Paper 2 Revision

Key topics to practice for 4th June

Very Likely – Sequences

Q1.

The first four terms of a linear sequence are

6 13 20 27

+7 +7 +7

Write down the expression for the *n*th term.

7 times table − 1

Answer $7n - 1$

(Total 1 mark)

Q2.

Here is the term-to-term rule for a sequence.

Double the previous term and add 3

×2 then +3

The first three terms of the sequence are $a + 1$ $2a + 5$ $4a + 13$ $8a + 24$

Show that the sum of the first **four** terms is a multiple of 3

$(4a+13) \times 2 = 8a + 26$

$8a + 26 + 3 = 8a + 29$

1st 2nd 3rd 4th

$a + 1 + 2a + 5 + 4a + 13 + 8a + 24 = 15a + 48$

$= 3(5a + 16)$

As 3 is a factor, it must be a multiple of 3

(Total 3 marks)

Q3.

Which of these is a geometric progression?

Circle your answer.

+2 +2 +2 +2
1 3 5 7 9
Arithmetic

+3 +5 +7 +9
1 4 9 16 25
Quadratic
(Square numbers)

+2 +3 +4 +5
1 3 6 10 15
Quadratic (Triangular numbers)

1 3 9 27 81
Powers of 3

(Total 1 mark)

Q4.

Work out an expression for the *n*th term of the quadratic sequence

11 15 21 29 39 ...

4 6 8 10

2 2 2 → ÷2 = 1 → $1n^2$ will be in the sequence nth term.

(5) 11 15 21 29 39

$1n^2$ 1 4 9 16 25

(5) $-1n^2$ 10 11 12 13 14

nth term of this is $1n + 9$

$5 - n^2 = n + 9$

$5 = 1n^2 + 1n + 9$

*n*th term = $n^2 + n + 9$

(Total 4 marks)

Very Likely – Direct & Inverse Proportion

Q1.

Density = $\frac{\text{mass}}{\text{volume}}$

Choose some suitable numbers to substitute in.

Let mass = 4, Vol = 4 Density = $\frac{4}{4} = 1$

÷2 = 2 ×4 = 16 new Density = $\frac{2}{16} = \frac{1}{8}$ ÷8

The mass is divided by 2 and the volume is multiplied by 4

What happens to the density?

Circle your answer.

× 2 ÷ 2 × 8 ÷ 8

(Total 1 mark)

Q2.

An object is dropped from a height h cm.

It takes T seconds to reach the ground.

h is directly proportional to the square of T → $h = kT^2$ ✓ Need to work out constant

When $h = 80$ $T = 4$ → Substitute this in.

Work out the value of h when $T = 7.5$

$80 = k \times 4^2$

$80 = k \times 16$

$\div 16$ | $5 = k$ | $\div 16$

So $h = 5T^2$

$h = 5 \times 7.5^2$

Answer 281.25

(Total 5 marks)

Q3.

H is inversely proportional to the cube root of L. → $H = \frac{k}{\sqrt[3]{L}}$

$H = 7$ when $L = 64$

(a) Work out an equation connecting H and L.

$7 = \frac{k}{\sqrt[3]{64}}$

$7 = \frac{k}{4}$

$\times 4$ | $28 = k$ | $\times 4$

Answer $H = \frac{28}{\sqrt[3]{L}}$

(3)

(b) Work out the value of H when $L = 2744$

$H = \frac{28}{\sqrt[3]{2744}} = 2$

$H =$ 2

(2)

(Total 5 marks)

Q4.

P, Q and R have positive values.

P is directly proportional to the square of Q.

When $P = 1.25$, $Q = 0.5$

Q is inversely proportional to R.

When $Q = 0.5$, $R = 6$

Work out the value of R when $P = 0.8$

$P = kQ^2$

$1.25 = k \times 0.5^2$

$1.25 = k \times 0.25$ ÷0.25

$5 = k$

$P = 5Q^2$

$Q = \frac{k}{R}$

$0.5 = \frac{k}{6}$ ×6

$3 = k$

$Q = \frac{3}{R}$

$P = 0.8$

$0.8 = 5Q^2$ ÷5

$0.16 = Q^2$ √

$0.4 = Q$

$0.4 = \frac{3}{R}$ ×R

$0.4R = 3$ ÷0.4

$R = \frac{3}{0.4} = 7.5$

Answer 7.5

(Total 5 marks)

Very Likely – Gradient, Intercepts, y = mx + c

Q1.

A straight line passes through (3, 14) and (12, 32)

Work out the equation of the line.

Give your answer in the form $y = mx + c$

Gradient (m) $= \frac{32-14}{12-3} = \frac{18}{9} = 2$

$y = 2x + c$

Sub in (3, 14) (or (12, 32)) it doesn't matter

$14 = 2 \times 3 + c$

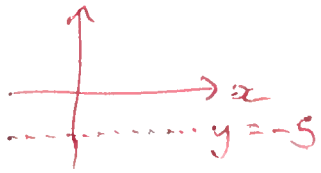
$14 = 6 + c$

$c = 8$

Answer $y = 2x + 8$

(Total 3 marks)

Q2. Draw a sketch



Circle the equation of the line that is parallel to the x-axis.

$y = -5$ $\quad$ $x - y = 0$ $\quad$ $x = 3$ $\quad$ $x + y = 0$

(Total 1 mark)

Q3.

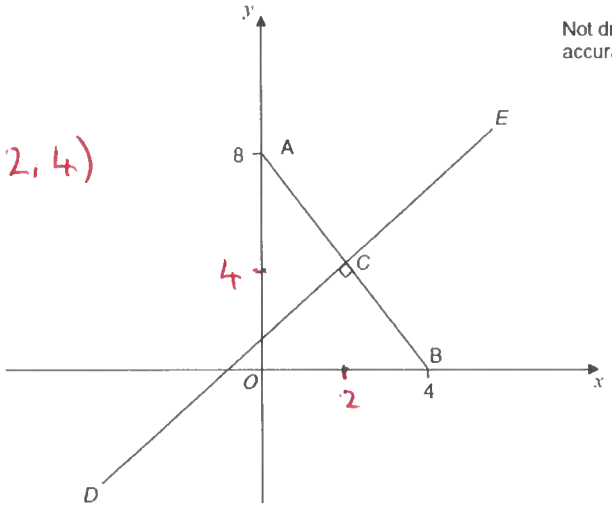
Circle the equation of the line that is parallel to $y = \frac{1}{2}x + 3$ ← gradient = $\frac{1}{2}$

$y = -2x$ $\quad$ $y = 2x$ $\quad$ $y = \frac{1}{2}x$ $\quad$ $y = -\frac{1}{2}x$

(Total 1 mark)

Q4.

ACB is a straight line.
A is the point (0, 8), and *B* is the point (4, 0)
C is the midpoint of *AB*. C(2, 4)
Line *DCE* is perpendicular to line *ACB*.



Work out the equation of line *DCE*.

Gradient of AB

$= \frac{0-8}{4-0} = \frac{-8}{4} = -2$

Perpendicular gradient = $\frac{1}{2}$

$y = \frac{1}{2}x + C$ Sub in C(2, 4)

$4 = \frac{1}{2} \times 2 + C$

$4 = 1 + C \rightarrow C = 3$

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

(Total 5 marks)

Very Likely – Speed & compound measures

Q1.

A car journey is in two stages.

$\rightarrow S = \frac{D}{T} = \frac{110}{1} = 55$ mph

Stage 1 The car travels 110 miles in 2 hours.

Stage 2 The car travels 44 miles at the same average speed as Stage 1

Work out the time for Stage 2

Give your answer in minutes.

Stage 2: $T = \frac{D}{S} = \frac{44}{55} = 0.8$ hours

$0.8 \times 60 = 48$ minutes

Answer 48 minutes

(Total 3 marks)

Q2.

An exhibition

was open for 240 hours

and

had 29 760 visitors.

For $\frac{2}{5}$ of the time the exhibition was open, there were 172 visitors per hour.

For the remaining time, how many visitors per hour were there?

$\frac{2}{5}$ of 240 (÷5 then ×2)

$= 96$ hours → 172 visitors per hour

$96 \times 172 = 16512$ visitors.

$29760 - 16512 = 13248$ visitors left.

$240 - 96 = 144$ hours

$13248 \div 144 = 92$

Answer 92

(Total 4 marks)

Q3.

Priya and Joe travel the same 16.8 km route.

Priya starts at 9.00 am and walks at a constant speed of 6 km/h

Joe starts at 9.30 am and runs at a constant speed.

Joe overtakes Priya at 10.20 am

At what time does Joe finish the route?

(This is one method that doesn't require $S = \frac{D}{T}$)

At 10:20 Priya has been walking for 1 hour 20 mins

6km + 2km = 8km

Priya walks 8km.

Joe does 8km in 50 mins

16.8 ÷ 8 = 2.1 ×2.1↓ 16.8km ↓×2.1 105 mins = 1hr 45 mins

9:30 + 1hr 45 mins = 11:15 am

Answer 11:15 am

(Total 5 marks)

Very Likely – Functions

Q1.

f(x) = 8x − 5

Work out the value of f(−2)

Plug it in to your calc

f(−2) = 8×(−2) −5

= −21

Answer −21

(Total 1 mark)

Q2.

$f(x) = \frac{1}{2}x$ $\quad g(x) = x - x^2$

Solve $f^{-1}(x) = gf(x)$

$y = \frac{1}{2}x$ (x2) $\Rightarrow 2y = x$ (x2) so $f^{-1}(x) = 2x$

sub f into g

$gf(x) = \left(\frac{1}{2}x\right) - \left(\frac{1}{2}x\right)^2$ $\quad \left[\left(\frac{1}{2}x\right)^2 = \frac{1}{2}x \times \frac{1}{2}x = \frac{1}{4}x\right]$

$= \frac{1}{2}x - \frac{1}{4}x^2$

$f^{-1}(x) = gf(x)$ becomes $2x = \frac{1}{2}x - \frac{1}{4}x^2$ (x4) $\Rightarrow 8x = 2x - x^2$ (x4)

Rearrange $\Rightarrow x^2 + 6x = 0$

Factorise $x(x+6) = 0$

$x = 0 \quad x = -6$

Answer $x = 0 \quad x = -6$

(Total 4 marks)

Q3.

$f(x) = 2x - 3$ and $g(x) = x^2$

Show that $f^{-1}(55) = fg(4)$

$f^{-1}(x) = \frac{x+3}{2}$ (opposite of x2 -3 is +3 ÷2)

$f^{-1}(55) = 29$

$g(4) = 16$

$fg(4) = f(16) = 29$

$\therefore f^{-1}(55) = fg(4) = 29$

(Total 4 marks)

Q4.

$f(x) = \dfrac{2x+3}{x-4}$

→ Same topic as rearranging harder formulae.

Work out $f^{-1}(x)$

$y = \dfrac{2x+3}{x-4}$

$y(x-4) = 2x+3$

$xy - 4y = 2x+3$

$-2x$ | $xy - 4y - 2x = 3$ | $-2x$

$+4y$ | $xy - 2x = 3 + 4y$

$x(y-2) = 3+4y$ → $x = \dfrac{3+4y}{y-2}$

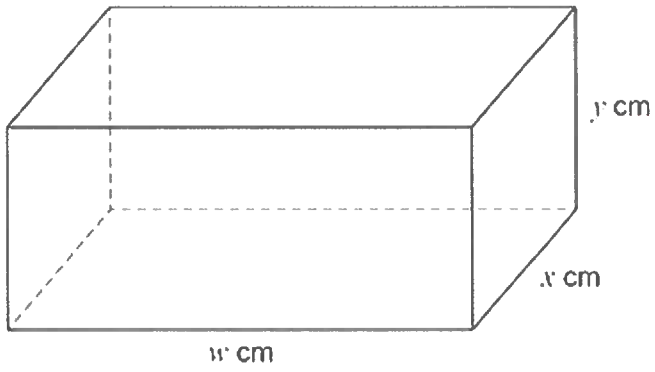
Answer $f^{-1}(x) = \dfrac{3+4x}{x-2}$ **(Total 4 marks)**

Very Likely – Volume of 3D shapes

Q1.

Here is a cuboid.

w, x and y are **different** whole numbers.



The total length of **all** the edges of the cuboid is 80 cm

The volume is **greater** than 200 cm^3

Work out one possible set of values for w, x and y.

$4w + 4x + 4y = 80$

$\div 4$ | $w + x + y = 20$ | $\div 4$

So $w+x+y=20$

w, x, y different

$w \times x \times y > 200$

Must satisfy all 3

$w =$ 10 $x =$ 6 $y =$ 4

1 possible solution → or 5, 7, 8 etc...

(Total 2 marks)

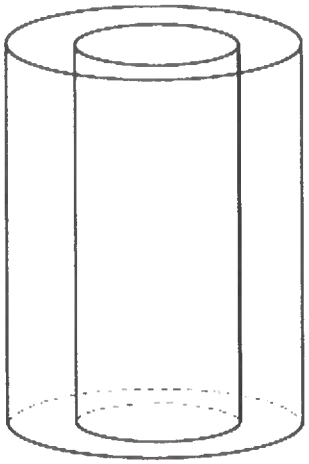
Q2.

The diagram shows a hollow cylinder made from thick glass.

The radius of the **outer** cylinder is 10 cm.

The height of the cylinder is 25 cm.

The radius of the **inner** cylinder is 4 cm.



1 of these at each end

$2 \times (\pi \times 10^2 - \pi \times 4^2)$

$= 527.78756$

Inner surface area:

$25 \times \pi \times 8 = 628.31853$

Outer surface area

$25 \times \pi \times 20 = 1570.7963$

Work out the **total** surface area of the glass.

Total = 2726.9

Answer 2726.9 cm^2

(Total 5 marks)

Q3.

Volume of a sphere = $\frac{4}{3}\pi r^3$ where r is the radius.

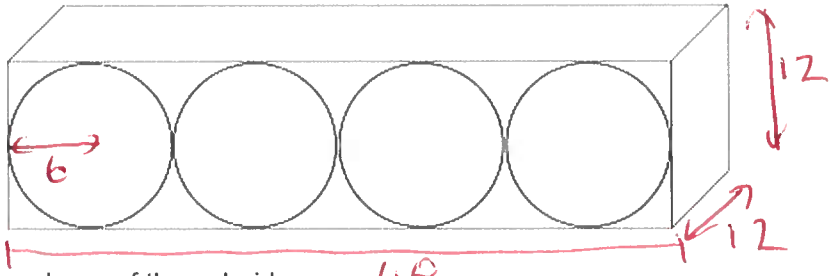
(a) Work out the volume of a sphere of radius 6 cm.

$\frac{4}{3} \times \pi \times 6^3 = 904.7786\ldots$

Answer 904.8 cm³

(2)

(b) Four spheres of radius 6 cm are packed tightly into a cuboid as shown.



Work out the volume of the cuboid.

$48 \times 12 \times 12$

$= 6912$

Answer 6912 cm³

(4)

(Total 6 marks)

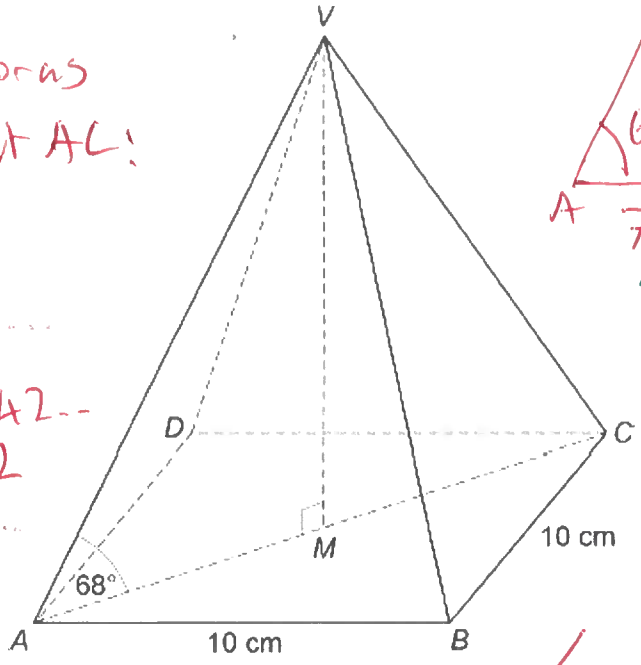
Q4.

VABCD is a square-based pyramid.

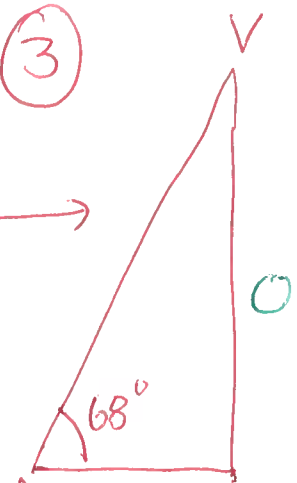
The horizontal base *ABCD* has side length 10 cm and centre *M*.

Angle *VMA* is 90°

Angle *VAM* is 68°



(3) Extract triangle AMV →



(1) Use Pythagoras to work out AC:

$\sqrt{10^2+10^2}$

$= 14.142...$

(2) $AM = 14.142... \div 2$

$= 7.0716...$

(4) Use Trigonometry to work out perpendicular height

Volume of pyramid = $\frac{1}{3}$ × area of base × perpendicular height

Work out the volume of the pyramid.

$VM = \tan(68) \times 7.071...$

$= 17.5015$

$Vol = \frac{1}{3} \times 10^2 \times 17.5015...$

$= 583.38...$

Answer 583.4 cm³

(Total 6 marks)

Very Likely – Percentage change

Q1.

Work out 320 as a percentage of 80

Circle your answer.

$\frac{320}{80} = 4 \times 100 = 400\%$

25% 75% 300% 400%

(Total 1 mark)

Q2.

Carly's total annual pay = salary + bonus

	Salary	Bonus
Last year	£26 000	£4000
This year	6% increase	9% decrease

→ 30 000 Total

→ 31 200

Work out the percentage change in her total annual pay.

State whether it is an increase or a decrease.

$26000 \times 1.06 + 4000 \times 0.91$

$= 31\,200$

Increase of 1200

$\%$ increase $= \frac{1200}{30\,000} \times 100 = 4\%$

increase

Answer _____

(Total 4 marks)

Q3.

w is a positive number.

x is 10% more than w.

y is 10% less than x.

Let $w = 10$
$x = 11$
$y = 9.9$

10% of 11 = 1.1

Which statement is true?

Tick **one** box.

$w < x$ and $w < y$	☐	No
$w < x$ and $w = y$	☐	No
$x > y$ and $w > y$	☑	Yes.
$x > y$ and $w = y$	☐	No

[You could pick any value for w]

(Total 1 mark)

Q4.

Paul is competing in a pole vault competition.

His first vault is 4.5 m

His best vault is 12% higher than this. → $4.5 \times 1.12 = 5.04$ m

However, his best vault is 10% lower than the winning vault.

Work out the height of the winning vault.

This is just one possible method.

5.04 → 90%
0.56 10% ÷9
5.6 m 100% x10

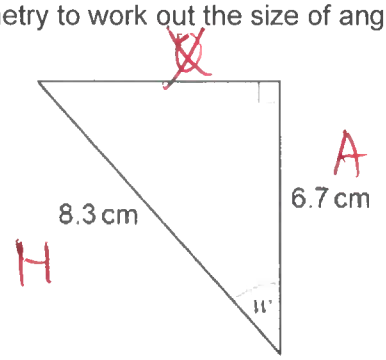
Answer 5.6 m

(Total 4 marks)

Very Likely – Trigonometry (SOHCAHTOA)

Q1.

Use trigonometry to work out the size of angle w.



Not drawn accurately

$\cos w = \frac{6.7}{8.3}$

$w = \cos^{-1}\left(\frac{6.7}{8.3}\right) =$

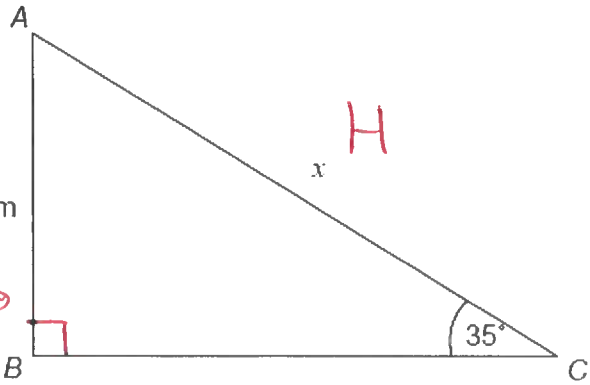
$w =$ 36.2 °

(Total 3 marks)

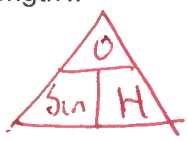
Q2.

Nigel is using trigonometry to work out the size of length x

He assumes that angle ABC is a right angle.



(a) Using Nigel's assumption, work out the length x



$x = \frac{4}{\sin 35}$

$=$

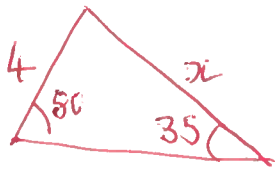
Answer 6.97 cm

(2)

(b) In fact, angle ABC is 80°

How inaccurate does this make the answer to part **(a)**?

You **must** show your working.



Use Sine rule

$\frac{4}{\sin 35} = \frac{x}{\sin 80}$ | $\times \sin 80$

$\times \sin 80$ | $4 \sin 80 = x$

$\frac{4 \sin 80}{\sin 35}$ | $= 6.867$

About 0.1 cm

inaccurate! - Not much

(3)

(Total 5 marks)

Q3.

VABCD is a pyramid with a horizontal square base.

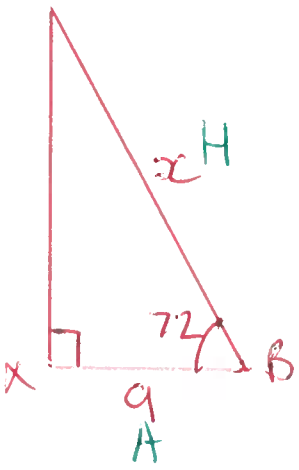
X is the centre of the base.

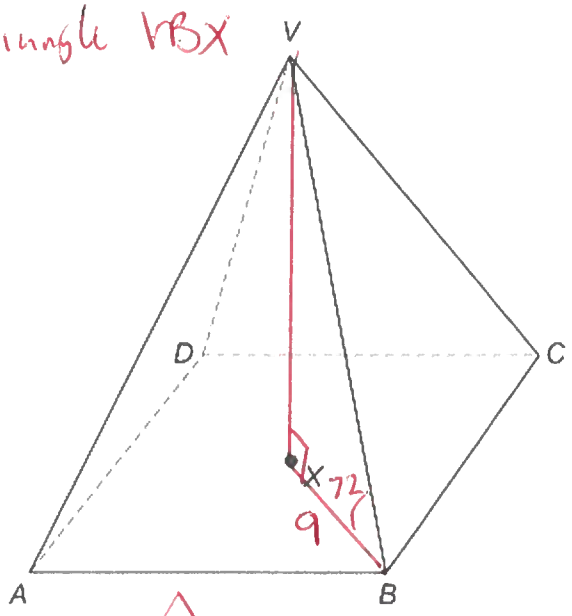
V is vertically above *X*.

BD = 18 cm

Angle *VBX* = 72°

V Extract triangle VBX





Work out the length of *VB*.

$x = \frac{9}{\cos 72} = 29.1$

Answer 29.1 cm

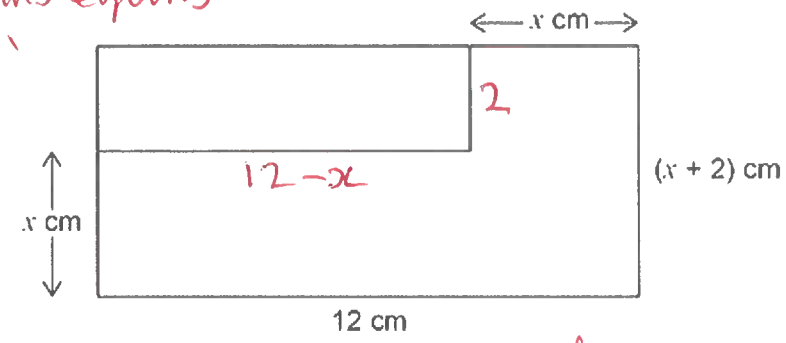
(Total 3 marks)

Likely – Forming and solving equations

Q1.

Here are two rectangles.

means equals '='



The area of the shaded rectangle is $\frac{1}{4}$ the area of the large rectangle.

Work out the value of x.

The area of the shaded rectangle $= \frac{1}{4} \times$ area of large rectangle

$2(12 - x) = \frac{1}{4} \times (12(x + 2))$

$24 - 2x = \frac{1}{4} \times (12x + 24)$

$24 - 2x = 3x + 6$ | $+2x$ then -6

$+2x$ then -6 | $18 = 5x$

Answer $x = \frac{18}{5} = 3.6$ cm

(Total 4 marks)

Q2.

Here is the rule for a sequence.

After the first two terms, each term is the sum of the previous two terms

The 1st term is 33

The 2nd term is x

The 4th term is 73

Work out the value of x.

33 x $33 + x$ 73

This is also the sum of the previous 2 terms

$x + 33 + x = 73$

$2x + 33 = 73$

$2x = 40$

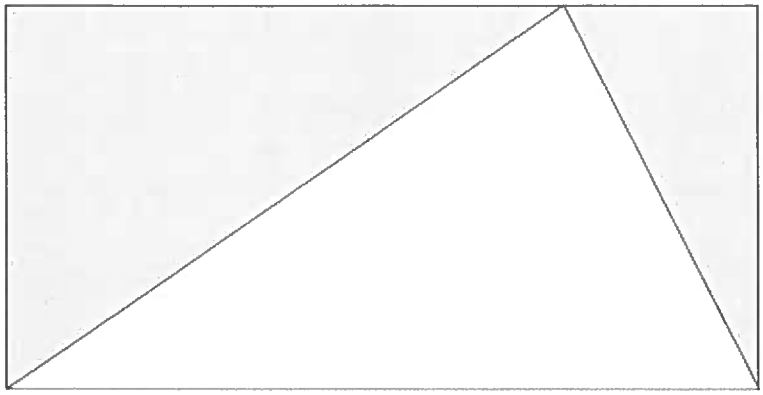
$x = 20$

$x =$ 20

(Total 3 marks)

Q3.

The diagram shows a rectangle split into three triangles.



Not drawn accurately

The **total** shaded area is 8.5 cm²

Work out the value of x

Give your answer to 1 decimal place.

→ Rectangle area − Triangle area

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

$= \frac{3x(2x+3)}{2}$ The shaded area is the same as the triangle!!

Now solve

$8.5 = \frac{3x(2x+3)}{2}$ ×2

$17 = 3x(2x+3)$

$17 = 6x^2 + 9x$ −17

$0 = 6x^2 + 9x - 17$

Must be = 0 to solve quadratic

$a=6 \quad b=9 \quad c=-17$

Implies that you should use the quadratic formula given on the formula sheet.

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

$= \frac{-9 \pm \sqrt{9^2-4\times6\times(-17)}}{2\times6}$ $= 1.09...$

$= 1.1$

(Ignore negative solution)

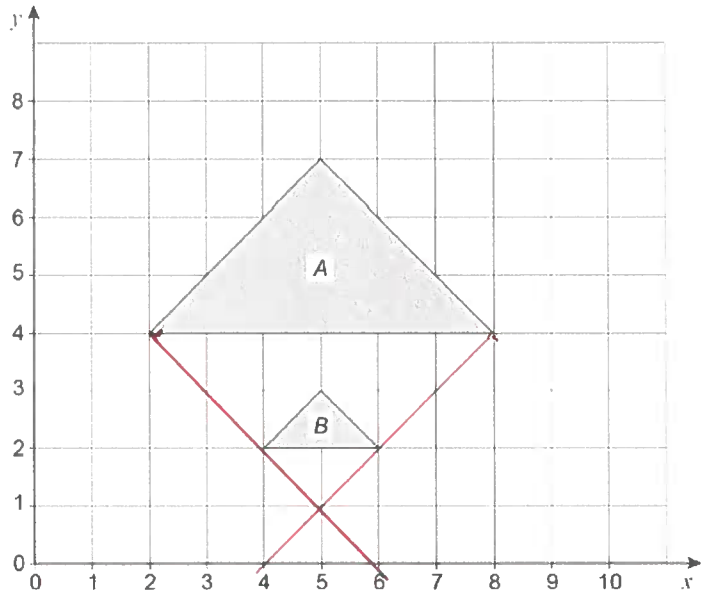
Answer _____

(Total 5 marks)

Likely – Transformations

Q1.

Describe fully the **single** transformation that maps triangle *A* to triangle *B*.

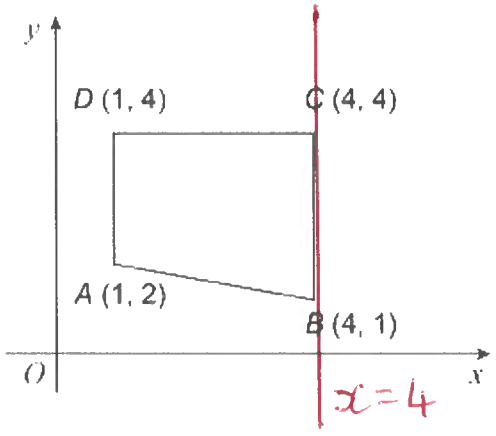


Enlargement, scale factor $\frac{1}{3}$, centre (5, 1)

(Total 3 marks)

Q2.

ABCD is a quadrilateral.



Not drawn accurately

The quadrilateral is reflected in the line $x = 4$

Which vertices are invariant? → Don't move.

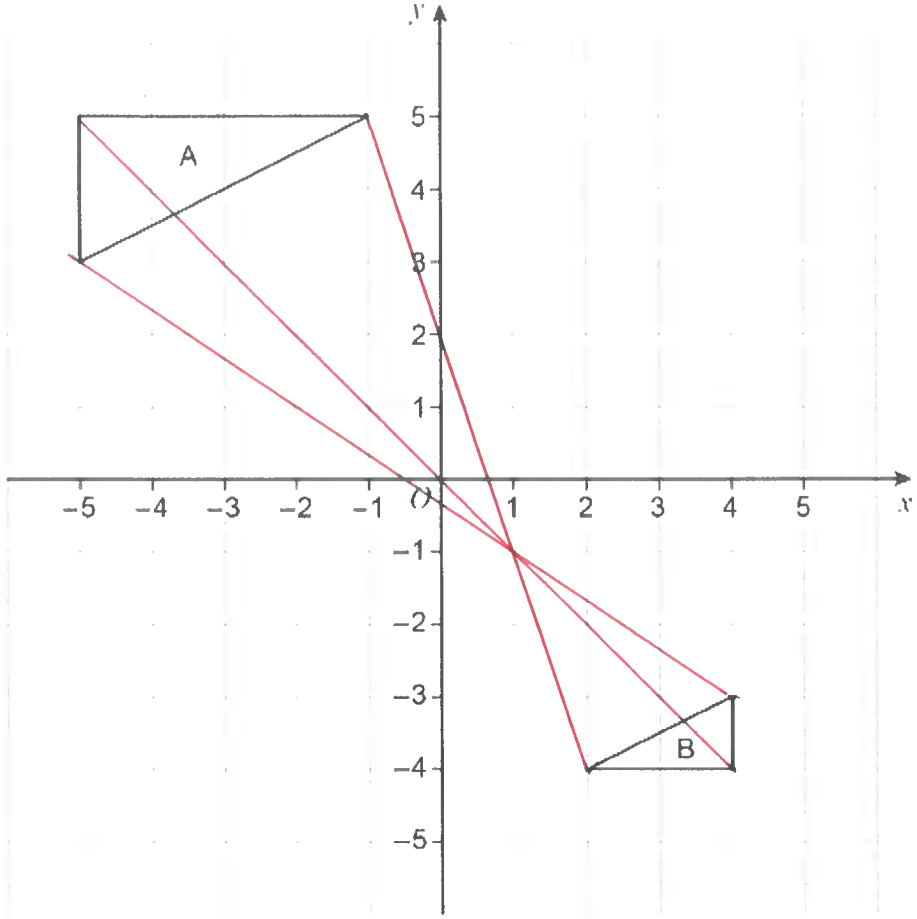
Circle your answer.

A and *D* | *C* and *D* | *B* and *C* | *B* and *D*

(Total 1 mark)

Q3.

Shape A and shape B are shown on the grid.



Describe the **single** transformation that maps shape A to shape B.

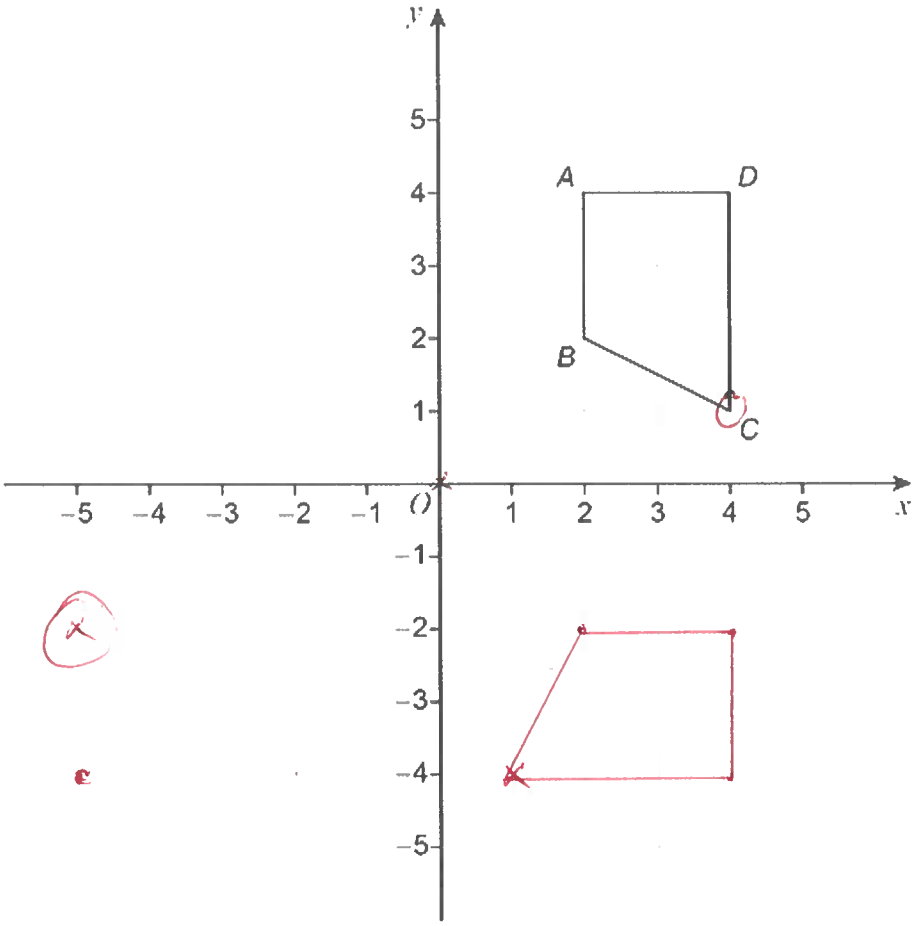
Enlargement, scale factor $-\frac{1}{2}$

centre (1, −1)

(Total 3 marks)

Q4.

Quadrilateral *ABCD* is shown.



Work out the coordinates of *C* when *ABCD* is

rotated 90° clockwise about *O*

then

translated by $\begin{pmatrix} -6 \\ 2 \end{pmatrix}$

Answer (-5 , -2)

(Total 2 marks)

Likely – Bounds

Q1.

The dimensions of a rectangular floor are to the nearest 0.1 metres.

Not drawn accurately

Bounds

A force of 345 Newtons is applied to the floor.

The force is to the nearest 5 Newtons.

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

Work out the upper bound of the pressure.

Give your answer to 4 significant figures.

You **must** show your working.

force ÷ Area

upper bound for force

Lower bound for area

UB for force = 347.5

LB for area = 2.55 × 6.35

UPPER BOUND for Pressure = $\frac{347.5}{2.55 \times 6.35}$

= 21.4605...

Answer 21.46 N/m²

(Total 5 marks)

Q2.

A lorry is able to carry a maximum of 15 000 kg to 2 significant figures.

Mike loads the lorry with a container weighing 2800 kg to 2 significant figures.

He says,

"The lorry could be carrying more than 20% of its maximum load."

UB = 15 500 kg
LB = 14 500 kg
UB = 2850 kg
LB = 2750 kg.

Is he correct?

Yes ☐ No ☑

You **must** show your working.

Max % load = $\frac{2850 \text{ UB}}{14500 \text{ LB}}$ $\times 100$ = 19.7 %

Min % load = $\frac{2750 \text{ LB}}{15500 \text{ UB}}$ $\times 100$ = 17.7 %

It carries a maximum of 19.7 %

(Total 4 marks)

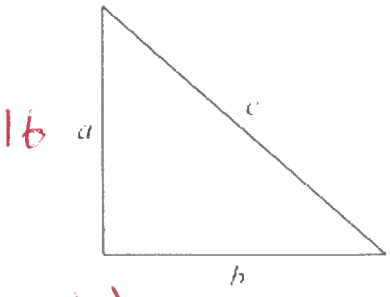
Likely – Pythagoras

Q1.

In this right-angled triangle,

a = 16 cm

$a : c = 4 : 5$



Work out the area of the triangle.

b = 3 parts. (3, 4, 5 Pythagorean triple)

~~3 : 4 : 5~~

a : b : c

4 : 3 : 5

×4 ×4 ×4

16 12 : 20

Area = $\frac{12 \times 16}{2}$

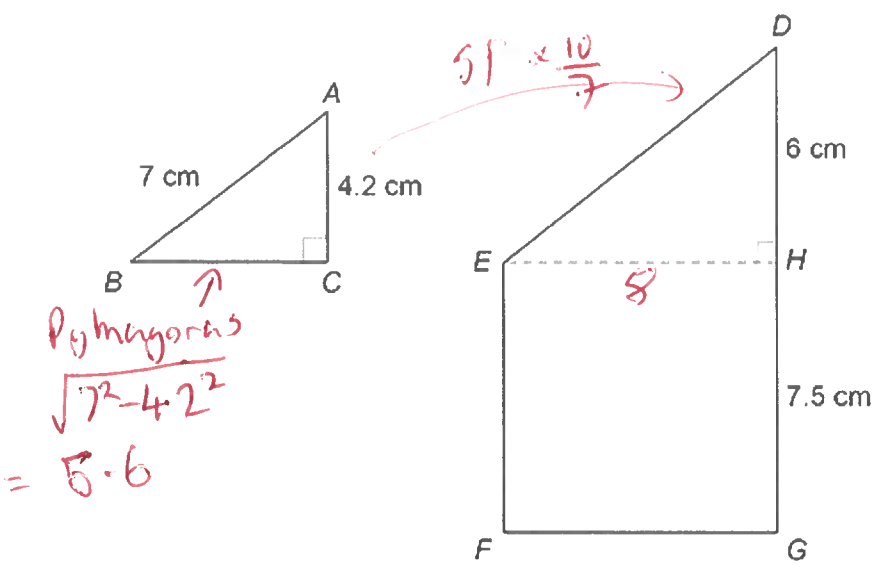
= 96

Answer 96 cm²

(Total 4 marks)

Q2.

Trapezium *DEFG* is formed by joining
triangle *DEH*
to
rectangle *EFGH*.



Not drawn accurately

ABC is similar to *DEH*.

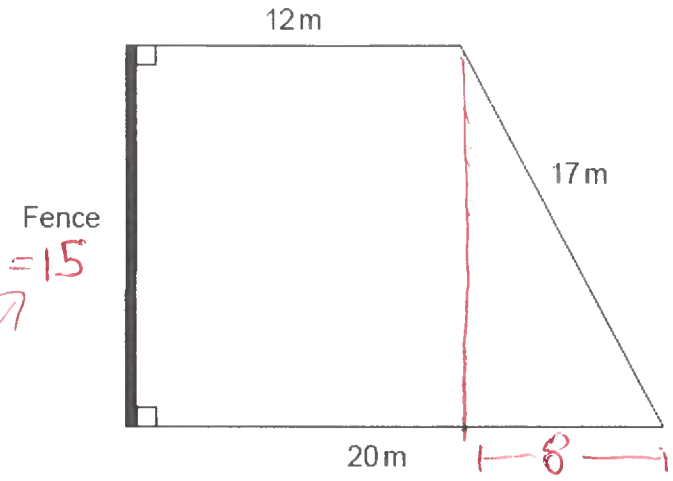
Work out the area of *DEFG*.

Answer 84 cm²

(Total 5 marks)

Q3.

The diagram shows a lawn with a fence along one edge.



Not drawn accurately

One can of weedkiller covers 90 square metres.
Each can costs £19.25

Work out the total cost of the cans of weedkiller needed to cover the lawn.

Need to know length of fence → Pythagorean.

$\sqrt{17^2 - 8^2} = 15$

Area of Trapezium = $\frac{(20+12) \times 15}{2}$

$= 240$

$240 \div 90 = 2.6$

So 3 cans needed

$3 \times 19.25 = 57.75$

Answer £ 57.75

(Total 5 marks)

Likely – Expected number of outcomes

Q1.

On a biased dice,

P(lands on 6) = 0.38

This dice is rolled 150 times.

How many times would you expect the dice **not** to land on 6 ?

P(not 6) = 0·62

0·62 x 150 = 93

Answer 93

(Total 3 marks)

Q2.

A bag contains discs.

Trial
A disc is chosen at random from the bag.
The colour of the disc is noted.
The disc is put back into the bag.

The trial is carried out 100 times.

The table shows the relative frequency of a blue disc after every 25 trials.

Total number of trials	25	50	75	100
Relative frequency of a blue disc	0.4	0.36	0.4	0.32

(a) For the trials from the 26th to the 50th, how many times was a blue disc chosen?

25 x 0·4 = 10 50 x 0·36 = 18

18 − 10 = 8

Answer 8

(2)

(b) There is a total of 1000 discs in the bag.

Work out the **best** estimate of the number of blue discs in the bag.

Use 100 trials.

0·32 × 1000 =

Answer 320

(1)

(Total 3 marks)

Q3.

Here are the results after 250 spins of a coin.

Heads	128
Tails	122

The coin is spun an extra 50 times.

After all 300 spins, the relative frequency of Heads is 0.49 0·49 × 300 = 147

For the **extra 50 spins**, work out number of Heads : number of Tails

147 − 128 = 19 heads out of 50

Heads : Tails

19 : 31

Answer 19 : 31

(Total 3 marks)

Likely – Substitution

Q1.

$\frac{a}{b} = 3c$

$\frac{b}{c} = 2$

Work out the value of a when $c = 8$

$\frac{b}{8} = 2$ ×8 ×8

$b = 16$

$\frac{a}{16} = 3 \times 8$

$\frac{a}{16} = 24$ ×16

$a = 384$ ×16

$a = 384$

Answer 384

(Total 3 marks)

Q2.

This formula works out the tax you pay on what you earn.

$$T = 0.2(E - 12570)$$

T is the tax you pay in pounds.

E is the amount you earn in pounds. = 24000

(a) How much tax do you pay if you earn £24 000?

$T = 0.2 \times (24000 - 12570)$

$= 2286$

Answer £ 2286

(2)

(b) What is the most you can earn without paying tax?

$T = 0$ $0 = 0.2(E - 12570)$

Answer £ 12570

(1)

(c) Alison pays £6300 tax.

Work out the amount she earns.

÷0.2 | 6300 = 0.2(E − 12570) | ÷0.2

+12570 | 31500 = E − 12570 | +12570

44070 = E

Answer £ 44070

(3)

(Total 6 marks)

Q3.

p is a positive number.

n is a negative number.

For each statement, tick the correct box.

	Always true	Sometimes true	Never true	
$p + n$ is positive	☐	✓	☐	5+3=8 5+-6=-1
$p - n$ is positive	✓	☐	☐	5--2=7
$p^2 + n^2$ is positive	✓	☐	☐	$5^2+(-2)^2=29$
$p^3 \div n^3$ is positive	☐	☐	✓	

positive^3 = positive

~~positive~~

negative^3 = negative

+ ÷ − = −

When you square a number it will always be ~~positive~~ positive.

(Total 4 marks)

Likely – Compound Interest and Reverse percentage

Q1.

A bus route had 90 000 passengers last year.
The number of passengers was predicted to increase

by 3% this year
and then
by 8% next year.

Is the predicted number of passengers for **next** year more than 100 000 ? Yes
You **must** show your working.

$90\,000 \times 1.03 \times 1.08 = 100\,116$

(Total 3 marks)

Q2.

On the same day, Kate buys

a car for £14 000
and
a painting for £5000

The value of the car decreases by 35% in the first year, and then by 10% each year.
The value of the painting increases by 4% each year.

Show that the painting becomes worth more than the car during the fifth year.

Year 4 : Car $14000 \times 0.65 \times 0.9^3 = 6633.90$
Painting $5000 \times 1.04^4 = 5849.29$
Year 5 : Car $14000 \times 0.65 \times 0.9^4 = 5970.51$
Painting $5000 \times 1.04^5 = 6083.26$

Painting became worth more after end of year 4 and before end of year 5

(Total 5 marks)

Q3.

£2448 is invested in an account at a rate of compound interest.

One year after the investment there is £2496.96 in the account.

How much is in the account four years after the investment?

$2496.96 \div 2448 = 1.02$

$2448 \times 1.02^4 = 2649.79$

Answer £ 2649.79

(Total 3 marks)

Q4.

The price of a toy increases by 12.5% to £19.53

Work out the **original** price of the toy.

112.5% → 19.53

÷112.5 ×100

1% → 0.1736

100% → 17.36

÷112.5 ×100

Answer £ 17.36

(Total 2 marks)

Likely – Grouped data and Histograms

Q1.

The times that 60 customers waited at a supermarket checkout are shown.

Time, t (minutes)	Frequency
$0 \leq t < 2$	18
$2 \leq t < 4$	10
$4 \leq t < 6$	16
$6 \leq t < 8$	12
$8 \leq t < 10$	4

$\frac{60+1}{2} = 30.5$

30^{th} / 31^{st}

(a) Write down the class interval that contains the median.

Answer $4 \leq t < 6$

(1)

(b) The manager of the supermarket says,

"Over 90% of our customers wait less than eight minutes."

Does the data support this statement?

Yes ☑ No ☐

You **must** show your working.

$18 + 16 + 10 + 12 = 56$

$\frac{56}{60} \times 100 = 93.3\%$

(2)

(Total 3 marks)

Q2.

Liam takes part in long jump competitions.

Here is some information about 40 of his jumps.

Length of jump, d metres	Number of jumps	Midpoint	
$7.0 \leqslant d < 7.4$	15	× 7.2 =	108
$7.4 \leqslant d < 7.8$	18	× 7.6 =	136.8
$7.8 \leqslant d < 8.2$	7	8	56
	Total = 40		300.8

Work out an estimate of the mean distance of these 40 jumps.

Give your answer as a decimal.

300.8 ÷ 40

= 7.52

Answer 7.52 m

(Total 3 marks)

Q3.

Here is some information about the members of a basketball club.

	Number of members	Mean height of members	Total height
Junior	30	× 1.6 m =	48 m
Senior	20	× 2.05 m =	41 m + = 89

Work out the mean height of all 50 members of the club.

Give your answer as a decimal.

89 ÷ 50 = 1.78

Answer 1.78 m

(Total 3 marks)

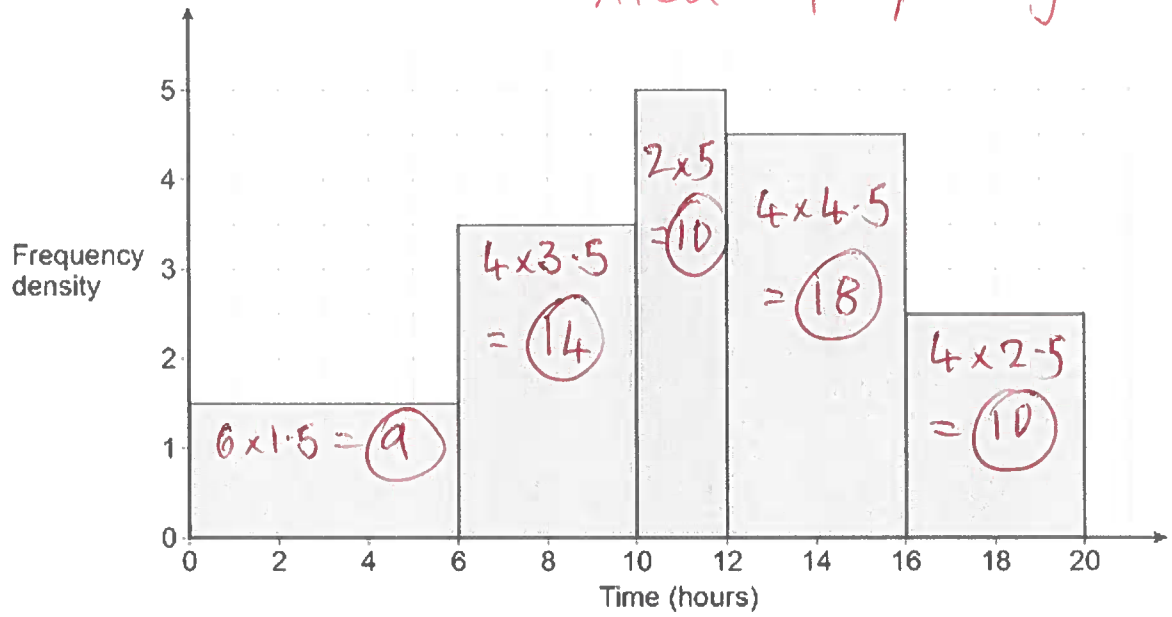
You also need to revise how to draw histograms

Q4.

61 students recorded how many hours they spent revising for a test.

The histogram represents the results.

Area = frequency.



(a) Work out an estimate of the mean time the 61 students spent revising.

You may use the table to help you.

Time, x (hours)	Frequency	Midpoint	F x mp
$0 \leqslant x < 6$	9	3	27
$6 \leqslant x < 10$	14	8	112
$10 \leqslant x < 12$	10	11	110
$12 \leqslant x < 16$	18	14	252
$16 \leqslant x < 20$	10	18	180
	61		681

681 ÷ 61 =

Answer 11·16 hours

(4)

(b) Give a reason why the answer to part (a) is an estimate.

We do not know the exact values for each student as the data is grouped.

(1)

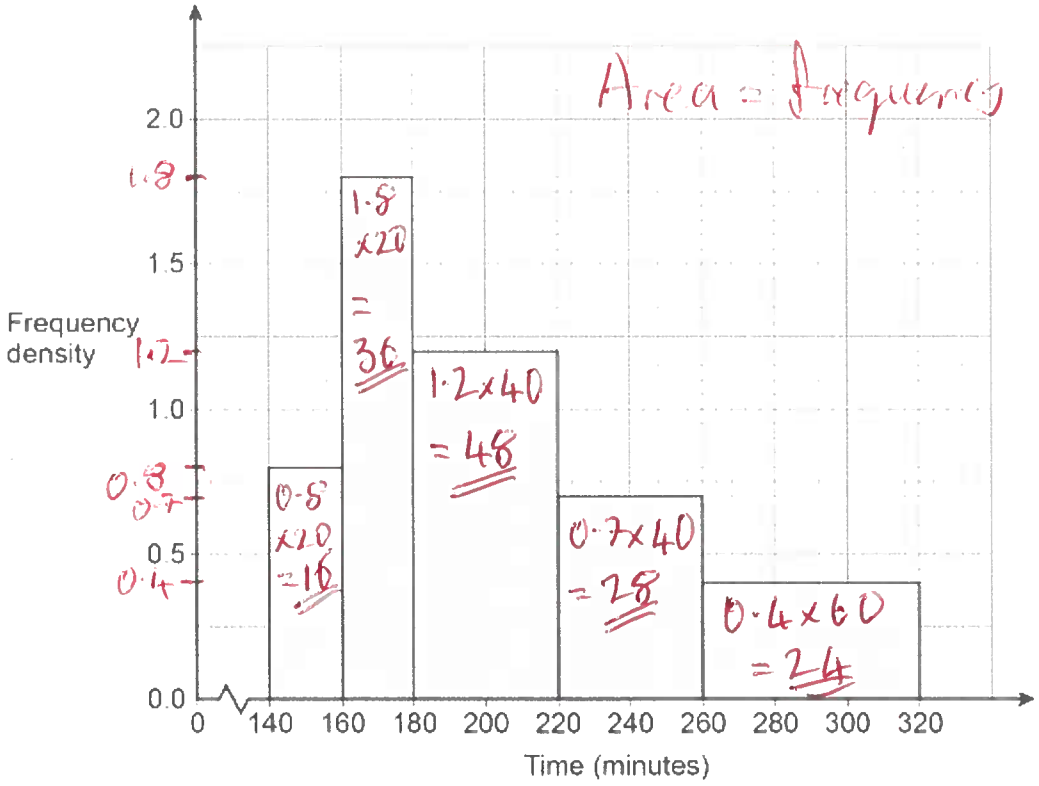
(Total 5 marks)

Q5.

180 runners **started** a marathon.

Some of the runners did not complete it.

(a) The histogram represents the times of the runners who did complete the marathon.



How many runners did **not** complete the marathon?

16 + 36 + 48 + 28 + 24 = 152

180 − 152 = 28

Answer 28

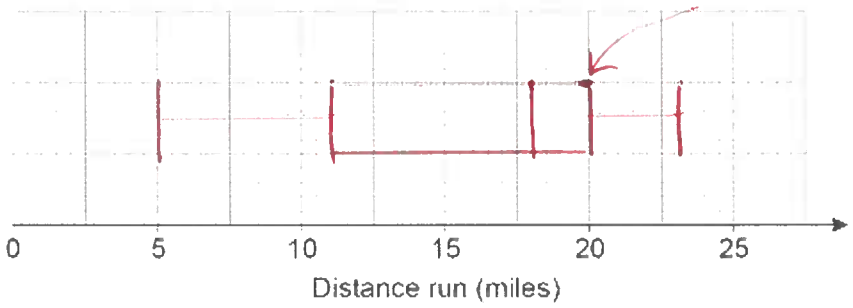
(3)

(b) The table shows information about the runners who did **not** complete the marathon.

	Distance run (miles)
Least distance	5
Greatest distance	23
Lower quartile	11
Median	18
Interquartile range	9

→ UQ − LQ = 9
UQ − 11 = 9
UQ = 20

Draw a box plot to represent the information.



(3)
(Total 6 marks)

Likely – Venn diagrams

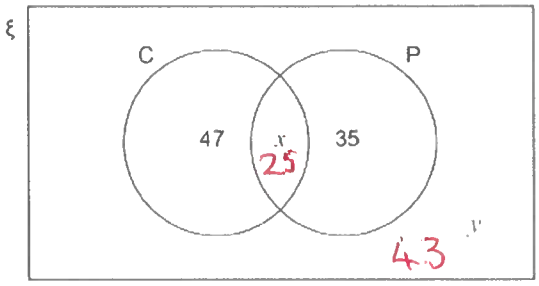
Q1.

The Venn diagram shows some information about 150 students.

ξ = 150 students

C = students who study Chemistry

P = students who study Physics



35 + x

The probability that a Physics student, chosen at random, also studies Chemistry is $\frac{5}{12}$

$\frac{x}{35+x} = \frac{5}{12}$

One of the 150 students is chosen at random.

Work out the probability that the student does **not** study either Chemistry or Physics.

$\frac{43}{150}$

$\frac{x}{35+x} = \frac{5}{12}$

$12x = 5(35+x)$
$12x = 175 + 5x$
$7x = 175$
$x = 25$

Total = 150

Answer _____

(Total 4 marks)

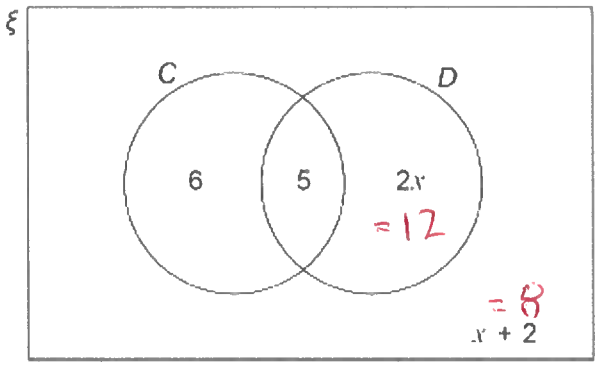
Q2.

In the Venn diagram

ξ represents 31 students in a class

C is students who have a cat

D is students who have a dog



(a) One student from the class is picked at random.

Work out the probability that the student has a dog.

$6 + 5 + 2x + x + 2 = 31$

$13 + 3x = 31$

$3x = 18 \quad x = 6$

Answer $\frac{17}{31}$

(3)

(b) One of the students who has a cat is picked at random. out of 11 students

Work out the probability that this student has a dog.

Answer $\frac{5}{11}$

(1)

(Total 4 marks)

Likely – Application of ratio

Q1.

A is half of B.

Work out the ratio $A : B$

Circle your answer.

1 : 2 (circled) 2 : 1 1 : 3 3 : 1

(Total 1 mark)

Q2.

The ratio of $x : y$ is 3 : 4

What fraction of y is x?

$\frac{x}{y} = \frac{3}{4}$

↑ y is denominator

Answer $\frac{3}{4}$

(Total 1 mark)

Q3.

The ratio of the number of adult to junior members at a gym is 7 : 6

Fourteen more juniors join the gym.

The ratio of the number of adults to juniors at the gym is now 7 : 8

Work out the total number of people at the gym.

Algebra method: A : J

$7x : 6x$

$7x : 6x + 14 = 7 : 8$

Form equation $\frac{7x}{7} = \frac{6x+14}{8}$

↓

Answer _____

(Total 3 marks)

$\times 8$ | $x = \frac{6x+14}{8}$ | $\times 8$

$-6x$ | $8x = 6x + 14$ | $-6x$

$\div 2$ | $2x = 14$ | $\div 2$

$x = 7$

So Originally $7x : 6x = 49 : 42$

$+14$ more $= 49 + 42 + 14$

$= 105$

Q4.

a is three quarters of c

$6b = 5c$

I chose 8 as this easy to find $\frac{3}{4}$ of 8

Work out the ratio $a : b : c$

Give your answer in its simplest form, where a, b and c are integers.

Let $c = 8$

a is $\frac{3}{4}$ of $8 \rightarrow a = 6$

$6b = 5 \times 8$

$6b = 40$

$b = \frac{40}{6}$

$a : b : c$

$6 : \frac{40}{6} : 8$ (×6 ×6)

$36 : 40 : 48$

$(\div 4)$ $9 : 10 : 12$

Answer 9 : 10 : 12

(Total 3 marks)

Likely – Solve quadratic equations

Q1.

(a) Factorise fully $10a^2 + 25a$

Answer $5a(2a + 5)$

(2)

(b) Solve $x^2 + 2x - 15 = 0$

$(x + 5)(x - 3) = 0$

$x = -5$ or 3

(3)

(Total 5 marks)

Q2.

Solve $x^2 + 7x - 11 = 0$

Give your solutions as decimals.

Don't bother trying to factorise.

$a=1 \quad b=7 \quad c=-11$

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-7 \pm \sqrt{49-4\times1\times(-11)}}{2}$

$= 1.32$ or -8.32

Answer _____

(Total 2 marks)

Q3.

Using the quadratic formula, or otherwise, solve $3x^2 + x - 5 = 0$

$a=3 \quad b=1 \quad c=-5$

$x = \frac{-1 \pm \sqrt{1^2-4\times3\times(-5)}}{6}$ $= 1.14$ or -1.47

Answer _____

(Total 2 marks)

Q4.

Solve $2x(x + 10) = 5x - 18$

$2x^2+20x = 5x-18$

$-5x$ | $2x^2+15x = -18$ | $-5x$

$+18$ | $2x^2+15x+18 = 0$

↓

Could use quad formula or factorise

$x =$ $-6, -1.5$

Answer _____

(Total 4 marks)

Likely – Iterative processes

Q1.

A sphere has radius r cm

An approximate value of r can be found using the iterative formula

$$r_{n+1} = \sqrt{\frac{239}{r_n}}$$

The starting value is $r_1 = 7$

(a) Work out the values of r_2 and r_3

$r_2 = \sqrt{\frac{239}{r_1}} = \sqrt{\frac{239}{7}} = 5.8431\ldots$

$r_2 =$ 5.8431

$r_3 =$ 6.3955

(2)

(b) Continue the iteration to work out the radius to 1 decimal place.

Make sure you know how to effectively use your calculator for this!!

Answer 6.2 cm

(1)

(Total 3 marks)

Q2.

Use the iteration $x_{n+1} = \sqrt{\frac{2x_n + 4}{5}}$

to work out an approximate solution to $x = \sqrt{\frac{2x + 4}{5}}$

Start with $x_1 = 1$

Give your answer to 2 decimal places.

Press 1 =

then $\sqrt{\frac{2 \times ANS + 4}{5}}$ =

Then keep pressing =

Answer 1.12

(Total 3 marks)

Q3.

An approximate value of a root of an equation, x, can be found using the iterative formula

$$x_{n+1} = \sqrt[3]{5(x_n)^2 - 2x_n - 3}$$

The starting value is $x_1 = 4$

(a) Work out the values of x_2 and x_3

$x_2 = \sqrt[3]{5 \times 4^2 - 2 \times 4 - 3}$

$= 4.1016$ (4dp)

$x_2 =$ 4.1016

$x_3 =$ 4.1776

(2)

(b) By continuing the iteration, show that the value of x is more than 4.25

After several iterations... 4.385

So > 4.25

(1)

(Total 3 marks)

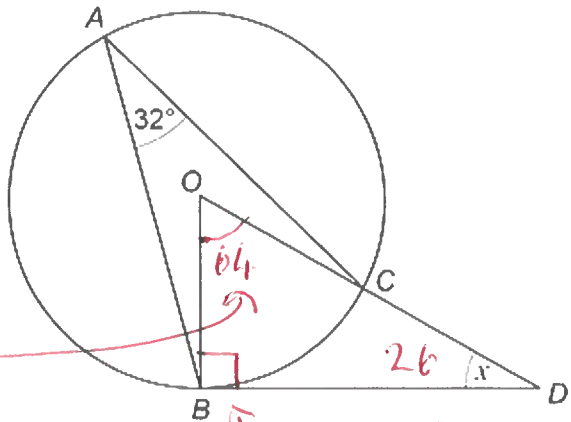
Likely – Circle Theorems

Q1.

A, B and C are points on a circle, centre O.

BD is a tangent to the circle.

OCD is a straight line.



Work out the size of angle x.

Angle at centre is double angle at circumference

Right angle.

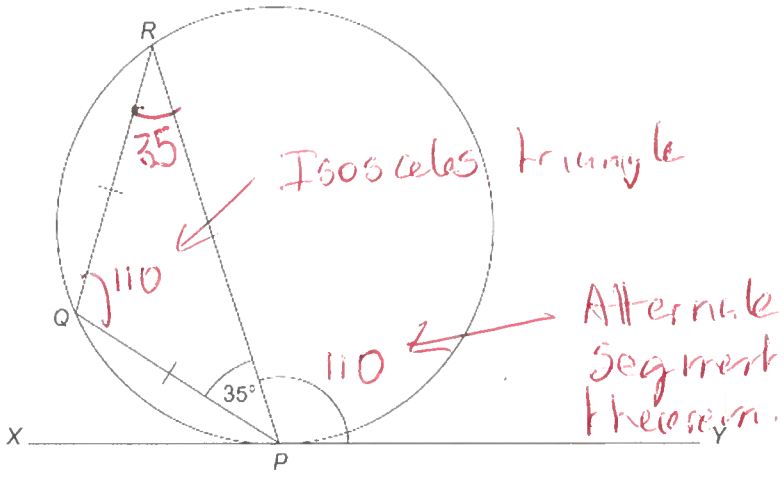
$x =$ 26 degrees

(Total 3 marks)

Q2.

P, *Q* and *R* are points on a circle.
Triangle *PQR* is isosceles.
XY is a tangent to the circle at *P*.

Work out the size of angle *RPY*.



Answer 110 degrees

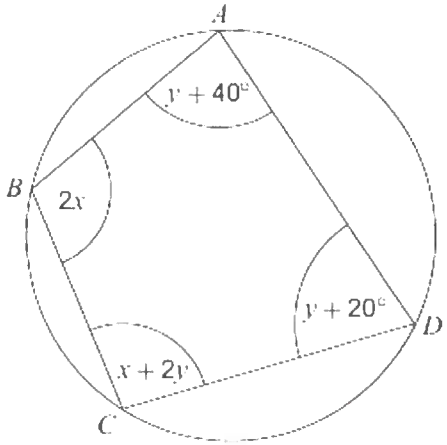
(Total 2 marks)

Q3.

ABCD is a cyclic quadrilateral.

Opposite angles add up to 180°

Work out the values of x and y.



$2x + y + 20 = 180$

$2x + y = 160$ ●

$x + 2y + y + 40 = 180$

$x + 3y = 140$ ● →

$2x + y = 160$

$x + 3y = 140$ ×2

$2x + y = 160$

$2x + 6y = 250$

$5y = 120$

$y = 24$

$2x + 24 = 160$

$2x = 136$

$x = 68$

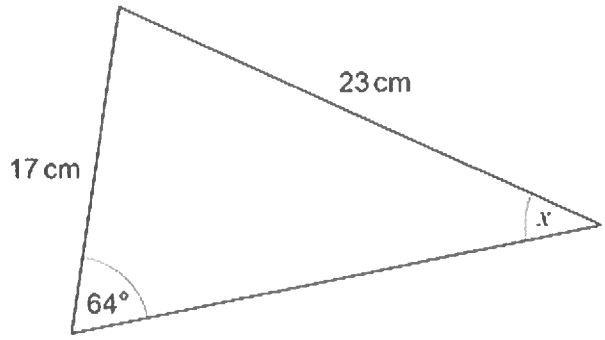
x = _____ , y = _____

(Total 5 marks)

Likely – Trigonometry (non-right angle)

Q1.

Use the sine rule to work out the size of angle x.



$\frac{\sin 64}{23} = \frac{\sin x}{17}$ ×17

$\frac{17 \times \sin 64}{23} = \sin x$

$0.664... = \sin x$

$x = \sin^{-1}(0.664...)$

$= 40.1$

x = 40.1 °

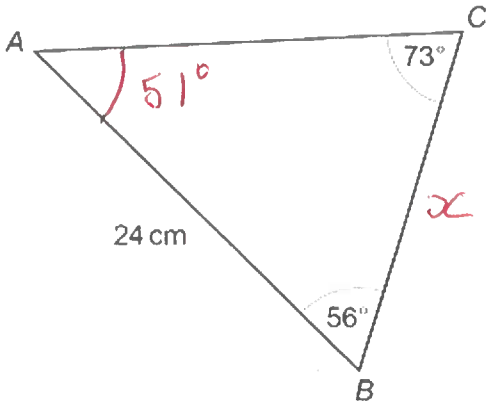
(Total 3 marks)

Q2.

Work out the area of triangle *ABC*.

$73+56=129$

$180-129=51°$



$\frac{x}{\sin 51} = \frac{24}{\sin 73}$

$x = \frac{24}{\sin 73} \times \sin 51 = 19.5$

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

$\text{or} = \frac{1}{2} \times 24 \times 19.5 \times \sin(56)$

$= 194.03$

Answer 194.03 cm²

(Total 4 marks)

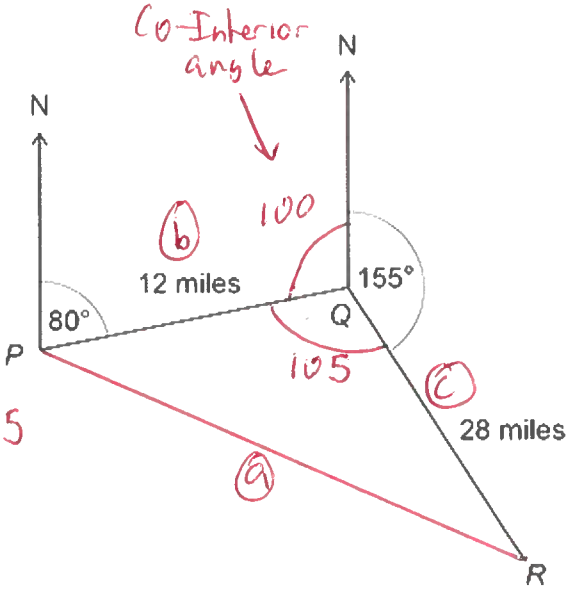
Q3.

A ship sails from *P* to *Q* and then from *Q* to *R*.

Q is 12 miles from *P*, on a bearing of 080°

R is 28 miles from *Q*, on a bearing of 155°

Work out the direct distance from *P* to *R*.



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

$= 12^2 + 28^2 - 2 \times 12 \times 28 \times \cos 105$

$= 1101.926398\ldots$

$\sqrt{1101.9\ldots} = 33.195$

Answer 33.195 miles

(Total 4 marks)

Likely – Similar Areas and Volumes

Q1.

Two spheres have radii in the ratio 5 : 3

Circle the ratio of their volumes. $5^3 : 3^3$

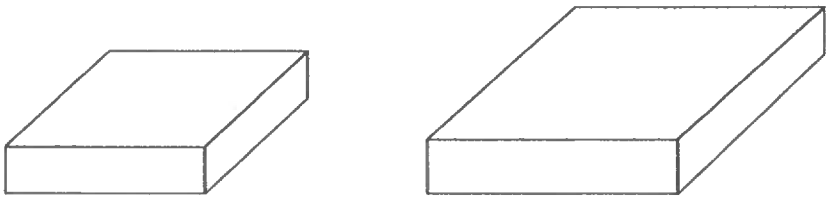
5 : 3 | 15 : 9 | 25 : 9 | 125 : 27

(Total 1 mark)

Q2.

Here are two square-based paving stones.

The stones are similar solids. → enlargements



The price per cm^3 is the same for both stones. → work out Volume SF

The price of the **larger** stone is £17.50

Work out the price of the smaller stone.

Length SF = $\frac{25}{20} = 1.25$

Vol SF = $1.25^3 = 1.953125$

$17.50 \div 1.953125 = 8.96$

divide as go from by to small

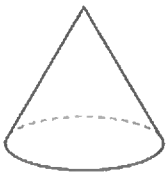
Answer £ 8.96

(Total 4 marks)

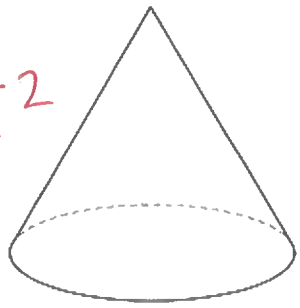
Q3.

Here are two similar cones.

Cone A



Cone B



The surface area of cone A is 2 m²

The surface area of cone B is 4.5 m²

Area Scale factor
= 4.5 ÷ 2
= 2.25

Work out the ratio radius of cone A : radius of cone B

Give your answer in the form 1 : n

Length Scale factor = $\sqrt{2.25}$ = 1.5

Answer 1 : 1.5

(Total 3 marks)

Likely – Factorise Quadratics

Q1.

Circle the factor of $x^2 - 5x$

$x - 1$ $\quad$ $-5x$ $\quad$ $x - 5$ $\quad$ $5x$

(Total 1 mark)

Q2.

Factorise $x^2 - 64$ → Difference of 2 squares.

Circle your answer.

$(x + 8)^2$ $\quad$ $(x - 8)^2$ $\quad$ $(x + 8)(x - 8)$ $\quad$ $x(x - 64)$

(Total 1 mark)

Q3.

Factorise $25a^2 - b^2$ → Difference of 2 squares

Answer $(5a-b)(5a+b)$

(Total 1 mark)

Q4.

Factorise $3x^2 - 16x - 12$

$3x \times -12 = -36 = 2 \times -18$

$-16 = 2 + -18$

	$3x$	$+2$
x	$3x^2$	$2x$
-6	$-18x$	-12

$(3x+2)(x-6)$

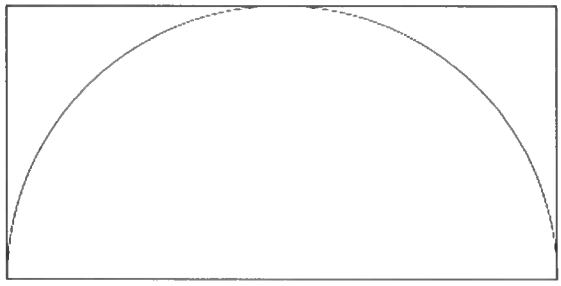
Answer _____

(Total 2 marks)

Likely – Circles and sectors

Q1.

The diagram shows a semicircle of diameter 15 cm inside a rectangle.



Work out the shaded area.

rectangle area: 15×7.5

semi circle area: $\frac{\pi \times 7.5^2}{2}$

$15 \times 7.5 - \frac{\pi \times 7.5^2}{2}$

$= 24.1427...$

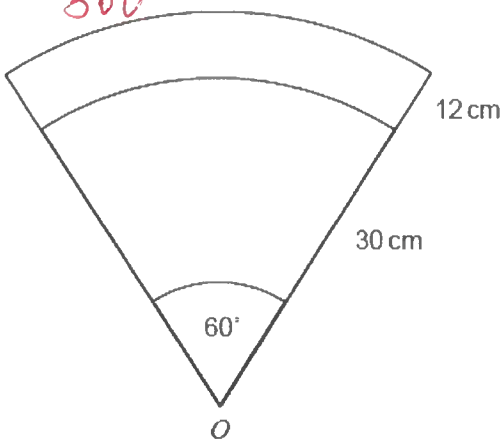
Answer 24.1 cm²

(Total 4 marks)

Arc Length = $\pi \times D \times \frac{\text{angle}}{360}$

Q2.

The diagram shows two circular arcs with centre O



How much longer is the big arc than the small arc?

Big arc length $= \pi \times 84 \times \frac{60}{360}$

$= 14\pi$

Small arc length $= \pi \times 60 \times \frac{60}{360}$

$= 10\pi$

$14\pi - 10\pi = 4\pi$

$= 12.566$

Answer 12.6 cm

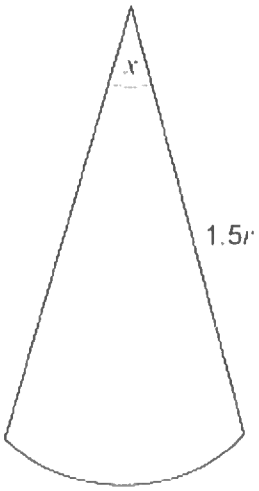
(Total 4 marks)

Q3.

Here are two sectors from different circles.

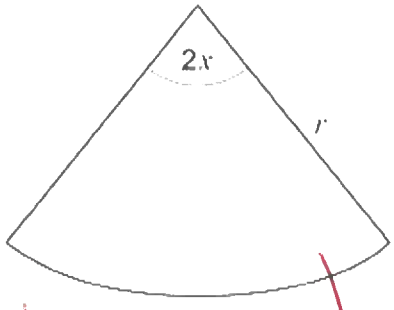
Not drawn accurately

Sector A



Sector B

Not drawn accurately



brackets

$\frac{\pi \times (1.5r)^2 \times x}{360}$

$\frac{\pi \times r^2 \times 2x}{360}$

Which sector has the bigger area?

Tick a box.

$= \frac{2.25\pi r^2 x}{360}$ > $= \frac{2\pi r^2 x}{360}$

☑ Sector A ☐ Sector B

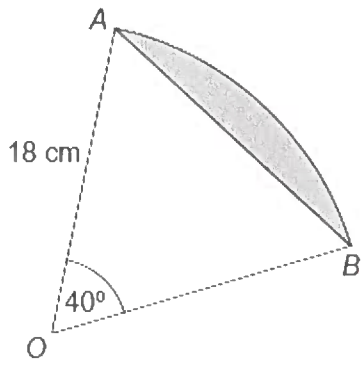
Show working to support your answer.

(Total 2 marks)

Q4.

The diagram shows a sector of a circle, centre *O*, radius 18 cm

Not drawn accurately



Work out the area of the shaded segment. → Area of Sector − Area of triangle

$\frac{\pi \times 18^2 \times 40}{360} - \frac{1}{2} \times 18 \times 18 \times \sin 40$

$= 8.9657$

Answer 8.9657 cm²

(Total 3 marks)