

Write your name here

Surname

Other names

Centre Number

Candidate Number

Edexcel GCSE

Mathematics A

Paper 1 (Non-Calculator)

Higher Tier

Tuesday 6 November 2012 – Morning

Time: 1 hour 45 minutes

Paper Reference

1MA0/1H

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

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators must not be used.**



Information

- The total mark for this paper is 100
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

P40673A

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6/6/7/C2



P 4 0 6 7 3 A 0 1 2 8

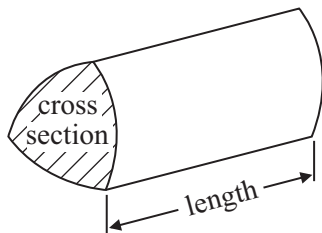
PEARSON

GCSE Mathematics 1MA0

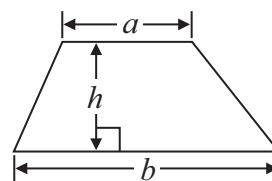
Formulae: Higher Tier

You must not write on this formulae page.
Anything you write on this formulae page will gain NO credit.

Volume of prism = area of cross section $\times$ length

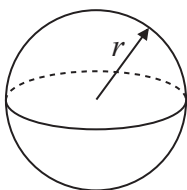


Area of trapezium = $\frac{1}{2} (a + b)h$



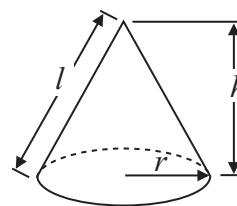
Volume of sphere = $\frac{4}{3} \pi r^3$

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

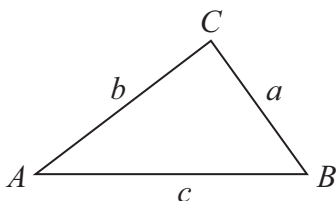


Volume of cone = $\frac{1}{3} \pi r^2 h$

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



In any triangle ABC



The Quadratic Equation

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

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

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

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

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



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

You must NOT use a calculator.

- 1** Here are the ingredients needed to make 16 gingerbread men.

Ingredients
to make **16** gingerbread men

180 g flour
40 g ginger
110 g butter
30 g sugar

Hamish wants to make 24 gingerbread men.

Work out how much of each of the ingredients he needs.

$$16 \times 1.5 = 24 \text{ gingerbread men}$$

$$180\text{g} \times 1.5 = 270\text{g}$$

$$\frac{110}{2} = 55$$

$$40\text{g} \times 1.5 = 60\text{g}$$

$$110\text{g} \times 1.5 = 165\text{g}$$

$$30\text{g} \times 1.5 = 45\text{g}$$

270g flour

60g ginger

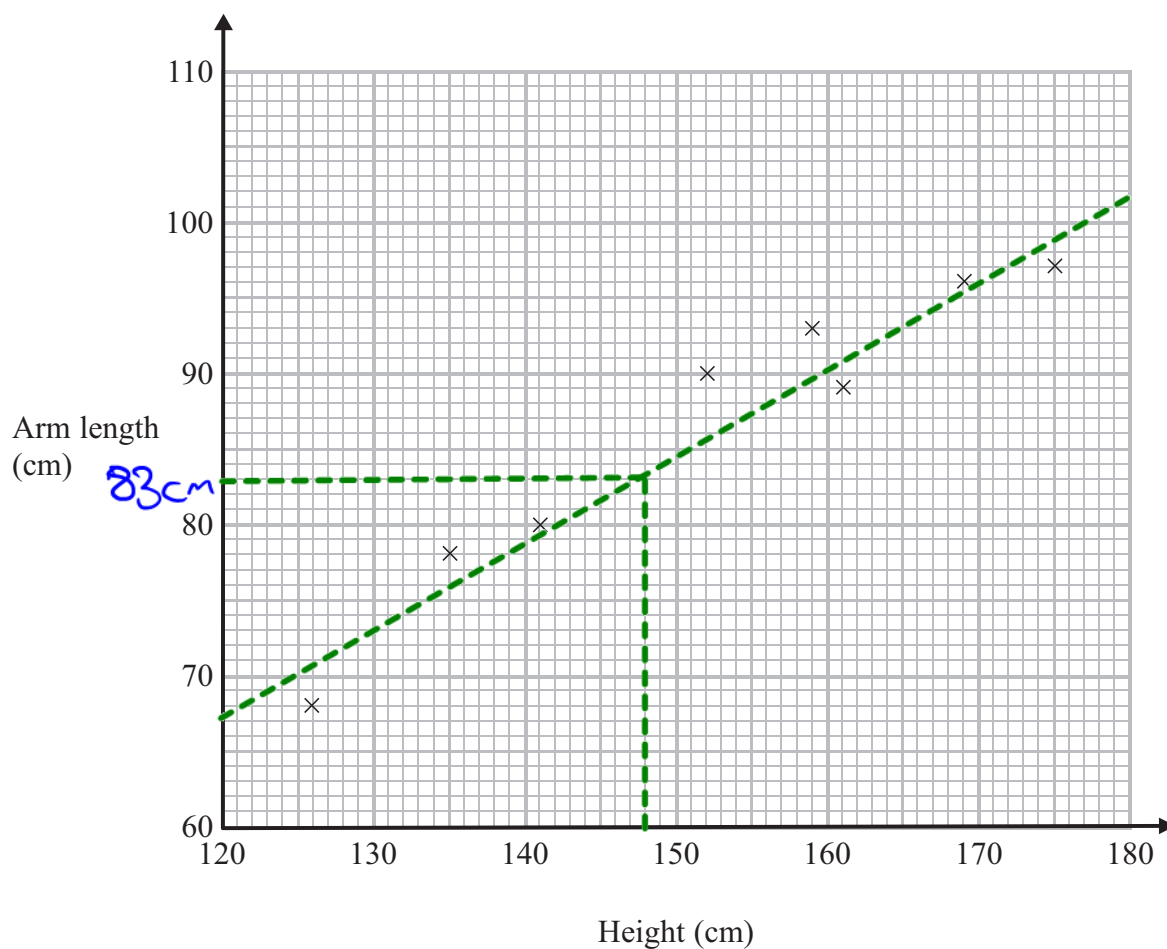
165g butter

45g sugar

(Total for Question 1 is 3 marks)



- 2 The scatter graph shows information about the height and the arm length of each of 8 students in Year 11



- (a) What type of correlation does this scatter graph show?

POSITIVE

(1)

A different student in Year 11 has a height of 148 cm.

- (b) Estimate the arm length of this student.

83

.....cm

(2)

(Total for Question 2 is 3 marks)



*3 Here is part of Gary's electricity bill.

Electricity bill	
New reading	7155 units
Old reading	7095 units
Price per unit 15p	

Work out how much Gary has to pay for the units of electricity he used.

$$\text{Electricity used} = 7155 - 7095$$

$$\begin{array}{r} 7155 \\ - 7095 \\ \hline 60 \\ \hline \end{array}$$

$$\begin{array}{r|l|l} \times & 10 & 5 \\ 60 & 600 & 300 \\ \hline \end{array}$$

$$600 + 300 = 900$$

$$60 \text{ units} \times 15\text{p} = 900\text{p}$$

$$900\text{p} = \underline{\underline{£9}}$$

(Total for Question 3 is 4 marks)



- 4 Alison wants to find out how much time people spend reading books. She is going to use a questionnaire.

Design a suitable question for Alison to use in her questionnaire.

How much time per day do you spend reading books?

☐ ☐ ☐ ☐
 none 0-1 hrs 2-3 hrs 4 hrs or more

(Total for Question 4 is 2 marks)

- 5 Work out an estimate for $\frac{31 \times 9.87}{0.509}$

Round these to 1sf

$$= \frac{30 \times 10}{0.5}$$

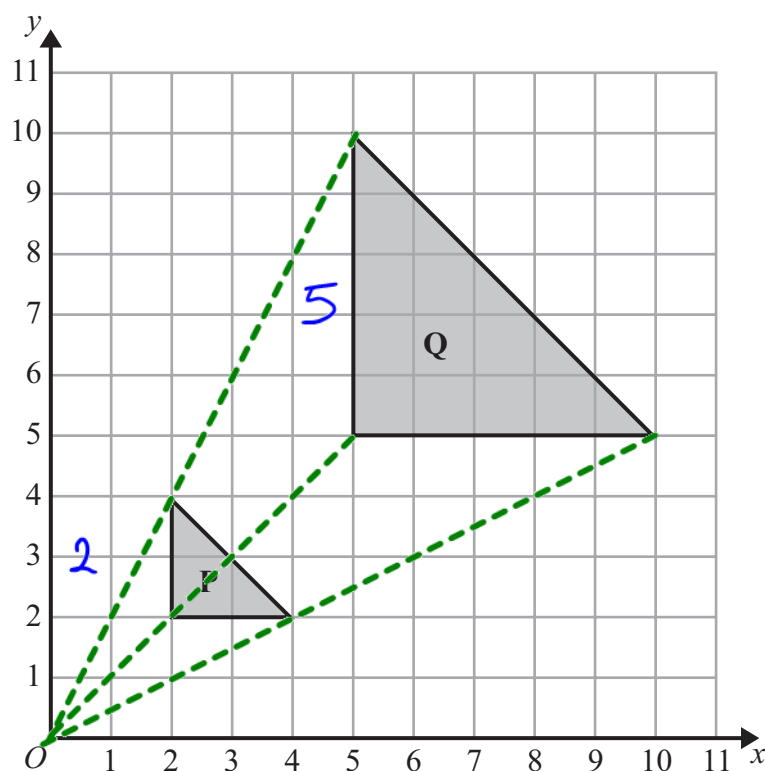
$$= \frac{300}{0.5} = 600$$

600

(Total for Question 5 is 3 marks)



6



Describe fully the single transformation that maps shape **P** onto shape **Q**.

An ENLARGEMENT of SCALE FACTOR 2.5
with CENTRE (0,0)

(Total for Question 6 is 3 marks)



7 Here is a diagram of Jim's garden.

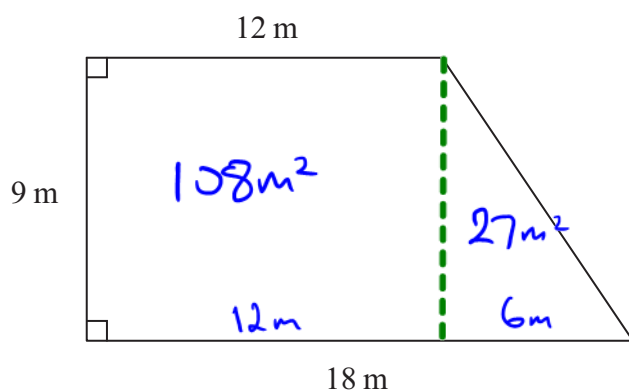


Diagram NOT
accurately drawn

$$9 \times 12 = 108 \text{ m}^2$$

$$\frac{1}{2} \times 9 \times 6$$

$$= \frac{1}{2} \times 54$$

$$= 27 \text{ m}^2$$

Jim wants to cover his garden with grass seed to make a lawn.

Grass seed is sold in bags.

There is enough grass seed in each bag to cover 20 m^2 of garden.

Each bag of grass seed costs £4.99

Work out the least cost of putting grass seed on Jim's garden.

$$108 + 27$$

$$= 135 \text{ m}^2$$

$$20 \overline{) 135}$$

To cover the garden
we need 7 bags
of grass seed.

20	1
40	2
60	3
80	4
100	5
120	6
140	7

$$7 \times £4.99 = (7 \times 5) - (7 \times 0.01)$$

$$= 35 - 0.07$$

$$= \underline{\underline{£34.93}}$$

£ 34.93

(Total for Question 7 is 4 marks)



- 8 There are only red counters, blue counters, white counters and black counters in a bag.

The table shows the probability that a counter taken at random from the bag will be red or blue.

Colour	red	blue	white	black
Probability	0.2	0.5	0.15	0.15

The number of white counters in the bag is the same as the number of black counters in the bag.

Tania takes at random a counter from the bag.

- (a) Work out the probability that Tania takes a white counter.

$$0.2 + 0.5 = 0.7$$

$$P(\text{white or Black}) = 1 - 0.7 = 0.3$$

$$P(\text{white}) = P(\text{Black}) = \frac{0.3}{2} = 0.15$$

$$\frac{0.15}{(2)}$$

There are 240 counters in the bag.

- (b) Work out the number of red counters in the bag.

$$P(\text{red}) = 0.2$$

$$240 \text{ counters} \times 0.2$$

$$= 48 \text{ counters}$$

$$\frac{48}{(2)}$$

(Total for Question 8 is 4 marks)



- 9 The diagram shows a prism.

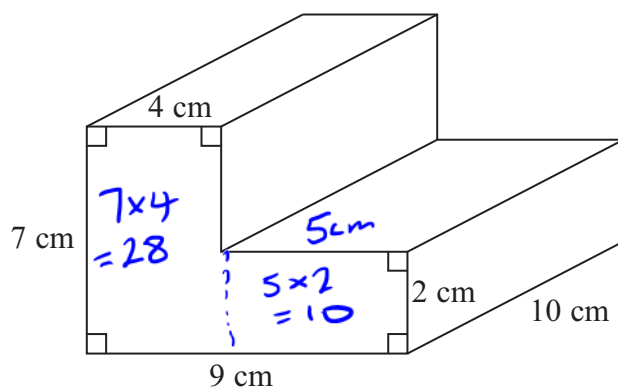


Diagram **NOT**
accurately drawn

Work out the volume of the prism.

Volume of prism = area of cross-section $\times$ length

Area of cross-section

$$28\text{cm}^2 + 10\text{cm}^2 = 38\text{cm}^2$$

Volume

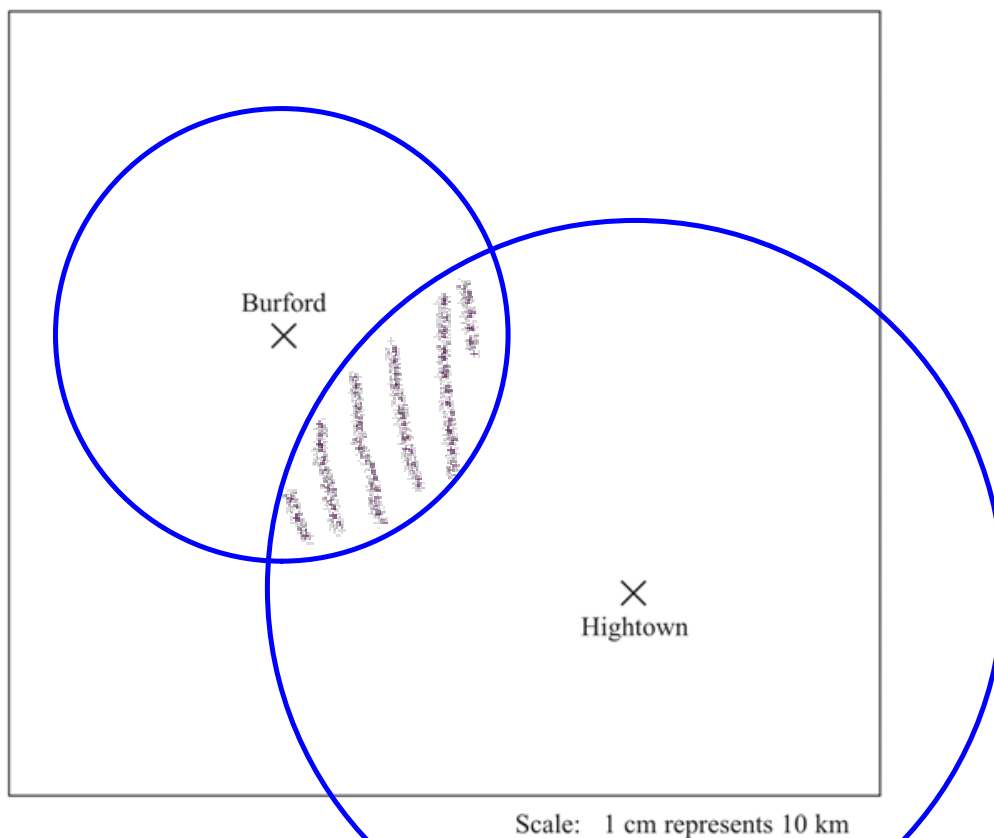
$$38\text{cm}^2 \times 10\text{cm} = 380\text{cm}^3$$

380.....cm³

(Total for Question 9 is 3 marks)



- 10 Here is a map.
The map shows two towns, Burford and Hightown.



A company is going to build a warehouse.

The warehouse will be less than 30 km from Burford **and** less than 50 km from Hightown.

Shade the region on the map where the company can build the warehouse.

(Total for Question 10 is 3 marks)



P 4 0 6 7 3 A 0 1 1 2 8

11 (a) Expand $4(3x + 5)$

$$4(3x + 5) = 12x + 20$$

$$12x + 20$$

(1)

(b) Expand and simplify $2(x - 4) + 3(x + 5)$

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

$$= 2x - 8 + 3x + 15$$

$$= 5x + 7$$

$$5x + 7$$

(2)

(c) Expand and simplify $(x + 4)(x + 6)$

x	x	$+4$
x	x^2	$+4x$
$+6$	$+6x$	$+24$

$$x^2 + 4x + 6x + 24$$

$$= x^2 + 10x + 24$$

$$x^2 + 10x + 24$$

(2)

(Total for Question 11 is 5 marks)



12 The diagram shows a circle drawn inside a square.

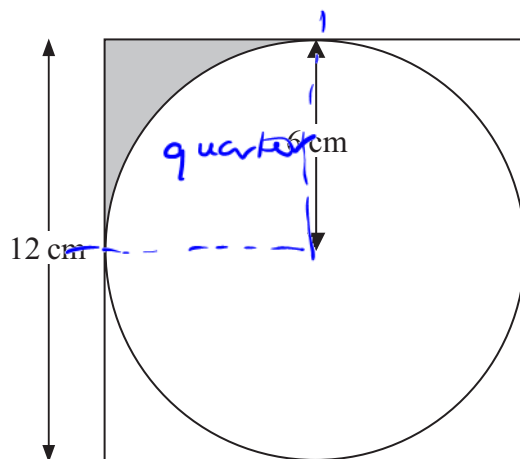


Diagram **NOT**
accurately drawn

The circle has a radius of 6 cm.

The square has a side of length 12 cm.

Work out the shaded area.

Give your answer in terms of π .

$$\text{Area of circle} = \pi r^2 = \pi \times 6^2 = 36\pi$$

$$\text{Area of square} = 12 \times 12 = 144$$

$$\text{Difference} = 144 - 36\pi$$

$$\frac{144 - 36\pi}{4} = 36 - 9\pi$$

$$36 - 9\pi \text{ cm}^2$$

(Total for Question 12 is 3 marks)



- *13 Talil is going to make some concrete mix.
He needs to mix cement, sand and gravel in the ratio 1 : 3 : 5 by weight.

Talil wants to make 180 kg of concrete mix.

Talil has

15 kg of cement

85 kg of sand

100 kg of gravel

Does Talil have enough cement, sand and gravel to make the concrete mix?

$$1 + 3 + 5 = 9$$

$$180 \text{ kg} \div 9 = 20 \text{ kg per part}$$

to make 180 kg of concrete you need

$$1 \times 20 = 20 \text{ kg of cement}$$

$$3 \times 20 = 60 \text{ kg of sand}$$

$$5 \times 20 = 100 \text{ kg of gravel}$$

$$\underline{180 \text{ kg}}$$

Talil has enough sand and gravel but not enough cement. He needs an extra 5 kg.

No, he can't make 180 kg of concrete.

(Total for Question 13 is 4 marks)



14 The bearing of a ship from a lighthouse is 050°

Work out the bearing of the lighthouse from the ship.

BACK BEARINGS

- if ORIGINAL BEARING is < 180 then
BACK BEARING is ORIGINAL $+ 180^\circ$
- if ORIGINAL BEARING is > 180 then
BACK BEARING is ORIGINAL $- 180^\circ$

$$\text{so BACK BEARING is } 050^\circ + 180^\circ \\ = \underline{\underline{230^\circ}}$$

230°

(Total for Question 14 is 2 marks)

15 (a) Simplify $m^5 \div m^3$

$$m^5 \div m^3 = m^{5-3} = m^2$$

m^2

(1)

(b) Simplify $5x^4y^3 \times x^2y$

$$5x^4y^3 \times x^2y$$

$$= 5 \times x^4 \times x^2 \times y^3 \times y$$

$$= 5x^6y^4$$

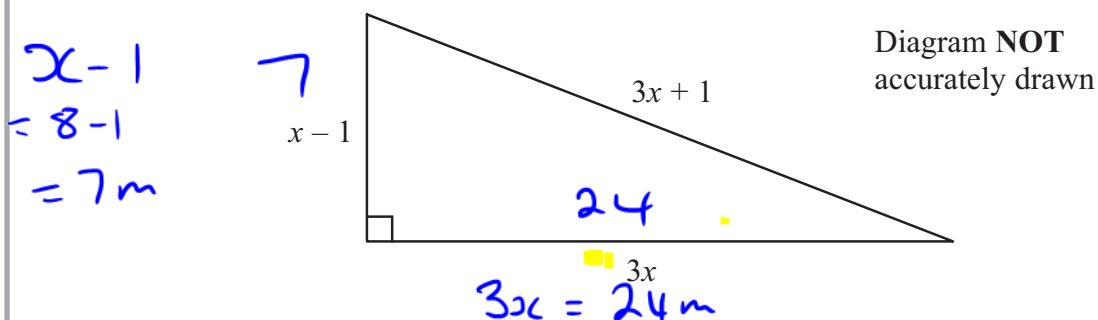
$5x^6y^4$

(2)

(Total for Question 15 is 3 marks)



16 The diagram shows a triangle.



In the diagram, all the measurements are in metres.

The perimeter of the triangle is 56 m.

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

Work out the value of A .

$$(x-1) + (3x+1) + 3x = 56\text{m}$$

$$x + 3x + 3x - 1 + 1 = 56\text{m}$$

$$7x = 56\text{m}$$

$$(\div 7) \quad x = 8\text{m}$$

x	20	4
7	140	28

$$140 + 28 = 168$$

$$\text{Area of } \Delta = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times 7 \times 24$$

$$= \frac{1}{2} \times 168$$

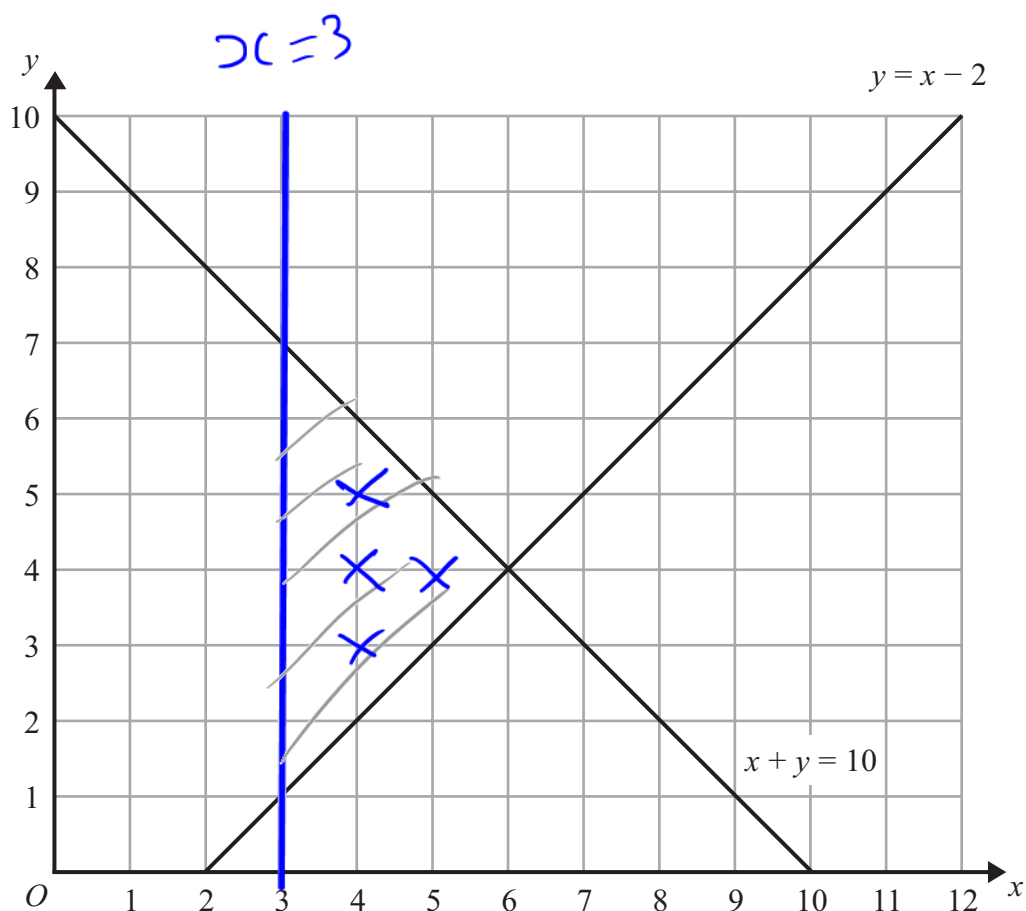
$$= 84\text{ m}^2$$

$$84\text{ m}^2$$

(Total for Question 16 is 4 marks)



17 The lines $y = x - 2$ and $x + y = 10$ are drawn on the grid.



On the grid, mark with a cross (x) each of the points with integer coordinates that are in the region defined by

$$\begin{aligned} y &> x - 2 \\ x + y &< 10 \\ x &> 3 \end{aligned}$$

(Total for Question 17 is 3 marks)



18 The diagram shows part of a pattern made from tiles.

A regular triangle is
EQUILATERAL

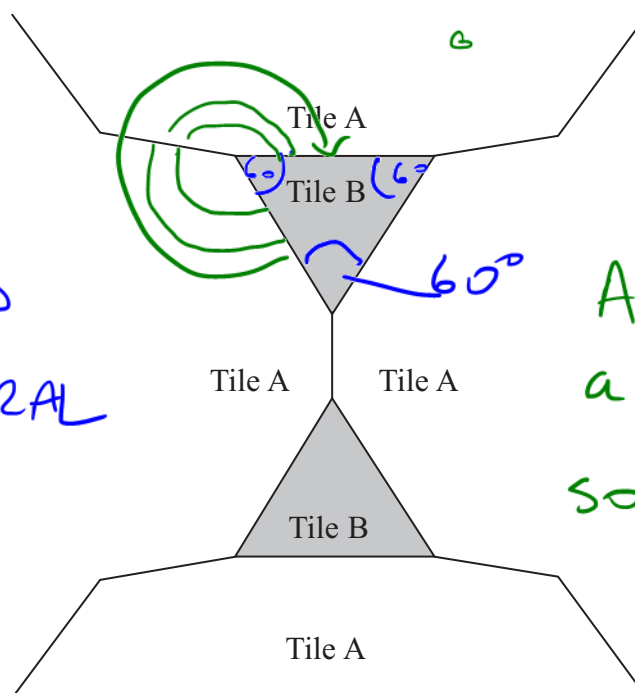


Diagram NOT
accurately drawn

Angles round
a point = 360°
so the bit
remaining
 $360 - 60$
 $= 300^\circ$

The pattern is made from two types of tiles, tile A and tile B.

Both tile A and tile B are regular polygons.

Work out the number of sides tile A has.

So each interior angle of tile A
is 150° . ($300 \div 2$)

and the exterior angle
is $180 - 150 = 30^\circ$



$$n = \frac{360^\circ}{\text{exterior angle}}$$

number
of sides

$$= \frac{360}{30} = 12 \text{ sides}$$

12 sides

(Total for Question 18 is 4 marks)



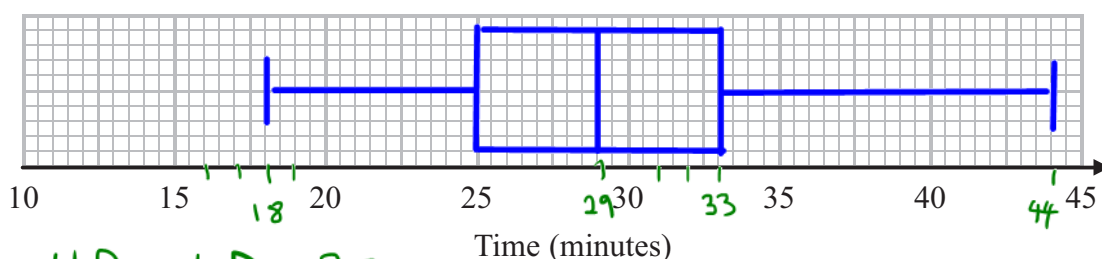
19 Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

Notice that the scale is 2 small squares per number

	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

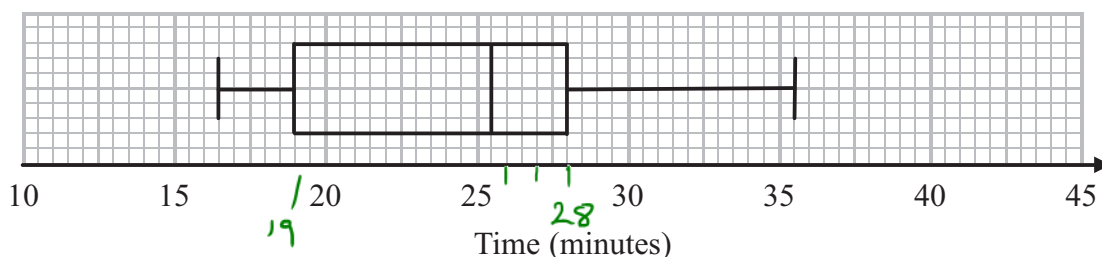
(a) On the grid, draw a box plot to show the information in the table.



$$IQR = UQ - LQ = 33 - 25 = 8$$

(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



$$IQR = UQ - LQ = 28 - 19 = 9$$

(b) Compare the distributions of the girls' times and the boys' times.

(you need to compare MEDIANs and IQRs)

The boys MEDIAN time (25.5 mins) is less than the girls MEDIAN time (29 mins). The boys' IQR is 9 and so wider than the girls' IQR which is 8 mins.

(2)

(Total for Question 19 is 4 marks)



20 Write the following numbers in order of size.
Start with the smallest number.

0.038×10^2 3800×10^{-4} 380 0.38×10^{-1}

$0.038 \times 10^2 = 3.8$ $3800 \times 10^{-4} = 0.38$
 $0.38 \times 10^{-1} = \underline{0.038}$

0.38×10^{-1} , 3800×10^{-4} , 0.038×10^{-2} , 380

(Total for Question 20 is 2 marks)

21 The table shows information about the speeds of 100 lorries.

cumulative
frequency
is the
running
TOTAL

Speed (s) in km/h	Frequency
$0 < s \leq 20$	2
$20 < s \leq 40$	9
$40 < s \leq 60$	23
$60 < s \leq 80$	31
$80 < s \leq 100$	27
$100 < s \leq 120$	8

(a) Complete the cumulative frequency table for this information.

Speed (s) in km/h	Cumulative frequency
$0 < s \leq 20$	2
$0 < s \leq 40$	11
$0 < s \leq 60$	34
$0 < s \leq 80$	65
$0 < s \leq 100$	92
$0 < s \leq 120$	100

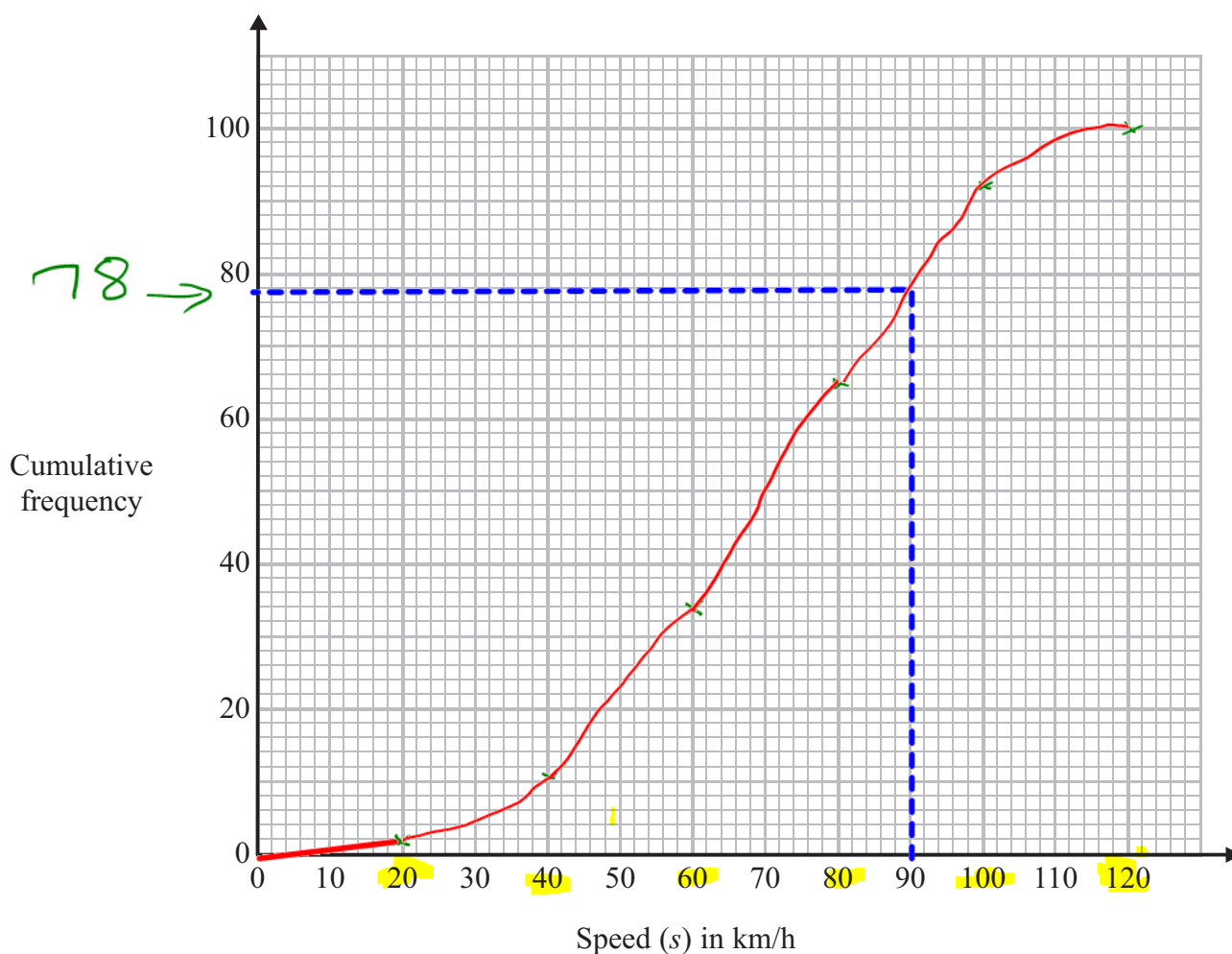
$+ 9 = 11$
 $+ 23 = 34$
 $+ 31 = 65$
 $+ 27 = 92$
 $+ 8 = 100$

(1)



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

(2)



(c) Find an estimate for the number of lorries with a speed of more than 90 km/h.

78 lorries are at 90 km/h or less

So $100 - 78 = 22$ lorries

22

are at more than 90 km/h

(2)

(Total for Question 21 is 5 marks)



22 Solve the simultaneous equations

$$\begin{array}{l} \textcircled{1} \quad 3x + 2y = 4 \\ \textcircled{2} \quad 4x + 5y = 17 \end{array}$$

Step 1: match the amount of either x or y in both equations

$$\begin{array}{rcl} \textcircled{1} \times 4 & 12x + 8y = & \textcircled{16} \\ \textcircled{2} \times 3 & 12x + \textcircled{15y} = & \textcircled{51} \end{array}$$

↑
 x s are
matched

this
equation
has $7y$
more

And $51 - 16$
 $= 35$ more
the other side
of the $=$
sign

Step 2: find the
value of y

so

$$7y = 35$$

and $y = 35 \div 7 = 5$

$$\underline{\underline{y = 5}}$$

Step 3: substitute found value into one of the equations
and solve for the other value

so $y = 5$

$$\begin{array}{l} \textcircled{1} \quad 3x + 2y = 4 \\ 3x + 10 = 4 \\ 3x = -6 \\ \underline{\underline{x = -2}} \end{array}$$

Step 4:

$$\begin{array}{l} x = -2 \\ y = 5 \end{array}$$

check using other equation

$$\textcircled{2} \quad 4x + 5y = 17$$

$$-8 + 25 = 17 \quad \checkmark$$

$$x = \underline{\underline{-2}}$$

$$y = \underline{\underline{5}}$$

(Total for Question 22 is 4 marks)



23

$$6 + 1\frac{1}{2} = 7\frac{1}{2} \text{ so length } PD = 7\frac{1}{2}$$

Diagram NOT
accurately drawny-intercept
is +6so D
is (0, 6)

(1, 4)

(2, 2)

A (3, 0)

y-intercept
of PB is $-1\frac{1}{2}$ (0, $-1\frac{1}{2}$)

Step 1. find coordinate of
point D using y-intercept
of equation of the line

ABCD is a square.

P and D are points on the y-axis.

A is a point on the x-axis.

PAB is a straight line.

Step 2 find coordinate of A

The equation of the line that passes through the points A and D is $y = -2x + 6$

Find the length of PD.

using eqn. of line $y = -2x + 6$
gradient

So every time x increase by 1 y goes down 2
(this is what the GRADIENT tells us)

Point A is (3, 0)

Step 3: find the equation of line PB.

It is perpendicular to line AD so the PRODUCT
of their gradients must be -1.

$$-2 \times \text{gradient PB} = -1 \text{ so gradient PB} = \frac{1}{2}$$

$$\text{so line PB is } y = \frac{1}{2}x + c \rightarrow y = \frac{1}{2}x - 1\frac{1}{2}$$

Step 4: find c by substituting in values

for coordinate A

(Total for Question 23 is 4 marks)

$$x = 3 \text{ so } 0 = \left(\frac{1}{2} \times 3\right) + c \text{ so } c = -1\frac{1}{2}$$

this is
y-intercept!

Turn over



24 Make t the subject of the formula

$$p = \frac{3 - 2t}{4 + t}$$

($\times (4+t)$)

$$p(4+t) = 3 - 2t$$

(expand)

$$4p + pt = 3 - 2t$$

($+2t$)

$$4p + pt + 2t = 3$$

($-4p$)

$$pt + 2t = 3 - 4p$$

(factorise)

$$t(p+2) = 3 - 4p$$

($\div (p+2)$)

$$t = \frac{3 - 4p}{p+2}$$

$$t = \frac{3 - 4p}{p+2}$$

(Total for Question 24 is 4 marks)



25 The diagram shows two similar solids, A and B.

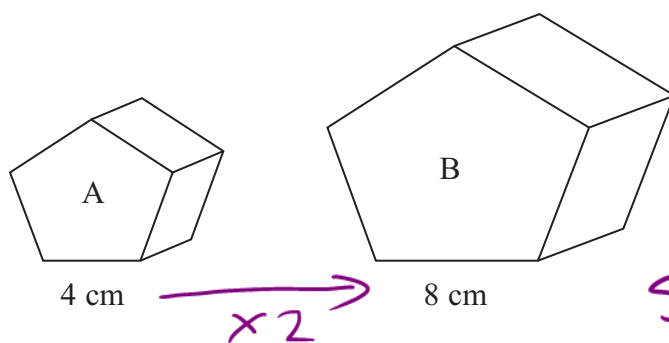


Diagram **NOT**
accurately drawn

Solid A has a volume of 80 cm^3 .

(a) Work out the volume of solid B.

$$\begin{aligned} SF &= 2 \\ \text{Area } SF &= 2^2 = 4 \\ \text{Volume } SF &= 2^3 = 8 \end{aligned}$$

$$\begin{aligned} \text{Vol } B &= \text{Vol } A \times \text{VSF} \\ &= 80 \times 8 \\ &= 640 \text{ cm}^3 \end{aligned}$$

$$\begin{array}{r} 640 \\ \hline \end{array} \text{ cm}^3$$

(2)

Solid B has a total surface area of 160 cm^2 .

(b) Work out the total surface area of solid A.

$$\begin{aligned} \text{SA of } A &= \text{SA of } B \div \text{ASF} \\ &= 160 \text{ cm}^2 \div 4 \\ &= 40 \text{ cm}^2 \end{aligned}$$

$$\begin{array}{r} 40 \\ \hline \end{array} \text{ cm}^2$$

(2)

(Total for Question 25 is 4 marks)



26 (a) Rationalise the denominator of $\frac{5}{\sqrt{2}}$

$$\frac{5}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{5\sqrt{2}}{2}$$

$$\frac{5\sqrt{2}}{2}$$

(2)

(b) Expand and simplify $(2 + \sqrt{3})^2 - (2 - \sqrt{3})^2$

$$(2 + \sqrt{3})(2 + \sqrt{3})$$

F	4
O	$2\sqrt{3}$
I	$2\sqrt{3}$
L	3
S	$7 + 4\sqrt{3}$

The tricky bit
is dealing
with the

SUBTRACTION
of the 2nd bracket

$$(2 - \sqrt{3})(2 - \sqrt{3})$$

F	4
O	$-2\sqrt{3}$
I	$-2\sqrt{3}$
L	+3
S	$7 - 4\sqrt{3}$

$$(7 + 4\sqrt{3}) - (7 - 4\sqrt{3})$$

$$= 7 + 4\sqrt{3} - 7 + 4\sqrt{3}$$

$$= 7 - 7 + 4\sqrt{3} + 4\sqrt{3}$$

$$= 8\sqrt{3}$$

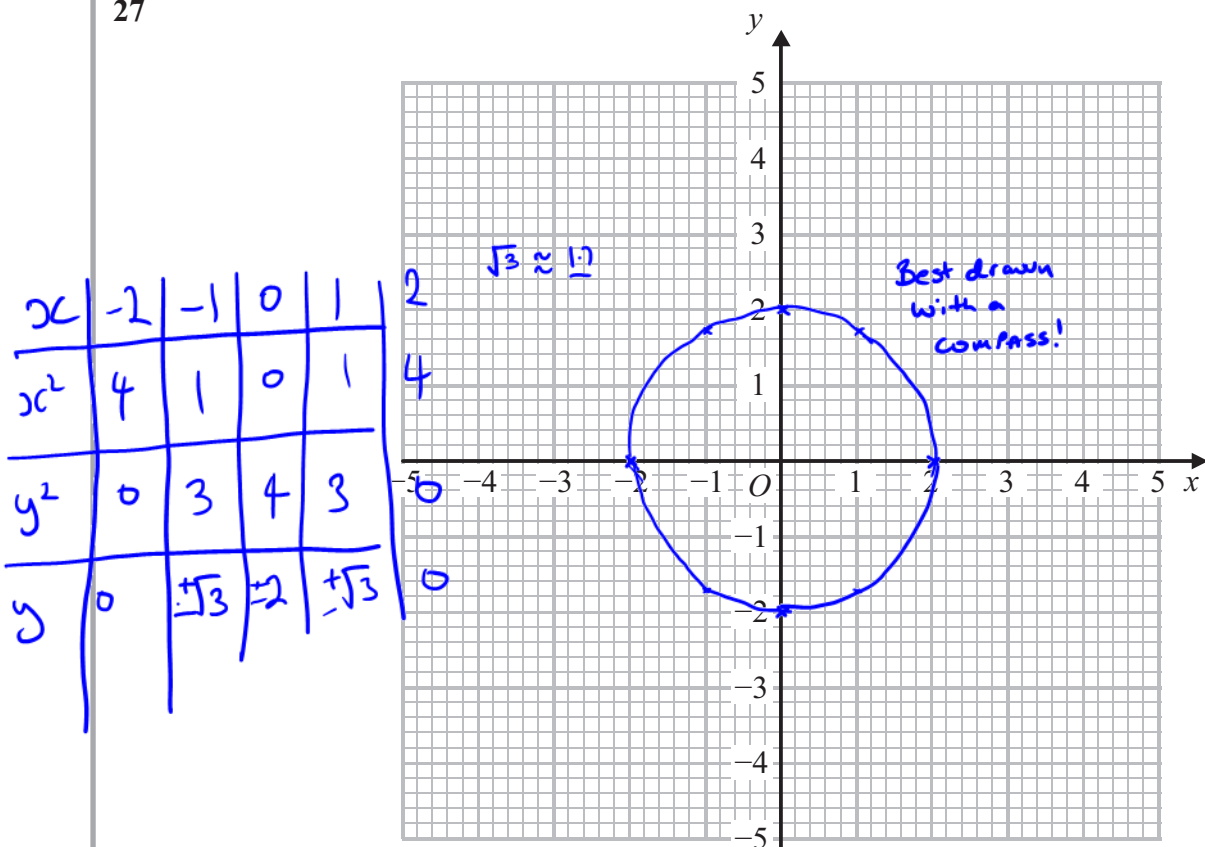
(2)

(Total for Question 26 is 4 marks)

REMEMBER
- - = + !

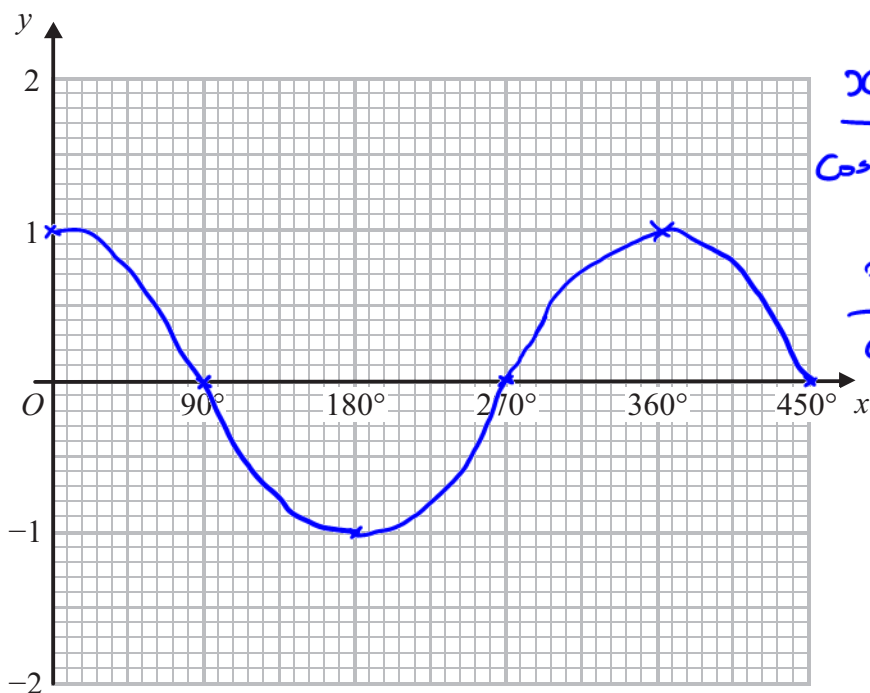


27



(a) On the grid, draw the graph of $x^2 + y^2 = 4$

This is the equation of a circle graph with RADIUS $\sqrt{4} = 2$ and centre $(0,0)$ ⁽²⁾



x	0	90	180	270
$\cos x$	1	0	-1	0

x	360
$\cos x$	1

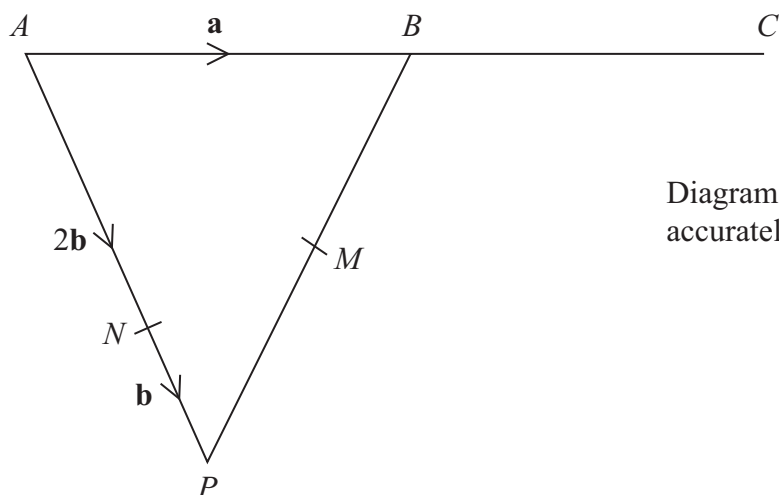
(b) On the grid, sketch the graph of $y = \cos x$ for $0^\circ \leq x \leq 360^\circ$

You need to remember the intercepts of cos and sin graphs! ⁽²⁾

(Total for Question 27 is 4 marks)



28

Diagram NOT
accurately drawn

APB is a triangle.
 N is a point on AP .

$$\vec{AB} = \mathbf{a} \quad \vec{AN} = 2\mathbf{b} \quad \vec{NP} = \mathbf{b}$$

(a) Find the vector $\vec{PB}$, in terms of $\mathbf{a}$ and $\mathbf{b}$.

$$\begin{aligned} \vec{PB} &= \vec{PA} + \vec{AB} \\ &= -3\mathbf{b} + \mathbf{a} \end{aligned}$$

$$\underline{\mathbf{a}} - 3\underline{\mathbf{b}} \quad (1)$$

B is the midpoint of AC .
 M is the midpoint of PB .

*(b) Show that NMC is a straight line.

$$\vec{PM} = \frac{1}{2} \vec{PB} = \frac{1}{2} (\underline{\mathbf{a}} - 3\underline{\mathbf{b}})$$

$$\begin{aligned} \vec{NM} &= \underline{\mathbf{b}} + \vec{PM} = \underline{\mathbf{b}} + \frac{1}{2} (\underline{\mathbf{a}} - 3\underline{\mathbf{b}}) = \underline{\mathbf{b}} + \frac{1}{2} \underline{\mathbf{a}} - \frac{3}{2} \underline{\mathbf{b}} \\ &= -\frac{1}{2} \underline{\mathbf{b}} + \frac{1}{2} \underline{\mathbf{a}} = \frac{1}{2} (\underline{\mathbf{a}} - \underline{\mathbf{b}}) \end{aligned}$$

$$\vec{NC} = \vec{NA} + \vec{AC} = -2\underline{\mathbf{b}} + 2\underline{\mathbf{a}} = 2(\underline{\mathbf{a}} - \underline{\mathbf{b}})$$

$\vec{NM}$ and $\vec{NC}$ are parallel because they are both multiples of vector $(\underline{\mathbf{a}} - \underline{\mathbf{b}})$. Because both vectors start at point N they are also on a straight line. (4)

(Total for Question 28 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

