms of **a** and **b**.
Give your answer in its simplest form.

$\overrightarrow{OT}$ = ...

(2)

21. The depth, D metres, of the water at the end of a jetty in the afternoon can be modelled by this formula

$$D = 5.5 + A \sin 30(t - k)°$$

where

t hours is the number of hours after midday,
A and k are constants.

Yesterday the low tide was at 3 p.m.
The depth of water at low tide was 3.5 m.

Find the value of A and k.

$A =$ .....

$k =$ .....

(4)

2. The table shows some expressions.
The letters a, b, c and d represent lengths.
π and 2 are numbers that have no dimensions.
Three of the expressions could represent areas.

Tick (✓) the boxes underneath the **three** expressions which could represent areas.

$\frac{\pi abc}{2d}$	πa^3	$2a^2$	$\pi a^2 + b$	$\pi(a+b)$	$2(c^2+d^2)$	$2ad^2$

(3)

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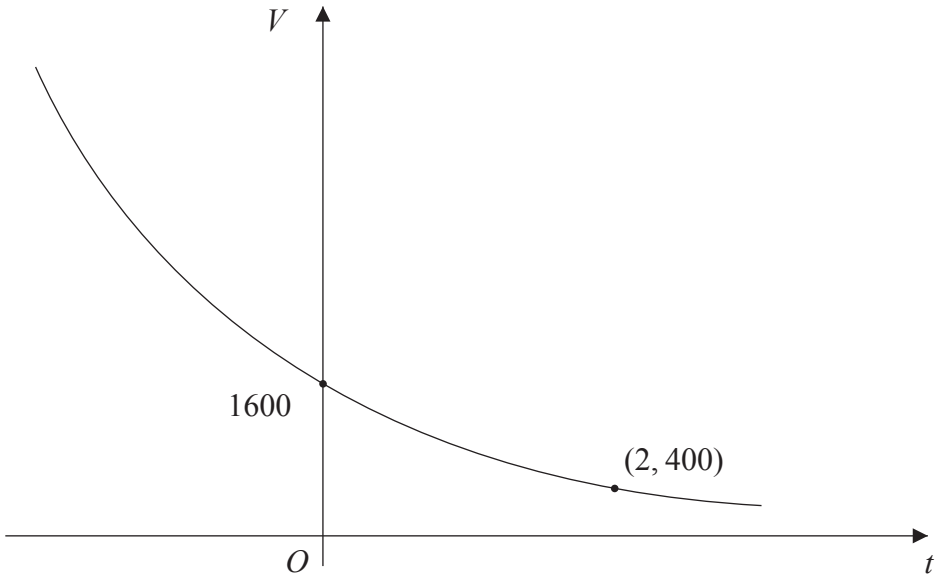
Page Total

15. Mr Patel has a car.



The value of the car on January 1st 2000 was £1600
The value of the car on January 1st 2002 was £400

The sketch graph shows how the value, £V, of the car changes with time.
The equation of the sketch graph is

$$V = pq^t$$

where t is the number of years after January 1st 2000.
p and q are positive constants.

(a) Use the information on the graph to find the value of p and the value of q.

$p =$ ..... $q =$ .....
(3)

(b) Using your values of p and q in the formula $V = pq^t$ find the value of the car on January 1st 1998.

£ .....
(2)

Page Total

14. Bill invests £500 on 1st January 2004 at a compound interest rate of R% per annum.

The value, £V, of this investment after n years is given by the formula

$$V = 500 \times (1.045)^n$$

(a) Write down the value of R.

$R =$.....

(1)

(b) Use your calculator to find the value of Bill's investment after 20 years.

£.....

(2)

(Total 3 marks)

Q14

9. The table shows some expressions.

Expression	Length	Area	Volume	None of these
πab				
$a + 2b$				
$\pi a^2 + b$				

The letters a and b represent lengths.
π and 2 are numbers that have no dimensions.

Place a tick (✓) in the correct column to show whether the expression can be used to represent a length, an area, a volume or none of these.

Q9

(Total 3 marks)

Blank

15. The table shows some rows of a number pattern.

Row 1	1^2	–	(0×2)
Row 2	2^2	–	(1×3)
Row 3	3^2	–	(2×4)
Row 4	4^2	–	(3×5)
Row *n*	.....		

(a) In the table, write down an expression, in terms of n, for Row n.

(1)

(b) Simplify fully your expression for Row n.
You must show your working.

.....

(2)

(Total 3 marks)

Q15

2. The cost of hiring a car can be worked out using this rule.

Cost = £90 + 50p per mile

The cost of hiring a car and driving m miles is C pounds.

(a) Complete the formula for C in terms of m.

$C =$ .....

(2)

Zara hired a car.

The cost is £240

(b) How many miles did Zara drive?

..... miles

(3)

(Total 5 marks)

Q2

20.

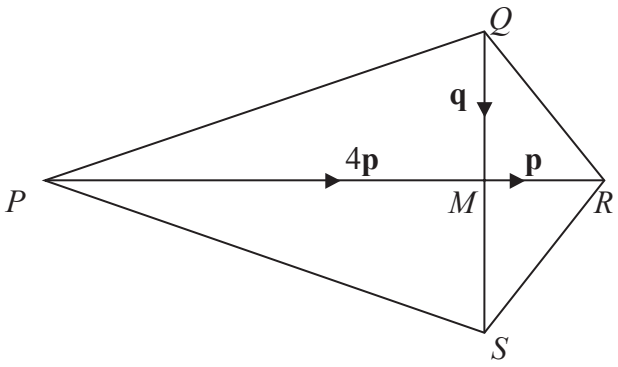


Diagram **NOT** accurately drawn

PQRS is a kite.
The diagonals *PR* and *QS* intersect at *M*.

$\overrightarrow{PM} = 4\mathbf{p}$

$\overrightarrow{QM} = \mathbf{q}$

$\overrightarrow{MR} = \mathbf{p}$

$\overrightarrow{QM} = \overrightarrow{MS}$

(a) Find expressions, in terms of **p** and/or **q** for

(i) $\overrightarrow{PR}$

$\overrightarrow{PR}$ .....

(ii) $\overrightarrow{QS}$

$\overrightarrow{QS}$ .....

(iii) $\overrightarrow{PQ}$

$\overrightarrow{PQ}$ .....

(4)

SR and *PQ* are extended to meet at point *T*.
Q is the midpoint of *PT*.

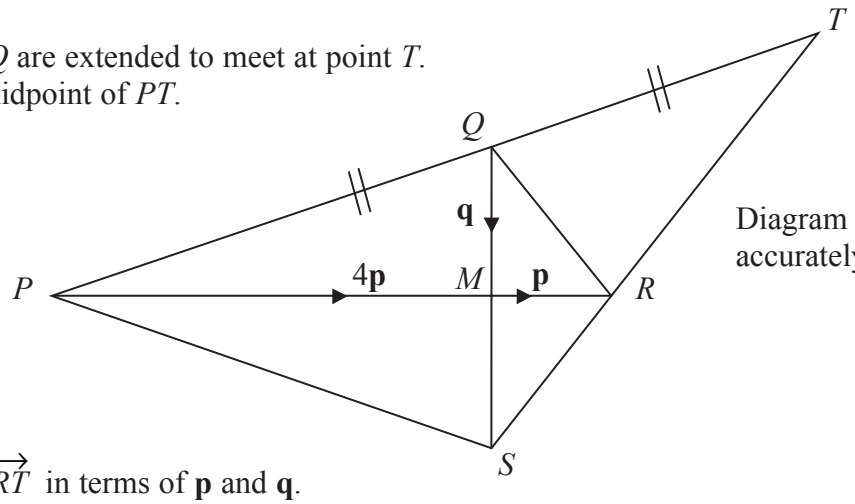


Diagram **NOT** accurately drawn

(b) Find $\overrightarrow{RT}$ in terms of **p** and **q**.

$\overrightarrow{RT}$ .....

(4)

(Total 8 marks)

Q20

2. (a) Simplify $4x + 3y - 2x + 5y$

.....

(2)

Compasses cost c pence each.
Rulers cost r pence each.

(b) Write down an expression for the total cost, in pence, of 2 compasses and 4 rulers.

..... pence

(2)

(Total 4 marks)

Q2

Blank

4. $P = 4k - 10$

$P = 50$

(a) Work out the value of k.

.....

(2)

$y = 4n - 3d$

$n = 2$
$d = 5$

(b) Work out the value of y.

.....

(2)

Q4

(Total 4 marks)

6. $F = 1.8C + 32$

(a) Work out the value of F when $C = -8$

.....

(2)

(b) Work out the value of C when $F = 68$

.....

(2) **Q6**

(Total 4 marks)

19. Toby invested £4500 for 2 years in a savings account.
He was paid 4% per annum compound interest.

(a) How much did Toby have in his savings account after 2 years?

£ .....
(3)

Jaspir invested £2400 for n years in a savings account.
He was paid 7.5% per annum compound interest.

At the end of the n years he had £3445.51 in the savings account.

(b) Work out the value of n.

.....
(2)

(Total 5 marks)

Q19

10. (a) Simplify $3a + 4c - a + 3c$

.....

(2)

(b) Expand $y(2y - 3)$

.....

(1)

(c) Factorise $x^2 - 4x$

.....

(2)

(d) Expand and simplify $2(x + 3) + 3(2x - 1)$

.....

(2)

(e) Solve $3(x + 2) = 8$

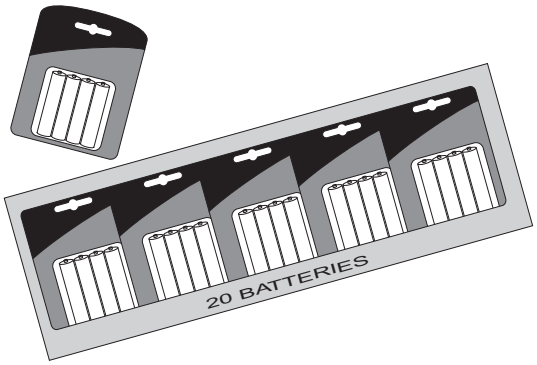
$x =$ .....

(2)

Q10

(Total 9 marks)

12. Batteries are sold in packets and boxes.



Each packet contains 4 batteries.
Each box contains 20 batteries.

Bill buys p packets of batteries and b boxes of batteries.
Bill buys a total of N batteries.

Write down a formula for N in terms of p and b.

.....

Q12

(Total 3 marks)

12.

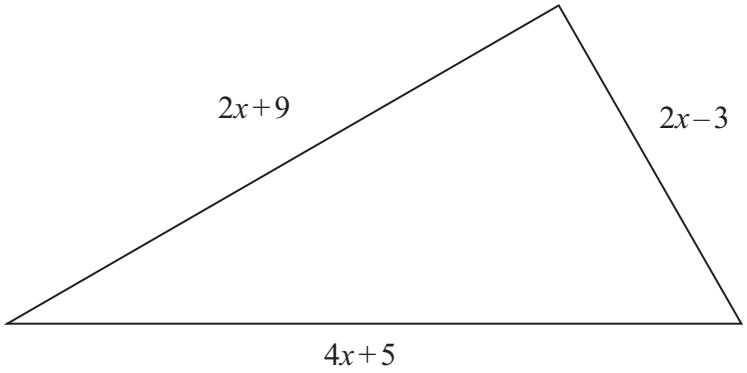


Diagram **NOT** accurately drawn

In the diagram, all measurements are in centimetres.

The lengths of the sides of the triangle are

$2x+9$
$2x-3$
$4x+5$

(a) Find an expression, in terms of x, for the perimeter of the triangle.
Give your expression in its simplest form.

.....

(2)

The perimeter of the triangle is 39 cm.

(b) Find the value of x.

$x =$ .....

(2)

Q12

(Total 4 marks)

25. y is directly proportional to x.

When $x = 500$, $y = 10$

(a) Find a formula for y in terms of x.

$y =$ .....

(3)

(b) Calculate the value of y when $x = 350$

$y =$ .....

(1)

Q25

(Total 4 marks)

28.

$$v = \sqrt{\frac{a}{b}}$$

a = 6.43 correct to 2 decimal places.
b = 5.514 correct to 3 decimal places.

By considering bounds, work out the value of v to a suitable degree of accuracy.

You must show all your working and give a reason for your final answer.

v = ...

Q28

(Total 5 marks)

Question 24

1. Simplify $6x + 9y + 2x - 3y$

.....

Q1

(Total 2 marks)

3.

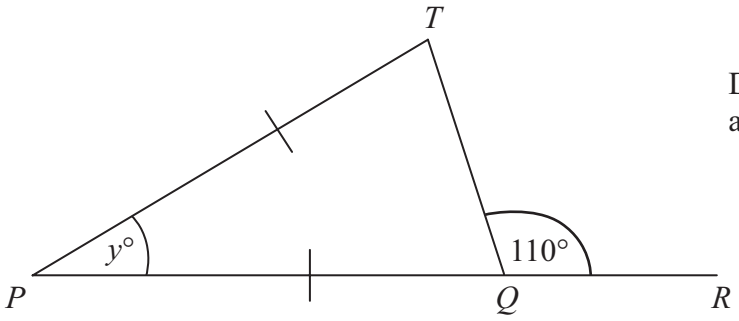


Diagram **NOT** accurately drawn

PQR is a straight line.
PT = *PQ*.

(i) Work out the value of *y*.

.....

(ii) Give reasons for your answer.

.....

.....

.....

Q3

(Total 4 marks)

20. (a) Here are some expressions.

a^3b	$a^2(c + b)$	$4abc$	$ab + c^3$	$4\pi c^2$

The letters a, b, and c represent lengths.
π and 4 are numbers that have no dimension.

Two of the expressions could represent volumes.
Tick the boxes (✓) underneath these two expressions.

(2)

The volume of this cube is 8 m^3.

(b) Change 8 m^3 into cm^3.

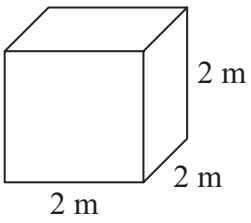


Diagram **NOT** accurately drawn

..... cm^3

(2)

Q20

(Total 4 marks)

2. (a) Simplify $p \times p \times p \times p$

.....

(1)

(b) Simplify $2c \times 3d$

.....

(1)

Q2

(Total 2 marks)

26. P is inversely proportional to V.

When $V = 8$, $P = 5$

(a) Find a formula for P in terms of V.

$P =$ .....

(3)

(b) Calculate the value of P when $V = 2$

.....

(1)

(Total 4 marks)

Q26

6. (a) Simplify $7x + 2y - x + 3y$

.....

(2)

(b) Solve $2x + 3 = 10$

$x =$ .....

(2)

(c) Simplify

(i) $c^5 \times c^6$

.....

(ii) $e^{12} \div e^4$

.....

(2) **Q6**

(Total 6 marks)

Blank

12. A shop sells small boxes and large boxes for storing CDs.

A small box stores x CDs.
A large box stores y CDs.

Ethan buys 7 small boxes.
He also buys 5 large boxes.

Ethan can store a total of T CDs in these boxes.

Write down a formula for T in terms of x and y.

.....

Q12

(Total 3 marks)

2 (a) Simplify $4b \times 2c$

.....

(1)

(b) Expand $3(2w - 5t)$

.....

(2)

(c) Expand and simplify $(x + 7)(x - 2)$

.....

(2)

(Total for Question 2 is 5 marks)

7 You can use this formula to change a temperature C, in °C, to a temperature F, in °F.

$$F = 1.8C + 32$$

(a) Use the formula to change 20°C into °F.

..... °F

(2)

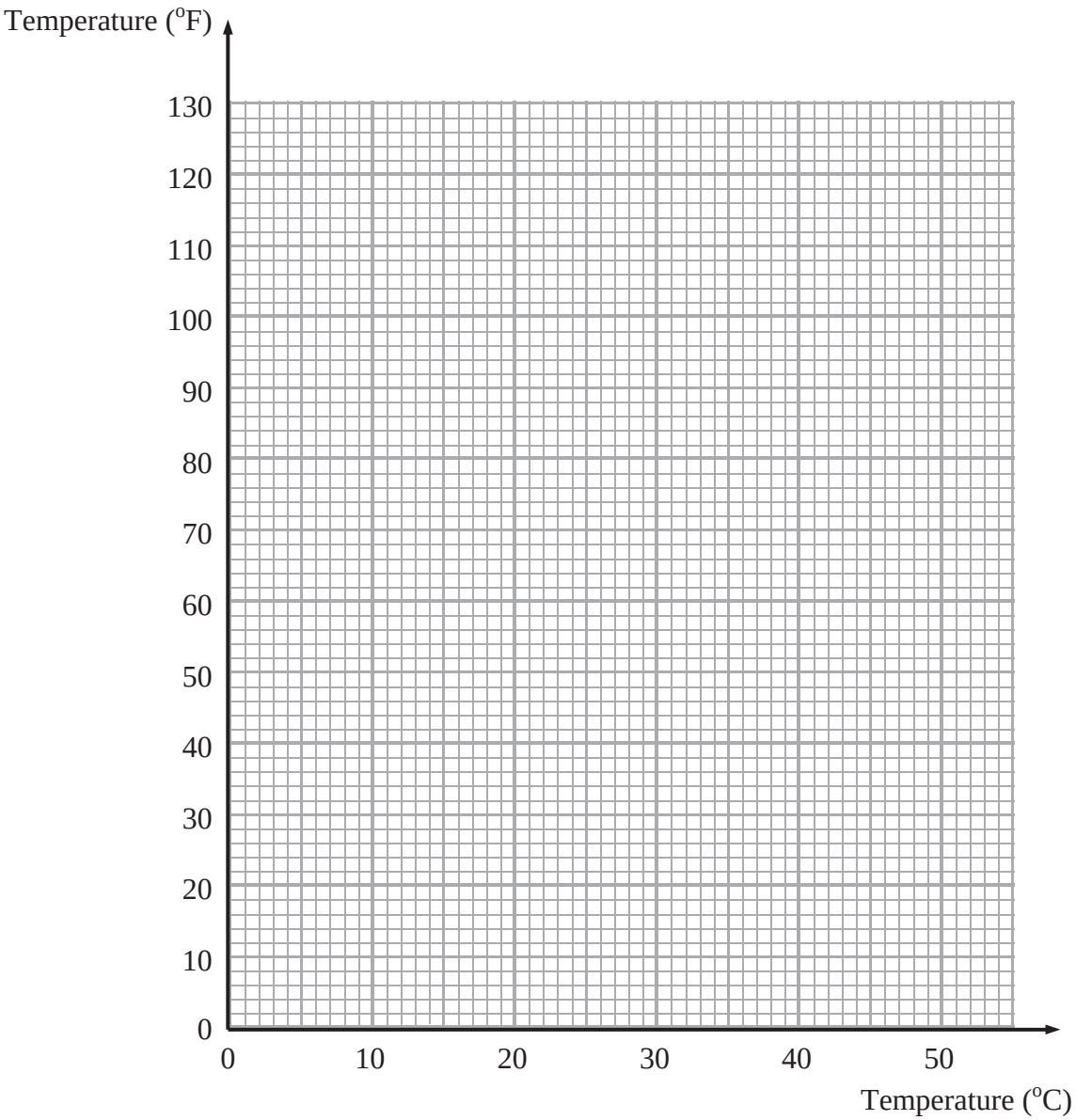
(b) On the grid opposite, draw a conversion graph that can be used to change between temperatures in °C and temperatures in °F.

(3)

(c) Use your graph to change 100 °F into °C.

..... °C

(1)



(Total for Question 7 is 6 marks)

***14** The diagram shows a pentagon.

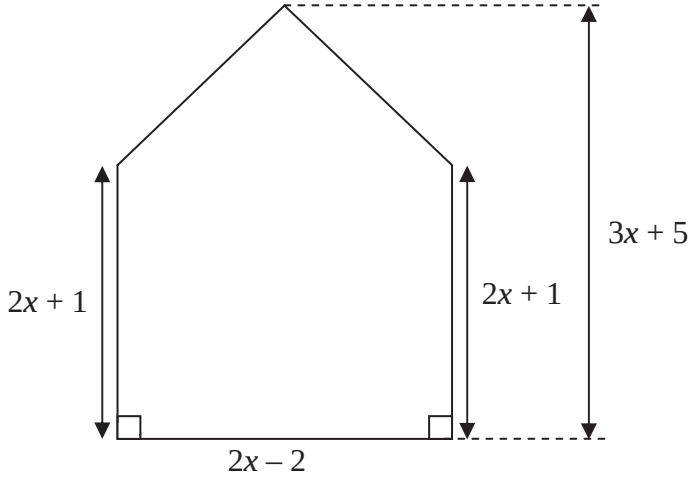


Diagram **NOT** accurately drawn

All measurements are in centimetres.

Show that the area of this pentagon can be written as $5x^2 + x - 6$

(Total for Question 14 is 4 marks)

9 Mary plays a game of throwing a ball at a target.

The table shows information about the probability of each possible score.

Score	0	1	2	3	4	5
Probability	0.09	x	$3x$	0.16	0.21	0.30

Mary is 3 times as likely to score 2 points than to score 1 point.

(a) Work out the value of x.

.....

(3)

Mary plays the game twice.

(b) Work out the probability of Mary scoring a total of 8

.....

(3)

(Total for Question 9 is 6 marks)

13 Aminata invested £2500 for n years in a savings account.
She was paid 3% per annum compound interest.

At the end of n years, Aminata has £2813.77 in the savings account.

Work out the value of n.

.....

(Total for Question 13 is 2 marks)

15

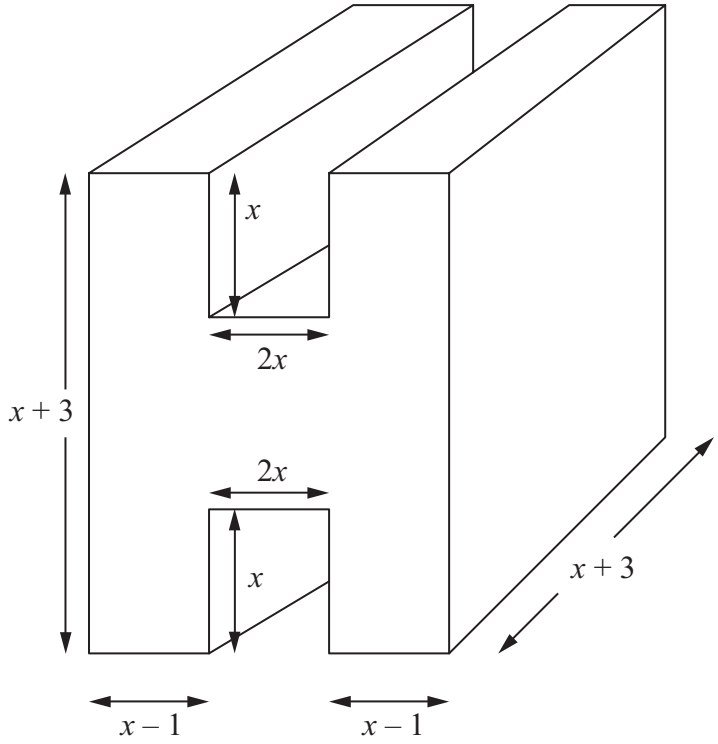


Diagram **NOT** accurately drawn.

The diagram shows a prism.
All measurements are in cm.
All corners are right angles.
The volume of the prism is V cm^3.

Find a formula for V.

$V =$ .....

(Total for Question 15 is 4 marks)

blank

5. $h = 5t^2 + 2$

(a) (i) Work out the value of h when $t = -2$

.....

(ii) Work out a value of t when $h = 47$

.....

(3)

(b) $-1 \leqslant n < 4$

n is an integer.
Write down all the possible values of n.

.....

(2)

(Total 5 marks)

Q5

25.

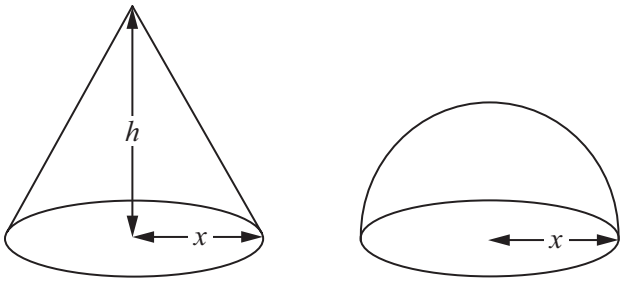


Diagram **NOT** accurately drawn

The diagram shows a solid cone and a solid hemisphere.

The cone has a base of radius x cm and a height of h cm.
The hemisphere has a base of radius x cm.
The surface area of the cone is equal to the surface area of the hemisphere.

Find an expression for h in terms of x.

.....

Q25

(Total 4 marks)

10. (a) Simplify $6e + 5f + e - 3f$

.....
(2)

(b) Solve $4(2x - 1) = 3x - 19$

$x =$ .....
(3)

(c) Solve $\frac{y+4}{5} = 30$

$y =$ .....
(2)

(Total 7 marks)

Q10

14. The table shows six expressions.
n is a positive integer.

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

(a) From the table, write the expression whose value is

(i) always even

.....

(ii) always a multiple of 3

.....

(2)

(b) From the table, write the expression which is a factor of $4n^2 - 1$

.....

(1)

(Total 3 marks)

Q14

20. The table shows some expressions.
a, b, c and d represent lengths.
π and 2 are numbers that have no dimensions.

$c^2(b+d)$	$\pi a^2 c^2$	$\frac{a^3 b}{c^3}$	$\pi a^2 b$	$\frac{2a^3 d}{c}$	d^2	$2a + b^2$

Tick (✓) the boxes underneath the **three** expressions which could represent volumes.

Q20

(Total 3 marks)

26. The voltage V of an electronic circuit is given by the formula

$$V = IR$$

where I is the current in amps
and R is the resistance in ohms.

Given that $V = 218$ correct to 3 significant figures,
$R = 12.6$ correct to 3 significant figures,

calculate the lower bound of I.

.....

Q26

(Total 3 marks)

5 Denzil has a 4-sided spinner.
The sides of the spinner are numbered 1, 2, 3 and 4
The spinner is biased.

The table shows each of the probabilities that the spinner will land on 1, on 3 and on 4
The probability that the spinner will land on 3 is x.

Number	1	2	3	4
Probability	0.3		x	0.1

(a) Find an expression, in terms of x, for the probability that the spinner will land on 2
Give your answer in its simplest form.

.....

(2)

(b) Write down the probability that the spinner will land on either 1 or 4

.....

(1)

Denzil spins the spinner 300 times.

(c) Write down an expression, in terms of x, for the number of times the spinner is likely to land on 3

.....

(1)

(Total for Question 5 is 4 marks)

2 (a) Simplify $3y + 2x - 4 + 5x + 7$

.....

(1)

(b) Factorise $2x^2 - 4x$

.....

(2)

(c) Expand and simplify $11 - 3(x+2)$

.....

(2)

(d) Expand and simplify $(x-6)(3x+7)$

.....

(2)

(Total for Question 2 is 7 marks)

11. (a) Simplify $m^3 \times m^6$

.....

(1)

(b) Simplify $\frac{p^8}{p^2}$

.....

(1)

(c) Simplify $(2n^3)^4$

.....

(2) Q11

(Total 4 marks)

Question 46

3 Julie is x years old.
Kevin is $x + 3$ years old.
Omar is $2x$ years old.

Write an expression, in terms of x, for the mean of their ages.

.....

(Total for Question 3 is 2 marks)

***6** This formula is used to work out the body mass index, B, for a person of mass M kg and height H metres.

$$B = \frac{M}{H^2}$$

A person with a body mass index between 25 and 30 is overweight.

Arthur has a mass of 96 kg.
He has a height of 2 metres.

Is Arthur overweight?
You must show all your working.

(Total for Question 6 is 3 marks)

15 The diagram shows shape **A**.
All the measurements are in centimetres.

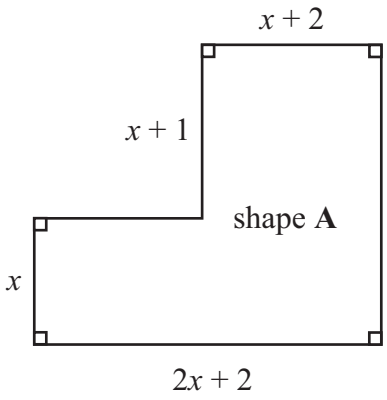


Diagram **NOT** accurately drawn

(a) Find an expression in terms of x for the area, in cm^2, of shape **A**.
You must simplify your answer.

.....

(4)

Shape **B** is a rectangle.
Shape **B** has the same area as shape **A**.
Shape **B** has a length of $(3x + 2)$ centimetres.

(b) Find an expression in terms of x for the width, in centimetres, of shape **B**.

.....

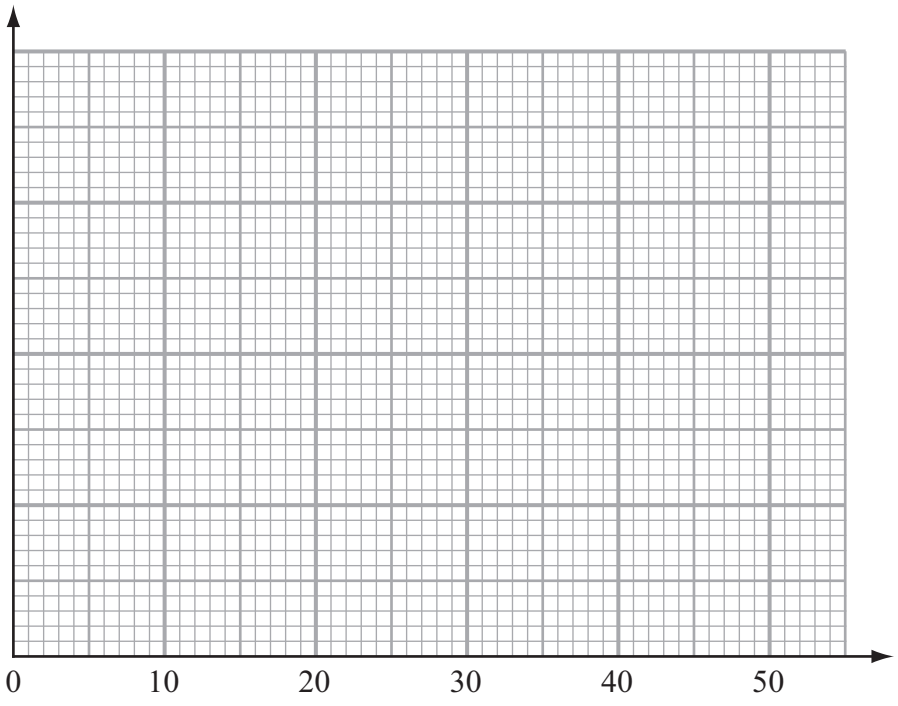
(1)

(Total for Question 15 is 5 marks)

12 The table gives some information about the distances, in miles, that some men travelled to work.

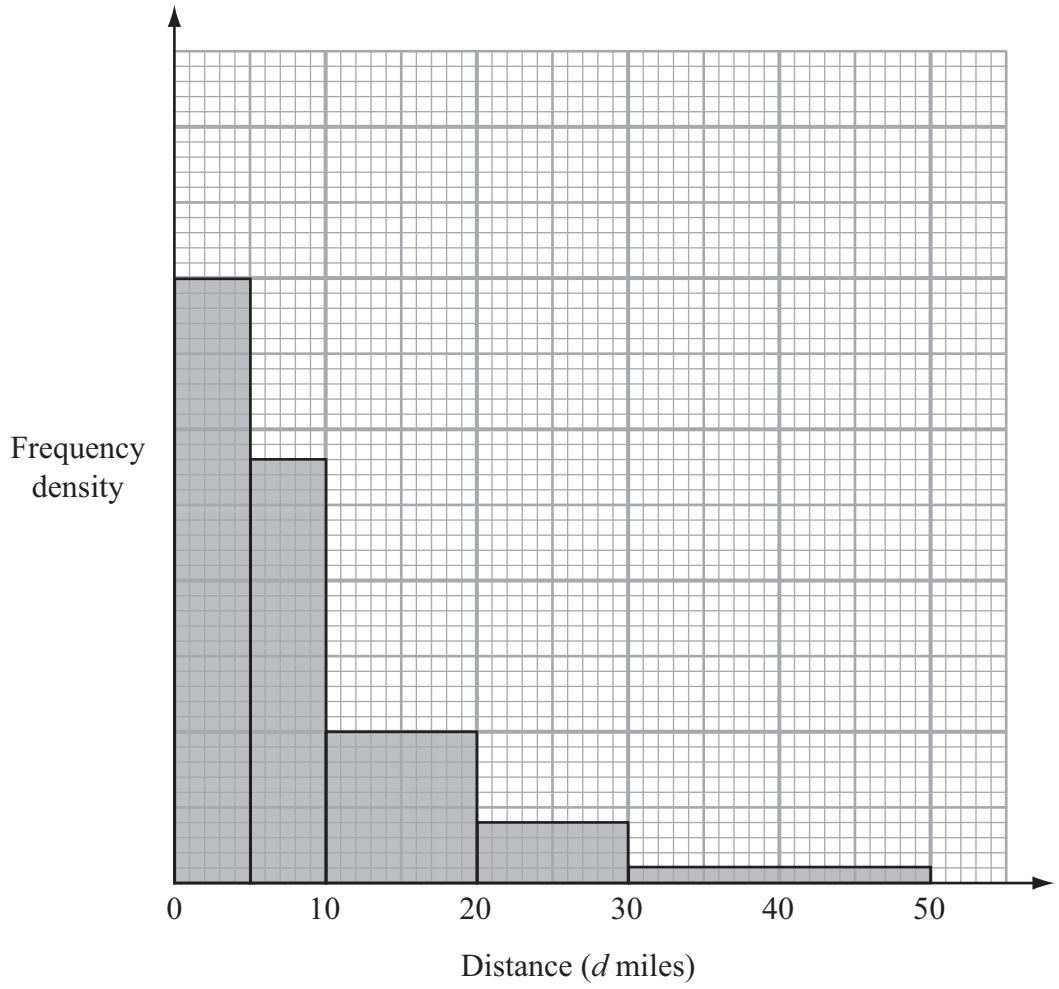
Distance (d miles)	Frequency
$0 < d \leqslant 5$	15
$5 < d \leqslant 10$	17
$10 < d \leqslant 20$	10
$20 < d \leqslant 30$	6
$30 < d \leqslant 50$	2

(a) Draw a histogram for the information in the table.



(3)

The histogram below shows information about the distances, in miles, that some women travelled to work.



x women travelled between 10 and 20 miles to work.

(b) Find an expression, in terms of x, for the total number of women represented by the histogram.

.....

(2)

(Total for Question 12 is 5 marks)

***13** The diagram shows a triangle inside a rectangle.

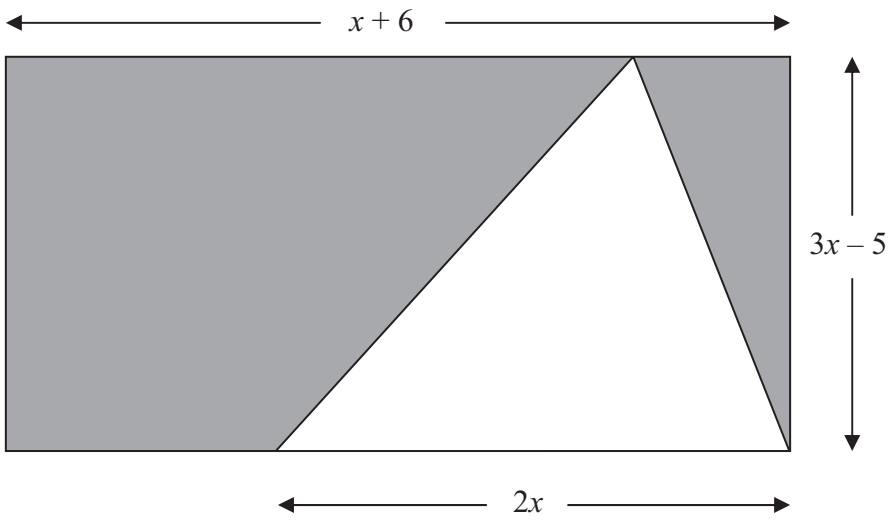


Diagram **NOT** accurately drawn

All measurements are given in centimetres.

Show that the total area, in cm^2, of the shaded regions is $18x - 30$

(Total for Question 13 is 4 marks)

5



You can work out the amount of medicine, c ml, to give to a child by using the formula

$$c = \frac{ma}{150}$$

m is the age of the child, in months.
a is an adult dose, in ml.

A child is 30 months old.
An adult's dose is 40 ml.

Work out the amount of medicine you can give to the child.

..... ml

(Total for Question 5 is 2 marks)

25 The diagram shows a solid metal cylinder.

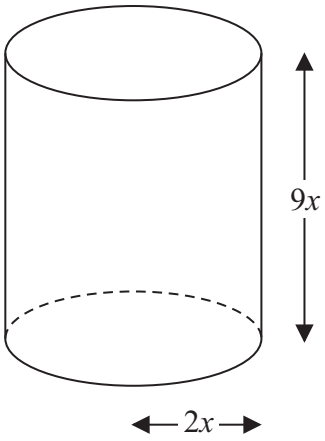


Diagram **NOT** accurately drawn

The cylinder has base radius $2x$ and height $9x$.

The cylinder is melted down and made into a sphere of radius r.

Find an expression for r in terms of x.

.....

(Total for Question 25 is 3 marks)

Question 53

11 There are N beads in a jar.
40 of these beads are black.

Julie takes at random a sample of 50 beads from the jar.
5 of the beads in her sample are black.

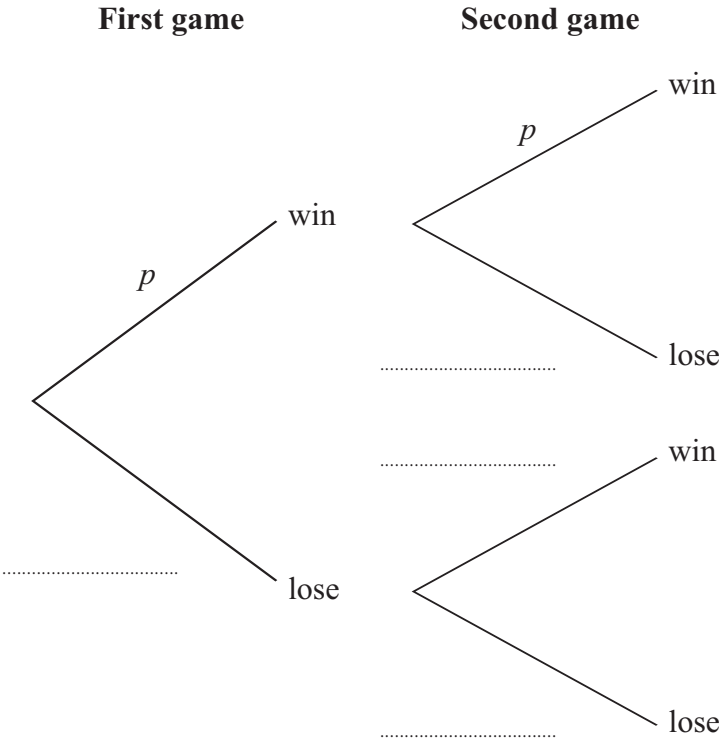
Work out an estimate for the value of N.

.....

(Total for Question 11 is 2 marks)

12 The probability that Rebecca will win any game of snooker is p.
She plays two games of snooker.

(a) Complete, in terms of p, the probability tree diagram.



(2)

(b) Write down an expression, in terms of p, for the probability that Rebecca will win both games.

.....

(1)

(c) Write down an expression, in terms of p, for the probability that Rebecca will win exactly one of the games.

.....

(2)

(Total for Question 12 is 5 marks)

13 y is directly proportional to x.

When $x = 600$, $y = 10$

(a) Find a formula for y in terms of x.

$y =$ .....

(3)

(b) Calculate the value of y when $x = 540$

$y =$ .....

(1)

(Total for Question 13 is 4 marks)

15

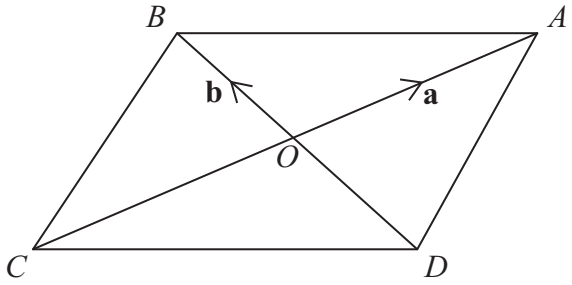


Diagram **NOT** accurately drawn

$ABCD$ is a parallelogram.
The diagonals of the parallelogram intersect at O.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$

(a) Write an expression, in terms of **a** and/or **b**, for

(i) $\overrightarrow{CA}$,

.....

(ii) $\overrightarrow{BA}$,

.....

(iii) $\overrightarrow{BC}$.

.....

(3)

X is the point such that $\overrightarrow{OX} = 2\mathbf{a} - \mathbf{b}$

(b) (i) Find an expression, in terms of **a** and **b**, for $\overrightarrow{AX}$.

.....

(ii) B, A and X lie on the same straight line.

Explain why.

.....

.....

.....

(3)

(Total for Question 15 is 6 marks)

Question 57

10 5 female giraffes have a mean weight of x kg.
7 male giraffes have a mean weight of y kg.

Write down an expression, in terms of x and y, for the mean weight of all 12 giraffes.

.....

(Total for Question 10 is 2 marks)

11

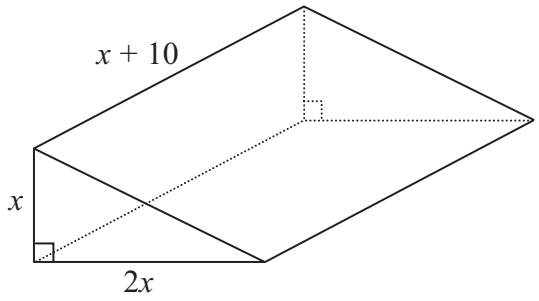


Diagram **NOT** accurately drawn

The diagram shows a solid triangular prism.
All the measurements are in centimetres.

The volume of the prism is V cm^3.

Find a formula for V in terms of x.
Give your answer in simplified form.

.....

(Total for Question 11 is 3 marks)

Question 59

2 Brian is x years old.
Peter is 4 years older than Brian.
Amy is 2 years younger than Brian.

The total of their ages is 26 years.

Work out the value of x.

.....

(Total for Question 2 is 4 marks)

16 Neil invested £500 on 1st January 2000 at a fixed compound interest rate of R% each year.

The value V, in pounds, of this investment after n years is given by the formula

$$V = 500 \times (1.025)^n$$

(a) Write down the value of R.

.....

(1)

(b) Use your calculator to find the value of Neil's investment at the end of 12 years.

£ .....

(2)

(Total for Question 16 is 3 marks)

7 (a) Simplify $5x + 4y + x - 7y$

.....

(2)

(b) Solve $7(x + 2) = 7$

.....

(2)

(Total for Question 7 is 4 marks)

Question 62

***24** $m = \dfrac{\sqrt{s}}{t}$

$s = 3.47$ correct to 2 decimal places
$t = 8.132$ correct to 3 decimal places

By considering bounds, work out the value of m to a suitable degree of accuracy.

You must show all your working and give a reason for your final answer.

(Total for Question 24 is 5 marks)

5 (a) Simplify $4x + 3y - x - 4y$

.....

(2)

(b) Simplify $2 + 4x - 7x$

.....

(1)

(c) Simplify $t^4 \times t^7$

.....

(1)

(d) Simplify $y^6 \div y^2$

.....

(1)

(e) Simplify $(c^3)^4$

.....

(1)

(Total for Question 5 is 6 marks)

Question 64

2 A taxi company uses this formula to calculate taxi fares.

$$f = 7d^2 + 320$$

where f is the taxi fare, in pence, and d is the distance travelled, in km.

Aziz uses this taxi company to travel a distance of 8 km.

Work out the taxi fare.

.....

(Total for Question 2 is 3 marks)

20

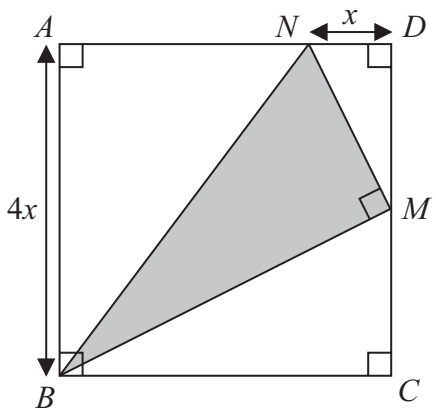


Diagram **NOT** accurately drawn

ABCD is a square with a side length of $4x$
M is the midpoint of *DC*.
N is the point on *AD* where $ND = x$

BMN is a right-angled triangle.

Find an expression, in terms of x, for the area of triangle *BMN*.
Give your expression in its simplest form.

.....

(Total for Question 20 is 4 marks)

2 (a) Simplify $2a + 4b + 3a - b$

.....

(2)

(b) Expand $5(m + 2)$

.....

(1)

(c) Simplify $a^5 \times a^4$

.....

(1)

(Total for Question 2 is 4 marks)

5 $k = 3e + 5$

(a) Work out the value of k when $e = -2$

.....

(2)

(b) Solve $4y + 3 = 2y + 14$

$y =$ .....

(2)

(c) Solve $3(x - 5) = 21$

$x =$ .....

(2)

$-3 < n < 4$
n is an integer.

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

.....

(2)

(Total for Question 5 is 8 marks)

21 Sasha drops a ball from a height of d metres onto the ground.

The time, t seconds, that the ball takes to reach the ground is given by

$$t = \sqrt{\frac{2d}{g}}$$

where g m/s^2 is the acceleration due to gravity.

$d = 35.6$ correct to 3 significant figures.
$g = 9.8$ correct to 2 significant figures.

(a) Write down the lower bound of d.

.....

(1)

(b) Calculate the lower bound of t.
You must show all your working.

.....

(3)

(Total for Question 21 is 4 marks)

4 (a) Simplify $4y + 2x - 3 + 3x + 8$

.....

(2)

(b) Factorise fully $9x^2 - 6xy$

.....

(2)

(c) Expand $4(x + 2)$

.....

(1)

(d) Expand and simplify $(x - 5)(x + 3)$

.....

(2)

(Total for Question 4 is 7 marks)

24 $OACB$ is a parallelogram.

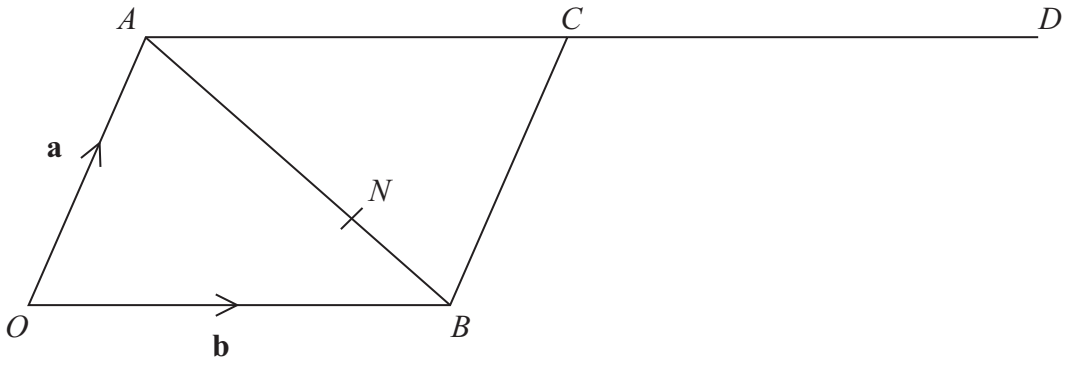


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$
D is the point such that $\overrightarrow{AC} = \overrightarrow{CD}$
The point N divides AB in the ratio $2:1$

(a) Write an expression for $\overrightarrow{ON}$ in terms of **a** and **b**.

.....

(3)

*(b) Prove that OND is a straight line.

(3)

(Total for Question 24 is 6 marks)

2 Tim plays a game.
He can win the game or he can lose the game or he can draw the game.

The probability that Tim will win the game is 0.25
The probability that Tim will lose the game is x.

(a) Give an expression, in terms of x, for the probability that he will draw the game.

.....

(2)

Tim plays the game 240 times.

(b) Work out an estimate for the number of times he will win the game.

.....

(2)

(Total for Question 2 is 4 marks)

Question 72

3 $t = x^2 - 5y$
$x = 6$
$y = 4$

Work out the value of t.

.....

(Total for Question 3 is 2 marks)

7 (a) Simplify $2e + 3f - e + 4f$

.....

(2)

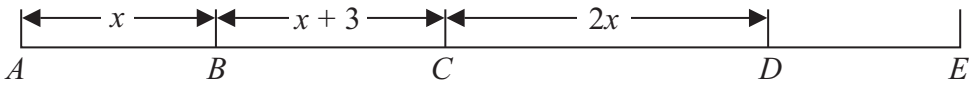
(b) Expand $5(2c + 3d)$

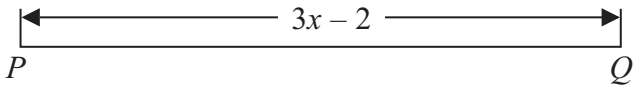
.....

(1)

(c) Here are two straight lines, $ABCDE$ and PQ.

Diagrams **NOT** accurately drawn





In the diagrams all the lengths are in cm.
$AE = 2PQ$.
Find an expression, in terms of x, for the length of DE.
Give your answer in its simplest form.

.....cm

(4)

(Total for Question 7 is 7 marks)

20 Steve has a photo and a rectangular piece of card.

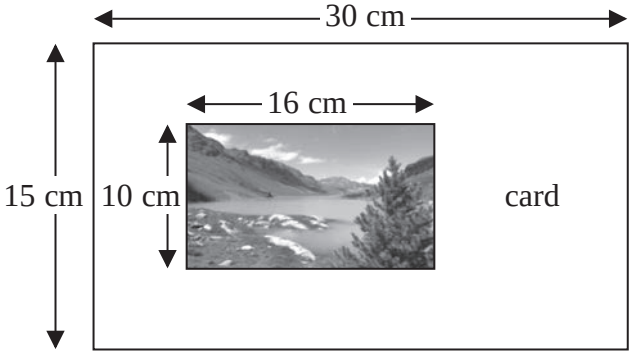
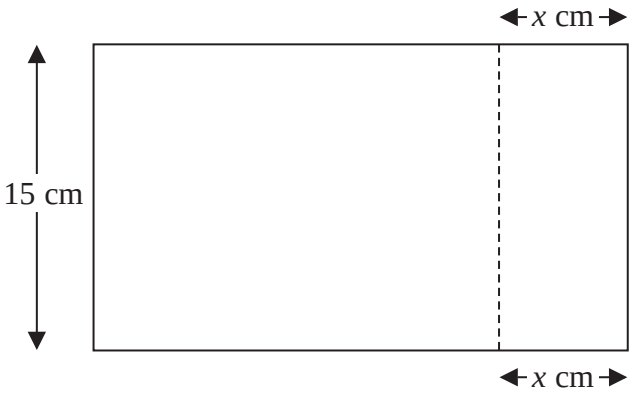


Diagram **NOT** accurately drawn

The photo is 16 cm by 10 cm.
The card is 30 cm by 15 cm.

Steve cuts the card along the dotted line shown in the diagram below.



Steve throws away the piece of card that is 15 cm by x cm.
The piece of card he has left is mathematically similar to the photo.

Work out the value of x.

.....

(Total for Question 20 is 3 marks)

***7**

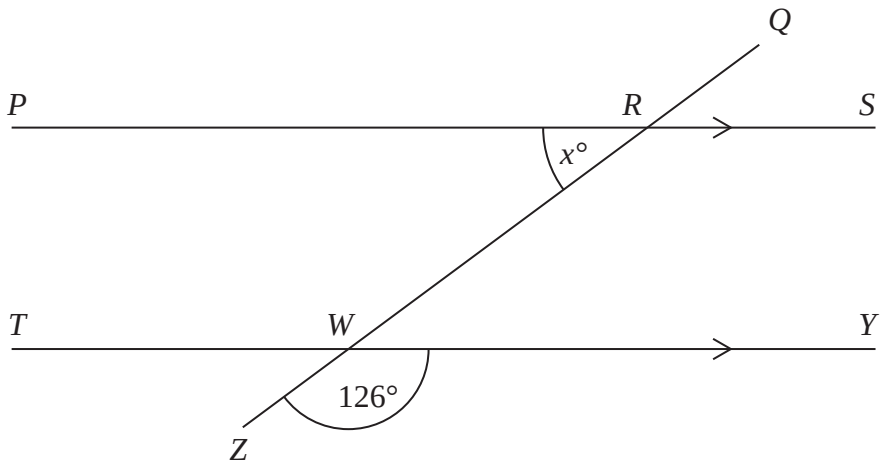


Diagram **NOT** accurately drawn

PRS and *TWY* are parallel straight lines.
QRWZ is a straight line.

Work out the value of *x*.
Give reasons for your answer.

(Total for Question 7 is 3 marks)

10 (a) Simplify $(p^3)^2$

.....
(1)

(b) Simplify $\frac{t^8}{t^3}$

.....
(1)

$2^3 \times 2^n = 2^9$

(c) Work out the value of n.

.....
(1)

$2x^3 = 128$

(d) Work out the value of x.

.....
(1)

(Total for Question 10 is 4 marks)

Question 77

5 There are 20 sweets in a box.
x of the sweets are red.
The rest of the sweets are yellow.

Tom takes at random a sweet from the box.

Write down an expression, in terms of x, for the probability that Tom takes a yellow sweet.

.....

(Total for Question 5 is 2 marks)

2 (a) Simplify $3e + 2f - e - 3f$

.....

(2)

(b) Expand $2(3x + 5)$

.....

(2)

(Total for Question 2 is 4 marks)

6 Stephanie is x years old.
Tobi is twice as old as Stephanie.
Ulrika is 3 years younger than Tobi.

The sum of all their ages is 52 years.

(a) Show that $5x - 3 = 52$

(3)

(b) Work out the value of x.

$x =$ .....

(2)

(Total for Question 6 is 5 marks)

11

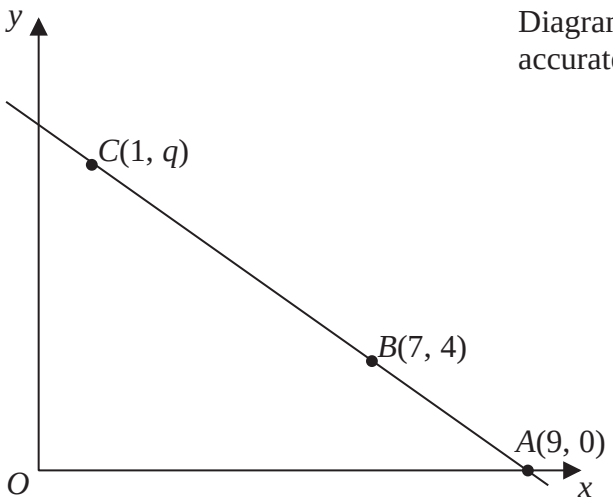


Diagram **NOT** accurately drawn

The points A, B and C lie on a straight line.

The coordinates of A are (9, 0).
The coordinates of B are (7, 4).
The coordinates of C are (1, q).

Work out the value of q.

.....

(Total for Question 11 is 3 marks)

Question 81

15 D is directly proportional to x.

$D = 36$ when $x = 5$

Work out the value of D when $x = 8$

$D =$ .....

(Total for Question 15 is 2 marks)

4 Kalinda buys x packs of currant buns and y boxes of iced buns.

There are 6 currant buns in a pack of currant buns.
There are 8 iced buns in a box of iced buns.

Kalinda buys a total of T buns.
Write down a formula for T in terms of x and y.

.....

(Total for Question 4 is 3 marks)

7 The diagram shows the plan of a floor.

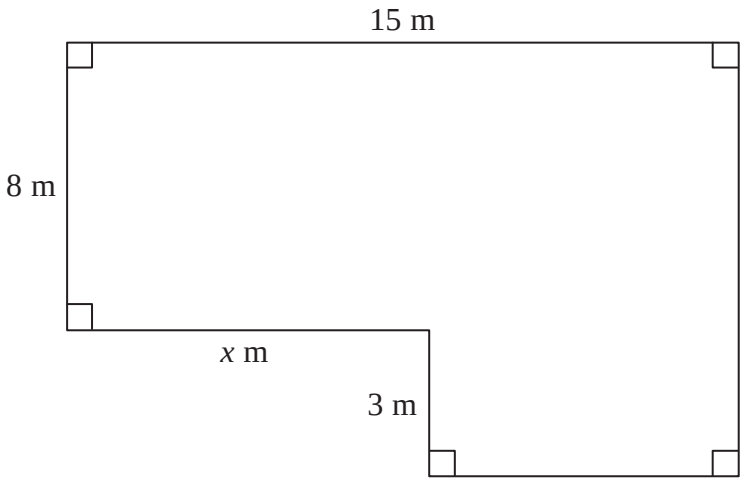


Diagram **NOT** accurately drawn

The area of the floor is 138 m^2.

Work out the value of x.

.....

(Total for Question 7 is 4 marks)

22 (a) Simplify fully $\dfrac{2x^2 - 5x + 3}{x^2 + 5x - 6}$

.....

(3)

(b) Make m the subject of

$$\frac{m}{v} - \frac{t}{b} = \frac{m - t}{R}$$

.....

(4)

(Total for Question 22 is 7 marks)

3 Dan, Harry and Regan sell cars.

Dan sells x cars.
Harry sells 5 more cars than Dan.
Regan sells twice as many cars as Dan.

Write an expression, in terms of x, for the mean number of cars Dan, Harry and Regan sell.

.....

(Total for Question 3 is 2 marks)

5 There are only red counters, yellow counters, blue counters and green counters in a bag.
Olu takes at random a counter from the bag.

The table shows each of the probabilities.

Colour	**Red**	**Yellow**	**Blue**	**Green**
Probability	0.6	0.25	$2x$	x

The probability that Olu will take a blue counter is twice the probability that he will take a green counter.

(a) Work out the value of x.

.....

(3)

Olu takes a counter from the bag.
He writes down the colour of the counter.
He puts the counter back in the bag.

Olu does this 50 times.

(b) Work out an estimate for the number of times that Olu takes a red counter from the bag.

.....

(2)

(Total for Question 5 is 5 marks)

23 The diagram shows a container for grain.

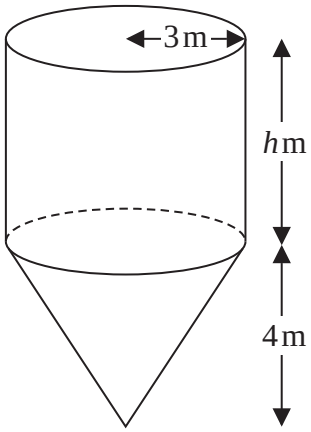


Diagram **NOT** accurately drawn

The container is a cylinder on top of a cone.
The cylinder has a radius of 3m and a height of hm.
The cone has a base radius of 3m and a vertical height of 4m.

The container is empty.
The container is then filled with grain at a constant rate.

After 5 hours the depth of the grain is 6 metres above the vertex of the cone.
After 9 hours the container is full of grain.

Work out the value of h.
Give your answer as a fraction in its simplest form.
You must show all your working.

.....

(Total for Question 23 is 5 marks)

13 Here is a shape.

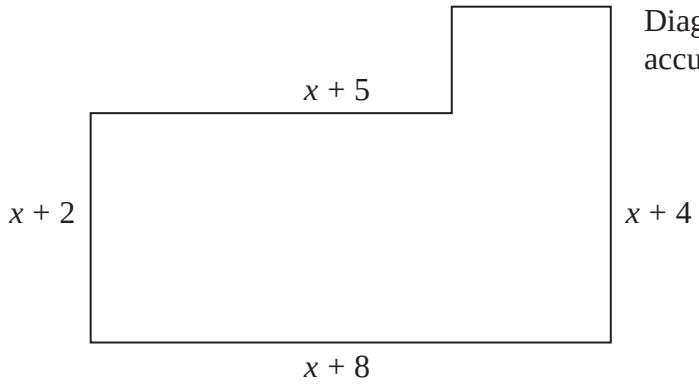


Diagram **NOT** accurately drawn

All the measurements are in centimetres.
All the corners are right angles.

The area of the shape is A cm^2.

Find a formula for A in terms of x.
Give your answer in its simplest form.

$A =$ .....

(Total for Question 13 is 4 marks)

Question 89

18 y is inversely proportional to the square of x.
When $x = 5$, $y = 15$

Write a formula for y in terms of x.

.....

(Total for Question 18 is 3 marks)

23

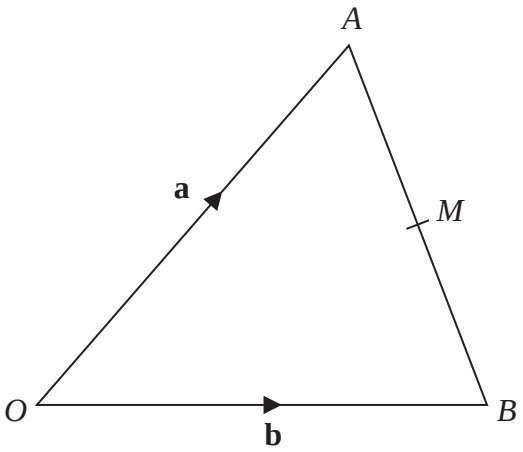


Diagram **NOT** accurately drawn

OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$

$\overrightarrow{OB} = \mathbf{b}$

M is the midpoint of *AB*.
OMN is a straight line such that $ON : OM = 3 : 2$

Find, in terms of **a** and **b**, an expression for the vector $\overrightarrow{ON}$.
Write your answer in its simplest form.

.....

(Total for Question 23 is 4 marks)

Question 91

6 Ken is x years old.
Liam is $(x + 4)$ years old.
Tina is $3x$ years old.

Write an expression, in terms of x, for the mean of their ages.

.....

(Total for Question 6 is 2 marks)

14

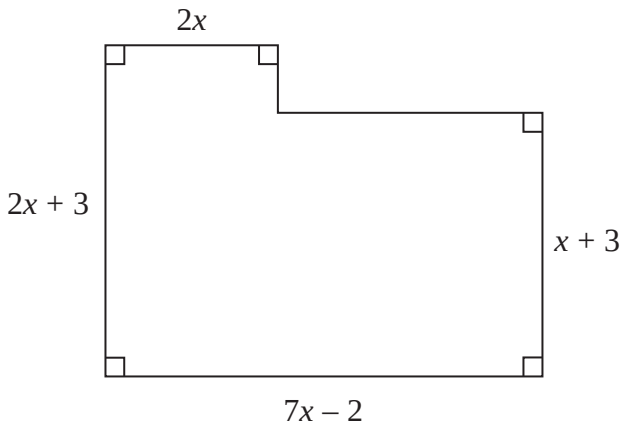


Diagram **NOT** accurately drawn

All the measurements in the diagram are in centimetres.

The area of the shape is A cm^2.

Find a formula for A in terms of x.
You must write your formula as simply as possible.

.....

(Total for Question 14 is 4 marks)

19 y is proportional to x^2.

When $x = 5$, $y = 100$

Work out the value of y when $x = 3$

$y =$ .....

(Total for Question 19 is 3 marks)

20 $I = \dfrac{V}{R}$

V = 250 correct to the nearest 5

R = 3900 correct to the nearest 100

Work out the lower bound for the value of I.
Give your answer correct to 3 decimal places.
You must show your working.

.....

(Total for Question 20 is 3 marks)

9 A shop sells packets of envelopes.

There are 5 envelopes in a small packet.
There are 20 envelopes in a large packet.

There is a total of T envelopes in x small packets and y large packets.

Write down a formula for T in terms of x and y.

.....

(Total for Question 9 is 3 marks)

2 (a) Simplify $3a \times 5b \times 2c$

.....

(1)

(b) Factorise $3y + 6$

.....

(1)

(c) Expand $x(x - 3)$

.....

(1)

(Total for Question 2 is 3 marks)

6 The body mass index, B, for a person of mass m kg and height h metres is given by the formula

$$B = \frac{m}{h^2}$$

Usman has a mass of 50 kg.
He has a height of 1.57 m.

(a) Work out Usman's body mass index.
Give your answer correct to one decimal place.

.....

(2)

Tom's height is 1.80 m.
He wants his body mass index to be 21

(b) Work out the mass that will give Tom a body mass index of 21

..... kg

(2)

Tom is a ski jumper.

The maximum length of skis he can use is 145% of his height.
Tom's height is 1.80 m.

(c) Work out the maximum length of skis Tom can use.

..... m

(3)

(Total for Question 6 is 7 marks)

21 $I = 5(v - u)$

$v = 14$ correct to 2 significant figures
$u = 8.7$ correct to 2 significant figures

Work out the upper bound for the value of I.
You must show your working.

.....

(Total for Question 21 is 3 marks)

Question 99

3 Alex is x cm tall.

Bob is 10 cm taller than Alex.
Cath is 4 cm shorter than Alex.

Write an expression, in terms of x, for the mean of their heights in centimetres.

.....

(Total for Question 3 is 3 marks)

11 Danielle invested £2800 for n years in a savings account.

She was paid 2.5% per annum compound interest.
The interest is paid into the account at the end of each year.

At the end of n years, the amount of money in the savings account is greater than £3000 for the first time.

Work out the value of n.

.....

(Total for Question 11 is 2 marks)

Question 101

2 $p = n^3 - 5$
$n = 2$

Work out the value of p.

.....

(Total for Question 2 is 2 marks)

5

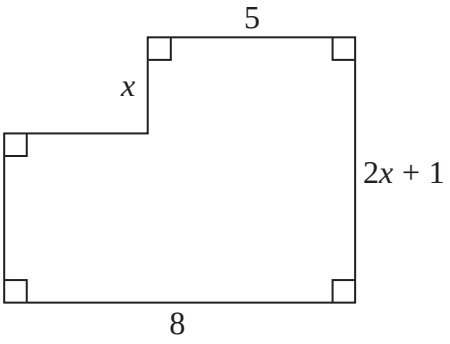


Diagram **NOT** accurately drawn

Here is a shape.
All the measurements are in metres.

The area of the shape is $A\text{m}^2$.

Find a formula for A in terms of x.

.....

(Total for Question 5 is 3 marks)

***14**

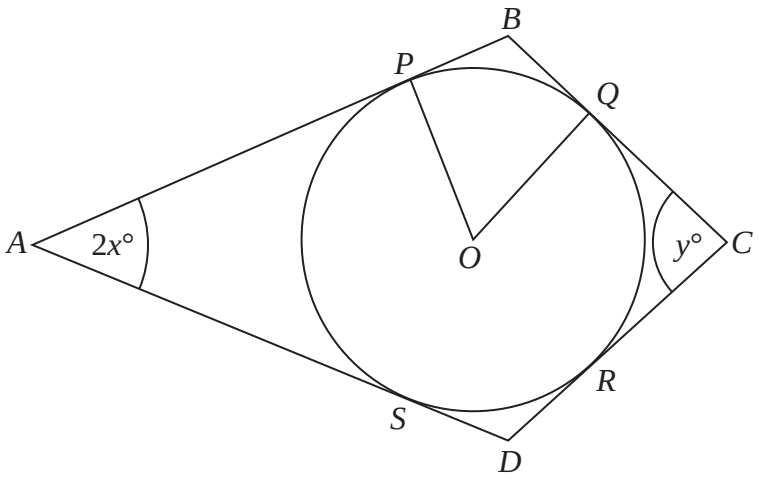


Diagram **NOT** accurately drawn

P, *Q*, *R* and *S* are points on the circumference of a circle, centre *O*.
APB, *BQC*, *CRD* and *DSA* are tangents to the circle.
ABCD is a kite.

Angle *PAS* = $2x°$
Angle *QCR* = $y°$

Find an expression in terms of x and y for the size, in degrees, of the angle *POQ*.
Give your expression in its simplest form.
Give reasons for your answer.

(Total for Question 14 is 5 marks)

***19** $p = \sqrt{\frac{s}{t}}$

s = 10.8 correct to 1 decimal place.
t = 75.06 correct to 2 decimal places.

By considering bounds, work out the value of p to a suitable degree of accuracy.

You must show all your working and give a reason for your final answer.

(Total for Question 19 is 5 marks)

20 y is inversely proportional to the square root of x.

When $x = 4$, $y = 9$

Work out the value of y when $x = 6$
Give your answer correct to 3 significant figures.

.....

(Total for Question 20 is 3 marks)

22 The diagram shows a prism.

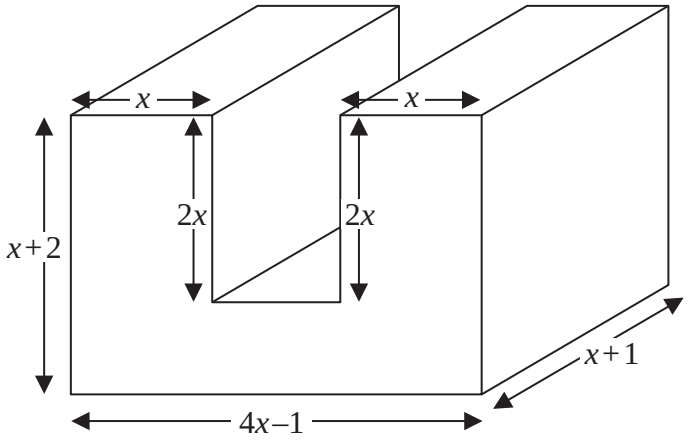


Diagram **NOT** accurately drawn

All measurements are in centimetres.
All corners are right angles.

Find an expression, in terms of x, for the volume, in cm^3, of the prism.
You must show your working.
Give your answer in its simplest form.

.....

(Total for Question 22 is 4 marks)

24 The intensity of the sound, I watts/m^2, received from a loudspeaker is inversely proportional to the square of the distance, d metres, from the loudspeaker.

When $d = 2$, $I = 30$

Work out the value of I when $d = 10$

.....

(Total for Question 24 is 3 marks)

5 Steph's weight in kilograms is $2x + 9$
Kyle's weight in kilograms is $4x - 7$

Write down an expression, in terms of x, for the mean of their weights.

..... kilograms

(Total for Question 5 is 2 marks)

10 (a) Write down the value of

(i) 7^0

.....

(ii) 5^{-2}

.....

(iii) $16^{\frac{1}{2}}$

.....

(3)

(b) Simplify fully $\dfrac{10a^7b^4}{2a^3b}$

.....

(2)

(Total for Question 10 is 5 marks)

21 Helen invested £6000 for n years in a savings account.
She got 3% compound interest each year.

At the end of n years Helen had £7379.24 in her savings account.

Work out the value of n.
You must show your working.

.....

(Total for Question 21 is 2 marks)

1 (a) Simplify $x^7 \times x^5$

.....

(1)

(b) Simplify $2y \div y$

.....

(1)

$v = 2t^2$

$t = 3$

(c) Work out the value of v.

.....

(1)

(d) Give an example to show that, when n is a whole number, $6n + 1$ is **not** always a prime number.
You must give your value of n.

$n =$ .....

(1)

(Total for Question 1 is 4 marks)

8 (a) Simplify $ab - 5g + 5ab - 2g$

.....

(2)

(b) Factorise $6m - 9$

.....

(1)

(c) Simplify $t^8 \div t^3$

.....

(1)

(d) Factorise fully $2x^2y + 4xy^2$

.....

(2)

(e) Expand and simplify $(w - 5)^2$

.....

(2)

(Total for Question 8 is 8 marks)

22 $a = \dfrac{v - u}{t}$

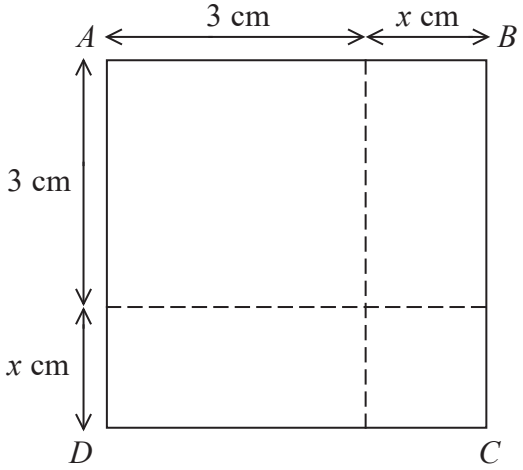
$v = 37.6$ correct to 3 significant figures.
$u = 11.3$ correct to 3 significant figures.
$t = 8.4$ correct to 2 significant figures.

Work out the upper bound for the value of a.
Show your working clearly.

.....

(Total for Question 22 is 3 marks)

4



The area of square $ABCD$ is 10 cm^2.

Show that $x^2 + 6x = 1$

(Total for Question 4 is 3 marks)

Question 115

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18 $16^{\frac{1}{5}} \times 2^x = 8^{\frac{3}{4}}$

Work out the exact value of x.

.....

(Total for Question 18 is 3 marks)

Question 116

10 Naoby invests £6000 for 5 years.
The investment gets compound interest of x% per annum.

At the end of 5 years the investment is worth £8029.35

Work out the value of x.

.....

(Total for Question 10 is 3 marks)

14 (a) Simplify $\dfrac{x^2 - 16}{2x^2 - 5x - 12}$

.....

(3)

(b) Make v the subject of the formula $w = \dfrac{15(t - 2v)}{v}$

.....

(3)

(Total for Question 14 is 6 marks)

9 Jack bought a new boat for £12 500

The value, £V, of Jack's boat at the end of n years is given by the formula

$$V = 12\,500 \times (0.85)^n$$

(a) At the end of how many years was the value of Jack's boat first less than 50% of the value of the boat when it was new?

.....

(2)

A savings account pays interest at a rate of R% per year.
Jack invests £5500 in the account for one year.

At the end of the year, Jack pays tax on the interest at a rate of 40%.
After paying tax, he gets £79.20

(b) Work out the value of R.

.....

(3)

(Total for Question 9 is 5 marks)

16 The petrol consumption of a car, in litres per 100 kilometres, is given by the formula

$$\text{Petrol consumption} = \frac{100 \times \text{Number of litres of petrol used}}{\text{Number of kilometres travelled}}$$

Nathan's car travelled 148 kilometres, correct to 3 significant figures.
The car used 11.8 litres of petrol, correct to 3 significant figures.

Nathan says,

"My car used less than 8 litres of petrol per 100 kilometres."

Could Nathan be wrong?
You must show how you get your answer.

(Total for Question 16 is 3 marks)

14 y is inversely proportional to d^2
When $d = 10$, $y = 4$

d is directly proportional to x^2
When $x = 2$, $d = 24$

Find a formula for y in terms of x.
Give your answer in its simplest form.

.....

(Total for Question 14 is 5 marks)

Question 121

19 The point P has coordinates $(3, 4)$
The point Q has coordinates (a, b)

A line perpendicular to PQ is given by the equation $3x + 2y = 7$

Find an expression for b in terms of a.

.....

(Total for Question 19 is 5 marks)

Question 122

9 $T = \sqrt{\frac{w}{d^3}}$

$w = 5.6 \times 10^{-5}$
$d = 1.4 \times 10^{-4}$

(a) Work out the value of T.
Give your answer in standard form correct to 3 significant figures.

$T =$ .....

(2)

w is increased by 10%
d is increased by 5%

Lottie says,

"The value of T will increase because both w and d are increased."

(b) Lottie is wrong.
Explain why.

.....

.....

(2)

(Total for Question 9 is 4 marks)

14 (a) Work out the value of $\left(\frac{16}{81}\right)^{\frac{3}{4}}$

.....

(2)

$3^a = \frac{1}{9}$ $3^b = 9\sqrt{3}$ $3^c = \frac{1}{\sqrt{3}}$

(b) Work out the value of $a + b + c$

.....

(2)

(Total for Question 14 is 4 marks)

Question 124

6 A is the point with coordinates $(5, 9)$
B is the point with coordinates $(d, 15)$

The gradient of the line AB is 3

Work out the value of d.

.....

(Total for Question 6 is 3 marks)

20 h is inversely proportional to p

p is directly proportional to $\sqrt{t}$

Given that $h = 10$ and $t = 144$ when $p = 6$
find a formula for h in terms of t

.....

(Total for Question 20 is 4 marks)

Question 126

6 Sally used her calculator to work out the value of a number y.

The answer on her calculator display began

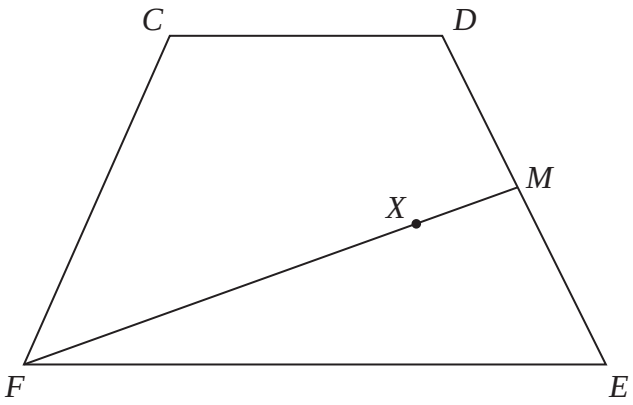
8.3

Complete the error interval for y.

..... $\leqslant y <$ .....

(Total for Question 6 is 2 marks)

20 $CDEF$ is a quadrilateral.



$\overrightarrow{CD} = \mathbf{a}$, $\overrightarrow{DE} = \mathbf{b}$ and $\overrightarrow{FC} = \mathbf{a} - \mathbf{b}$.

(a) Express $\overrightarrow{FE}$ in terms of **a** and/or **b**.
Give your answer in its simplest form.

.....

(2)

M is the midpoint of DE.
X is the point on FM such that $FX : XM = n : 1$
CXE is a straight line.

(b) Work out the value of n.

$n =$ .....

(4)

(Total for Question 20 is 6 marks)

Question 128

2 There are 60 people in a choir.
Half of the people in the choir are women.

The number of women in the choir is 3 times the number of men in the choir.
The rest of the people in the choir are children.

the number of children in the choir : the number of men in the choir = n : 1

Work out the value of n.
You must show how you get your answer.

n = ...

(Total for Question 2 is 4 marks)

Question 129

11 There are p counters in a bag.
12 of the counters are yellow.

Shafiq takes at random 30 counters from the bag.
5 of these 30 counters are yellow.

Work out an estimate for the value of p.

.....

(Total for Question 11 is 2 marks)

8 The number of days, d, that it will take to build a house is given by

$$d = \frac{720}{n}$$

where n is the number of workers used each day.

Ali's company will take 40 days to build the house.
Hayley's company will take 30 days to build the house.

Hayley's company will have to use more workers each day than Ali's company.

How many more?

.....

(Total for Question 8 is 3 marks)

Question 131

13 Sakira invested £3550 in a savings account for 3 years.

She was paid 2.6% per annum compound interest for each of the first 2 years.
She was paid R% interest for the third year.

Sakira had £3819.21 in her savings account at the end of the 3 years.

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

.....

(Total for Question 13 is 3 marks)

Question 132

20 $d = \frac{1}{8}c^3$

$c = 10.9$ correct to 3 significant figures.

By considering bounds, work out the value of d to a suitable degree of accuracy.
Give a reason for your answer.

(Total for Question 20 is 4 marks)

10 (a) Solve $\frac{9+x}{7} = 11 - x$

$x =$ .....

(3)

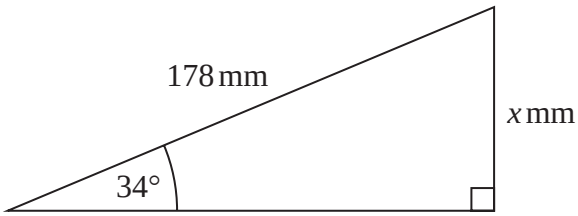
(b) Simplify $\frac{4(y+3)^3}{(y+3)^2}$

.....

(1)

(Total for Question 10 is 4 marks)

5

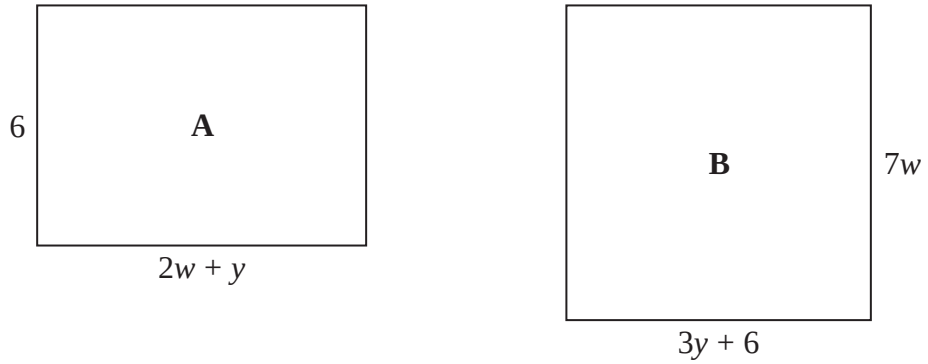


Work out the value of x.
Give your answer correct to 1 decimal place.

.....

(Total for Question 5 is 2 marks)

11 The diagram shows two rectangles, **A** and **B**.



All measurements are in centimetres.

The area of rectangle **A** is equal to the area of rectangle **B**.

Find an expression for y in terms of w.

.....

(Total for Question 11 is 4 marks)

21 The time period, T seconds, of a simple pendulum of length l cm is given by the formula

$$T = 2\pi\sqrt{\frac{l}{g}}$$

Katie uses a simple pendulum in an experiment to find an estimate for the value of g.

Here are her results.

l = 52.0 correct to 3 significant figures.
T = 1.45 correct to 3 significant figures.

Work out the upper bound and the lower bound for the value of g.
Use π = 3.142
You must show all your working.

upper bound = ...

lower bound = ...

(Total for Question 21 is 4 marks)

Question 137

12 $(ax^6)^{\frac{1}{n}} = 7x^3$

Work out the value of a and the value of n.

$a =$ .....

$n =$ .....

(Total for Question 12 is 2 marks)

Question 138

17 x is directly proportional to the square of y.
y is directly proportional to the cube of z.

$z = 2$ when $x = 32$

Find a formula for x in terms of z.

.....

(Total for Question 17 is 4 marks)

20 Pat throws a fair coin n times.

Find an expression, in terms of n, for the probability that Pat gets at least 1 head and at least 1 tail.

.....

(Total for Question 20 is 2 marks)

11 Cormac has some sweets in a bag.
The sweets are lime flavoured or strawberry flavoured or orange flavoured.

In the bag

$$\begin{matrix}\text{number of lime}\\ \text{flavoured sweets}\end{matrix} : \begin{matrix}\text{number of strawberry}\\ \text{flavoured sweets}\end{matrix} : \begin{matrix}\text{number of orange}\\ \text{flavoured sweets}\end{matrix} = 9 : 4 : x$$

Cormac is going to take at random a sweet from the bag.

The probability that he takes a lime flavoured sweet is $\frac{3}{7}$

Work out the value of x.

$x =$ .....

(Total for Question 11 is 3 marks)

17 y is directly proportional to the square root of t.
$y = 15$ when $t = 9$

t is inversely proportional to the cube of x.
$t = 8$ when $x = 2$

Find a formula for y in terms of x.
Give your answer in its simplest form.

.....

(Total for Question 17 is 4 marks)

3 Rick, Selma and Tony are playing a game with counters.

Rick has some counters.
Selma has twice as many counters as Rick.
Tony has 6 counters less than Selma.

In total they have 54 counters.

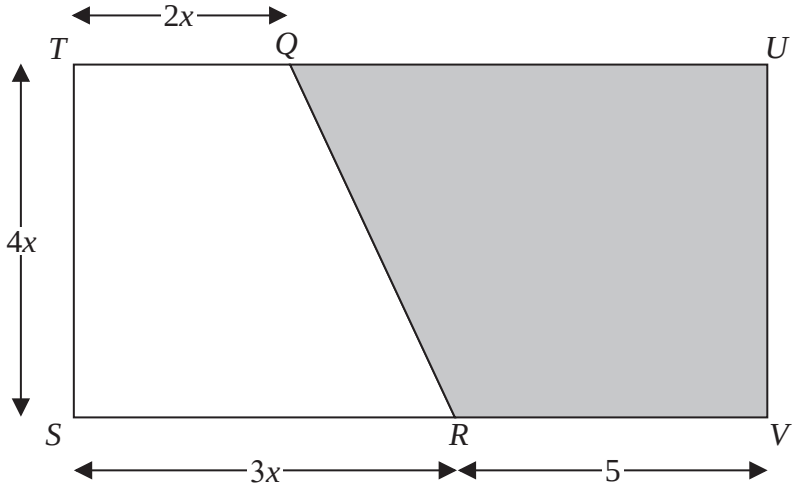
the number of counters Rick has : the number of counters Tony has = 1 : p

Work out the value of p.

p = ...

(Total for Question 3 is 5 marks)

7 The diagram shows rectangle *STUV*.
TQU and *SRV* are straight lines.
All measurements are in cm.



The area of trapezium *QUVR* is $A\,\text{cm}^2$

Show that $A = 2x^2 + 20x$

(Total for Question 7 is 3 marks)

16 $p = \sqrt{\frac{2e}{f}}$

$e = 6.8$ correct to 1 decimal place.

$f = 0.05$ correct to 1 significant figure.

Work out the upper bound for the value of p.
Give your answer correct to 3 significant figures.
You must show all your working.

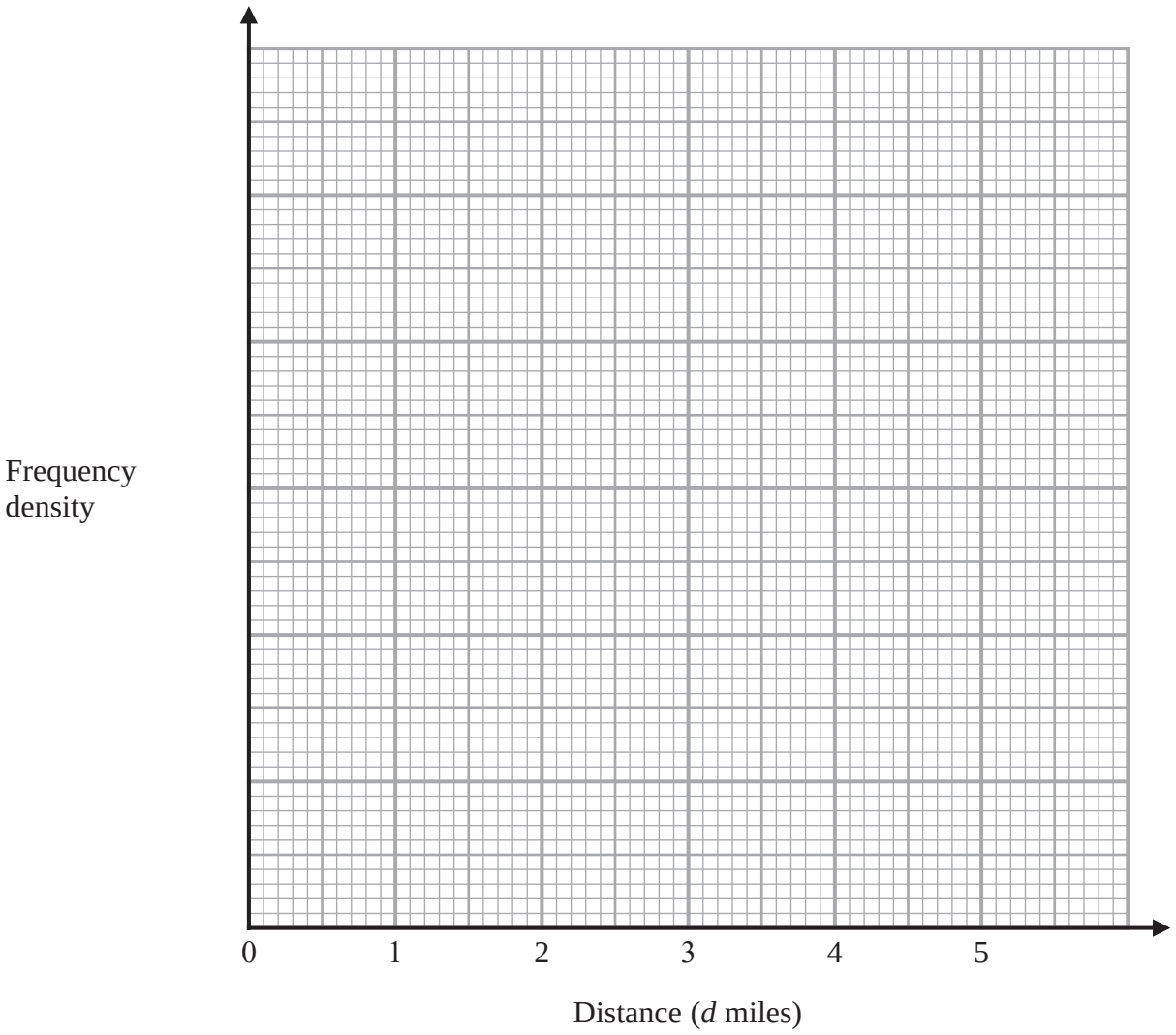
.....

(Total for Question 16 is 3 marks)

17 The table gives information about the distances, in miles, that some Year 10 students live from school.

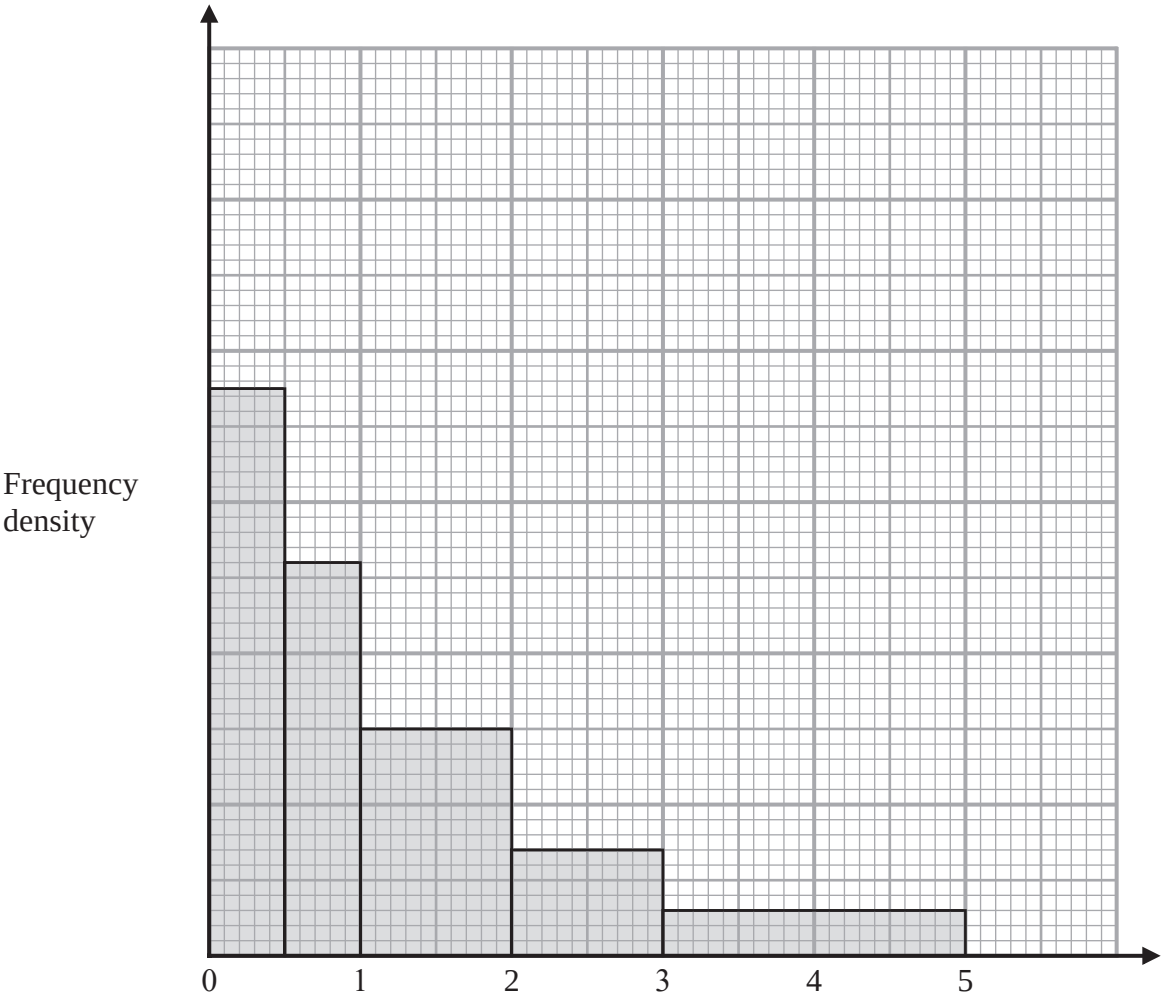
Distance (d miles)	Frequency
$0 < d \leqslant 1.0$	90
$1.0 < d \leqslant 1.5$	48
$1.5 < d \leqslant 2.0$	22
$2.0 < d \leqslant 3.0$	8
$3.0 < d \leqslant 5.0$	12

(a) On the grid, draw a histogram for this information.



(3)

The histogram below shows information about the distances, in miles, that some Year 11 students live from school.



The number of Year 11 students who live between 1 and 2 miles from school is n.

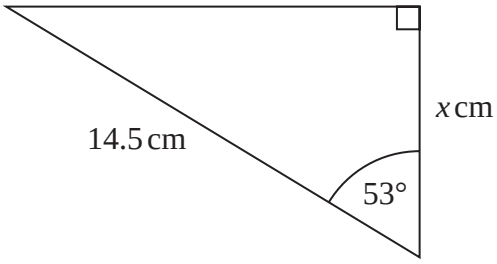
(b) Find an expression, in terms of n, for the number of Year 11 students who live between 3 and 5 miles from school.

.....

(2)

(Total for Question 17 is 5 marks)

5



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

x = ...

(Total for Question 5 is 2 marks)

10 Peter has to subtract $(x^2 - 2x - 4)$ from $(x^2 + 3x + 5)$

Here is his working

$$(x^2 + 3x + 5) - (x^2 - 2x - 4)$$
$$= x^2 + 3x + 5 - x^2 - 2x - 4$$
$$= x + 1$$

Explain what is wrong with Peter's working.

.....

.....

.....

(Total for Question 10 is 1 mark)

Question 148

12 Martin used his calculator to work out the value of a number P.
He wrote down the first two digits of the answer on his calculator.

He wrote down 1.2

Complete the error interval for P.

..... $\leqslant P <$ .....

(Total for Question 12 is 2 marks)

Question 149

13 y is directly proportional to x.

$y = 24$ when $x = 1.5$

Work out the value of y when $x = 5$

$y =$ .....

(Total for Question 13 is 3 marks)

19 The menu in a restaurant has starters, main courses and desserts.

There are 5 starters.
There are 12 main courses.
There are x desserts.

There are 420 different ways to choose one starter, one main course and one dessert.

Work out the value of x.

$x =$ .....

(Total for Question 19 is 2 marks)

22 There are only blue pens and red pens in a box.

The number of blue pens is four times the number of red pens.

Rita takes at random one pen from the box.
She records the colour of the pen and then replaces it in the box.
Rita does this n times, where $n \geqslant 2$

Write down an expression, in terms of n, for the probability that Rita gets a blue pen at least once and a red pen at least once.

.....

(Total for Question 22 is 2 marks)

Question 152

22 Given that the vector $a\begin{pmatrix}2\\6\end{pmatrix}+b\begin{pmatrix}8\\2\end{pmatrix}$ is parallel to the vector $\begin{pmatrix}13\\6\end{pmatrix}$

find an expression for b in terms of a.

.....

(Total for Question 22 is 3 marks)

Question 153

20 $2^x = \dfrac{2^n}{\sqrt[3]{2}}$ $\quad 2^y = \left(\sqrt{2}\right)^5$

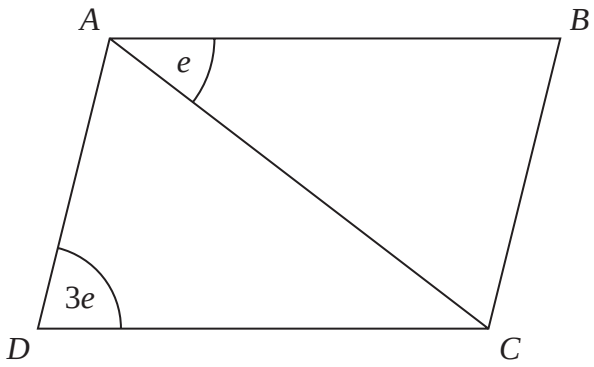
Given that $x + y = 8$

work out the value of n.

$n =$ .....

(Total for Question 20 is 3 marks)

4 *ABCD* is a parallelogram.



All angles are measured in degrees.

Find an expression, in terms of e, for the size of angle *CAD*.
Give a reason for each stage of your working.

.....

(Total for Question 4 is 3 marks)

Question 155

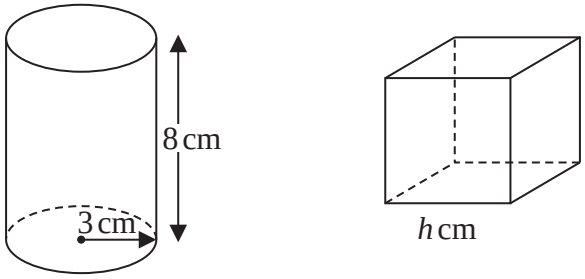
8 $1.25 \times 10^{-12} = k \times (4 \times 10^{-20})$

Work out the value of k.
Give your answer in standard form.

$k =$ .....

(Total for Question 8 is 2 marks)

12 The diagram shows a solid cylinder with base radius 3 cm and height 8 cm.
It also shows a solid cube with side length h cm.



The cylinder is made from steel with a density of 7.86 g/cm^3
The cube is made from brass with a density of 8.5 g/cm^3

The mass of the cylinder is equal to the mass of the cube.

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

h = ...

(Total for Question 12 is 5 marks)

12 Rudi invests £4500 in a savings account.

He gets compound interest at a rate of

2.4% for the first year
1.8% for each extra year.

(a) Work out the value of Rudi's investment at the end of 3 years.

£.....

(3)

Bruna buys a car for £7500

The value of the car depreciates by x% each year.
At the end of 2 years the value of the car is £4107

(b) Work out the value of x.

x = ...

(3)

(Total for Question 12 is 6 marks)

4 There are 280 chocolates in a box.
There are only dark chocolates, milk chocolates and white chocolates.

$\frac{1}{7}$ of the 280 chocolates are dark chocolates.

The number of milk chocolates : the number of white chocolates = 1 : 3

The number of white chocolates : the number of dark chocolates = n : 1

(a) Work out the value of n.
You must show all your working.

n = ...

(5)

10 milk chocolates from the box are eaten.

(b) Does this affect your answer to part (a)?
Give a reason for your answer.

.....

.....

.....

(1)

(Total for Question 4 is 6 marks)

Question 159

7 (a) Simplify $\dfrac{3(2-m)^2}{2-m}$

.....

(1)

(b) Solve $7 + x \leqslant \dfrac{5x}{2} - 8$

.....

(3)

(c) Solve $9 < 2y + 4 < 12$

.....

(2)

(Total for Question 7 is 6 marks)

6 Here are two lists of numbers.

List **A**	276	400	157	139		
List **B**	530	500	270	x	440	320

mean of list **A** : mean of list **B** = 3 : 5

Work out the value of x.

x = ...

(Total for Question 6 is 5 marks)