Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

C300UB0-1

S17-C300UB0-1

MATHEMATICS – Component 2
Calculator-Allowed Mathematics
HIGHER TIER

THURSDAY, 8 JUNE 2017

– MORNING

2 hours 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**3**	
2.	**3**	
3.	**3**	
4.	**1**	
5.	**3**	
6.	**2**	
7.	**4**	
8.	**3**	
9.	**3**	
10.	**5**	
11.	**5**	
12.	**4**	
13.	**10**	
14.	**6**	
15.	**3**	
16.	**4**	
17.	**7**	
18.	**5**	
19.	**6**	
20.	**9**	
21.	**9**	
22.	**9**	
23.	**6**	
24.	**7**	
Total	**120**	

ADDITIONAL MATERIALS

A calculator will be required for this examination.

A ruler, protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the need for good English and orderly, clear presentation in your answers.

C300UB01
01

Formula list

Area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

Curved surface area of a cone = πrl

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

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

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

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

Examiner only

1.

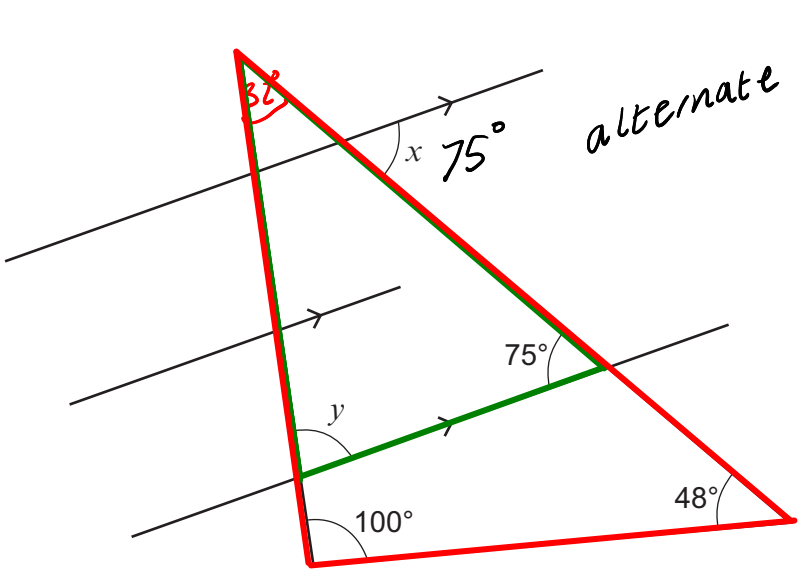

Diagram not drawn to scale

Work out the sizes of angle x and angle y. [3]

$180 - 100 - 48 = 32^\circ$ Angles in triangle

$180 - 32 - 75 = 73^\circ$ $y = 73^\circ$

$x =$ 75 °

$y =$ 73 °

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03

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2. Steve invests £3400 in an account paying 2·6% compound interest per annum.
Steve leaves his investment in the account for 10 years.

How much less than £5000 will this investment be worth at the end of the 10-year period?
Give your answer correct to the nearest penny.
You must show all your working. [3]

$3400 \times 1.026^{10} = £4394.94$

$5000 - 4394.94 = £605.06$

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3.

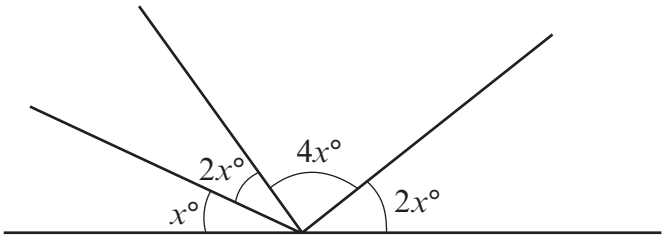

Diagram not drawn to scale

Write an equation in terms of x and solve it.
You must show all your working. [3]

$x + 2x + 4x + 2x = 9x$

$9x = 180$

$x = 20$

$x =$ 20

4. An amount of money is shared in the ratio 2 : 3 : 4. $2+3+4 = 9$
What fraction of this money is the largest share? [1]

$\frac{2}{9}$, $\frac{3}{9}$ and $\frac{4}{9}$

$\frac{4}{9}$

Examiner only

5. The area of a circle is 24 cm^2.

Calculate the radius of the circle. [3]

$\pi r^2 = 24$

$r^2 = \frac{24}{\pi}$

$r^2 = 7.639...$

$r = \sqrt{7.639...}$

Radius is 2.76 cm

6. Work out each of the following.
Give your answers in standard form.

(a) $4{\cdot}5 \times 10^{-6} \times 3{\cdot}4 \times 10^{20}$ [1]

1.53×10^{15}

(b) $\dfrac{6{\cdot}8 \times 10^{25}}{8 \times 10^5 + 2{\cdot}6 \times 10^6}$ [1]

2×10^{19}

Examiner only

7. *(a)*

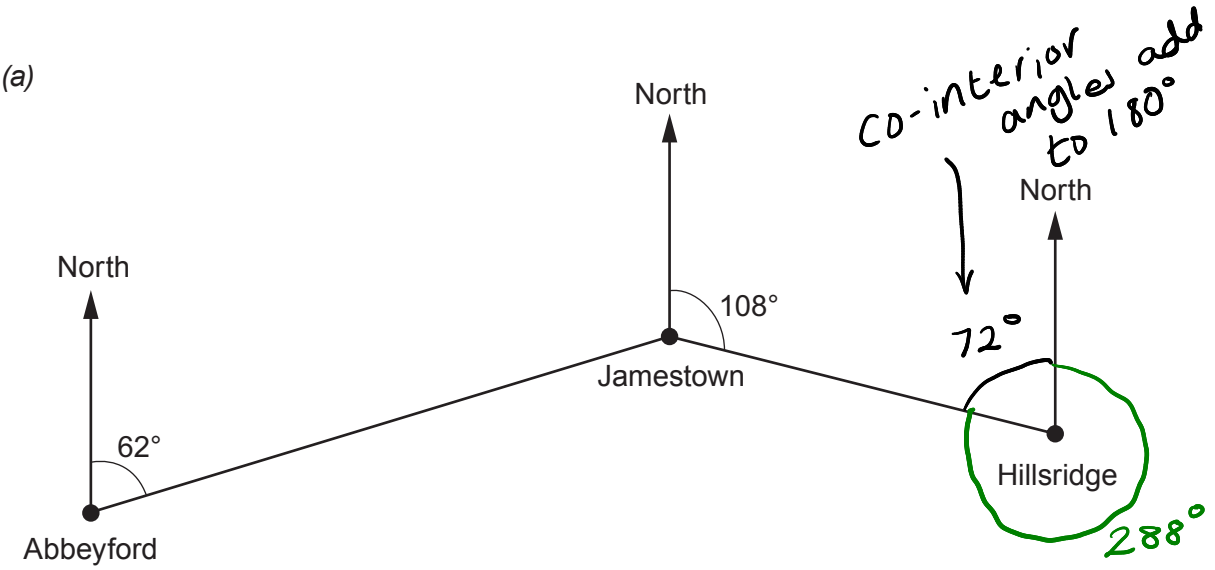

Diagram not drawn to scale

(i) What is the bearing of Jamestown from Abbeyford? [1]

062°

(ii) What is the bearing of Jamestown from Hillsridge? [1]

360 − 72 = 288°

(b) The actual distance between Abbeyford and Jamestown is 20 km.
On the map the distance between Abbeyford and Jamestown is 8 cm.
Work out the scale of the map.

Give your answer in the form 1 : ..... [2]

20 000 m = 2 000 000 cm

÷8 ↓ 8 : 2000000 ↓ ÷8

1 : 250000

Scale of map 1 : 250 000

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07

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8. It takes 3 people 6 days to mow a grass verge.

(a) How many days would it take 9 people to mow a grass verge that is **twice as long**? [2]

3 people would take 12 days to mow verge twice as long.

$3 \times 12 = 36$ (36 days of work needed)

$36 \div 9 = 4$

4 days

(b) State **one** assumption you have made in answering this question. [1]

All people work at the same rate

Examiner only

9. *(a)* Expand and simplify $(2x + 3)(x - 5)$. [2]

$2x^2 - 10x + 3x - 15$

$2x^2 - 7x - 15$

(b) Factorise $x^2 + 5x + 6$. [1]

$(x + 2)(x + 3)$

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09

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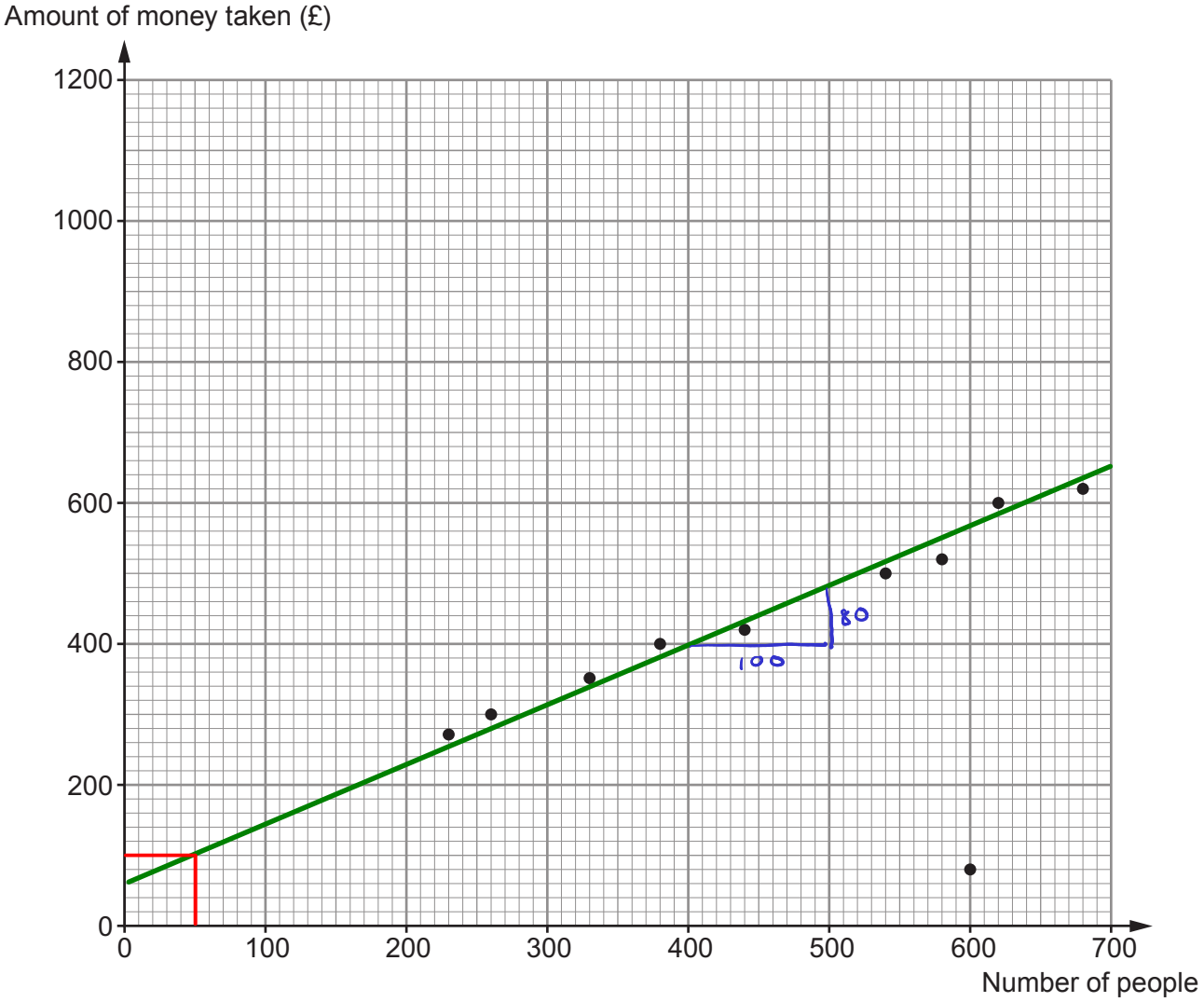
10. A festival was held over 10 days.
An ice cream van was parked on the festival site each day.

The scatter diagram shows the number of people attending the festival on each of the days and the amount of money taken by the ice cream van.



(a) It was really cold and wet on one of the days.
Although lots of people attended on this day, the amount of money taken by the ice cream van was very low.

On this cold and wet day:

- how many people attended the festival?
- what was the amount of money taken by the ice cream van? [1]

Number of people 600

Amount of money taken £ 80

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(b) Ignoring the outlier, draw a line of best fit on the scatter diagram. [1]

(c) (i) Estimate the amount of money that the ice cream van may have taken at the festival had only 50 people attended on a particular day. [1]

Estimate is £ 100

(ii) Why is this estimate unlikely to be accurate? [1]

50 people is outside the range of data (extrapolation) and therefore unreliable.

(d) Estimate how much each person attending the festival spends at the ice cream van. You must give the unit of your answer. [1]

$\frac{80}{100} = 0.8 = 80p$ (gradient)

Estimate is 80p per person

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11. Rosa starts a 27 km cycle race at 14:20.
She finishes the cycle race at 16:00.
Rosa set herself a target of achieving an average speed of 20 km per hour for the race.

(a) Did Rosa achieve her target?
You must show all your working. [3]

27 km in $1\frac{2}{3}$ hours $\left(\frac{5}{3}\right)$

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$= 27 \div \frac{5}{3}$$

$$= 16.2 \text{ km/h}$$

No.

(b) During the cycle race Rosa stopped for 25 minutes to mend a puncture.
Had she not needed to stop to mend her puncture, how would this have impacted on her
- average speed and
- achieving her target?

You must show all your working. [2]

she would have taken 1 hr 15 mins

$1\frac{1}{4}$ hr

speed = $27 \div 1.25$

$= 21.6$ km/h

Yes, her speed would have been greater than 20km/h

Examiner only

12. The table shows rainfall for each day during a month.

Rainfall, r (mm)	m.p.		Number of days	Mp × f
$0 \leqslant r < 4$	2	×	2	4
$4 \leqslant r < 8$	6	×	7	42
$8 \leqslant r < 12$	10	×	10	100
$12 \leqslant r < 16$	14	×	8	112
$16 \leqslant r < 20$	18	×	3	54
			30	

Calculate an estimate for the mean daily rainfall. [4]

4 + 42 + 100 + 112 + 54 = 312

312 ÷ 30 = 10.4 mm

Examiner only

13. *(a)* Roberto buys 3 kg of carrots and 8 kg of turnips.
He plans to make soup.

The recipe he plans to use says,

'The ratio of carrots : turnips : onions is 5 : 3 : 2.'

Roberto plans to use all of the carrots.

- How many kilograms of turnips will he have left?
- How many kilograms of onions will he need? [5]

C : T : O
5 : 3 : 2

3kg = 5 parts
3 ÷ 5 = 0.6kg (each part)

3 : 1.8 : 1.2

3 × 0.6 = 1.8kg of turnips needed

8 - 1.8 = 6.2kg left

2 × 0.6 = 1.2kg of onions needed

Examiner only

(b) A farm shop sells carrots and turnips.

Hadley buys 4 kg of carrots and 5 kg of turnips.
Daisy buys 3 kg of carrots and 8 kg of turnips.
Hadley spends £4.25 and Daisy spends £5.61.

Use an algebraic method to calculate the **total cost** of 1 kg of carrots and 10 kg of turnips.
You must show your working. [5]

$4c + 5t = 425 \quad \times 3$

$3c + 8t = 561 \quad \times 4$

$12c + 15t = 1275$

$12c + 32t = 2244$

$17t = 969$

$t = 57$

$4c + 5(57) = 425$

$4c + 285 = 425$

$4c = 140$

$c = 35$

$35 + 10(57) = 605$

Total cost of 1 kg of carrots and 10 kg of turnips is £6.05

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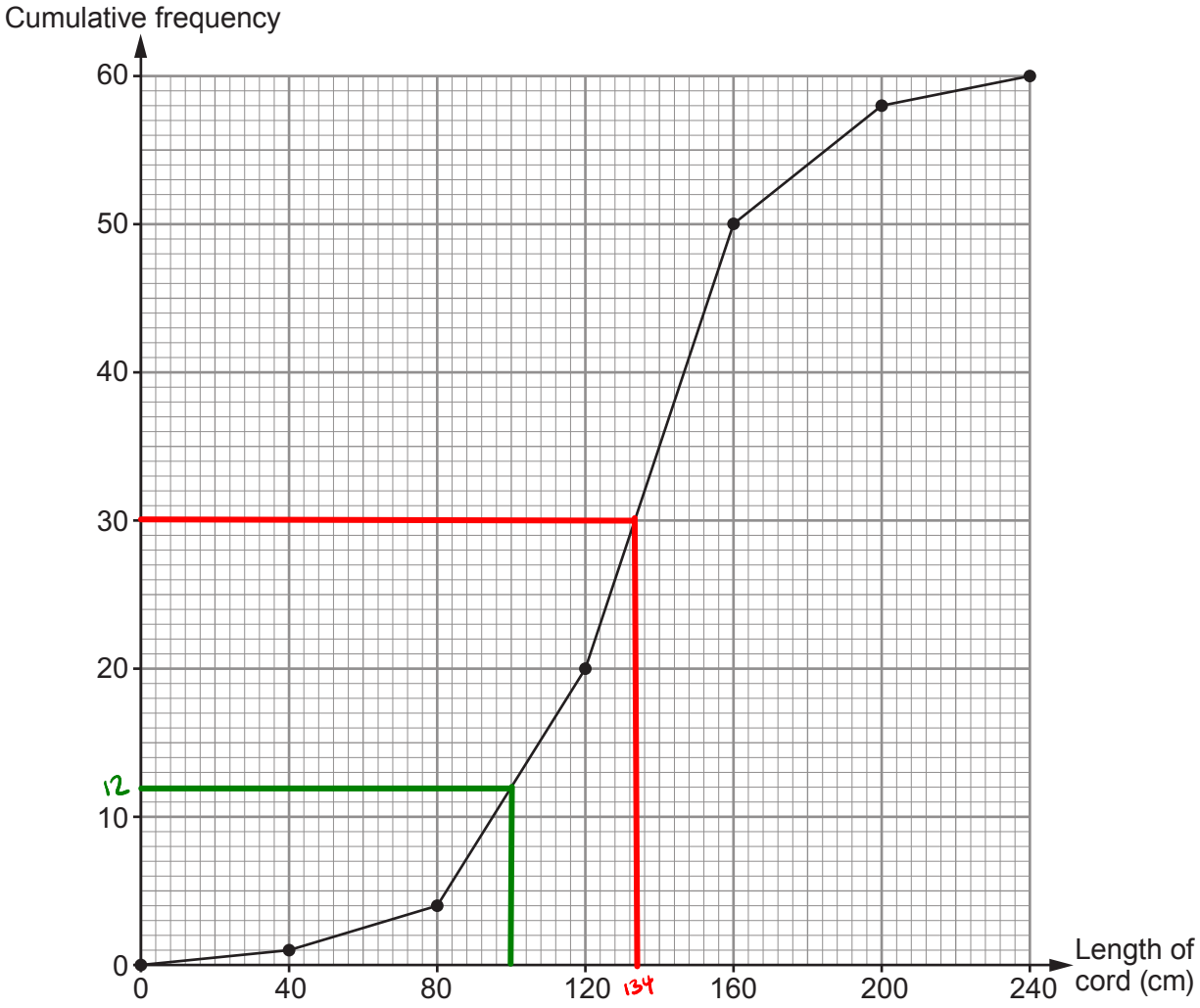
15

Examiner only

14. A store manager measured the length of the electrical cords on 60 different hairdryers. The cumulative frequency diagram illustrates the store manager's findings.



(a) How many electrical cords are between 1·6 m and 2 m in length? [1]

8

(b) The store had a target:

- at least 75% of hairdryers checked should have an electrical cord longer than 100 cm.

Does the store meet the target?

Give a reason for your answer.
State any assumption you made when calculating your answer.
You must show all your working. [3]

Examiner only

Working:

$60 - 12 = 48$ $\quad \frac{48}{60} \times 100 = 80\%$

80% of cords are Longer than 100 cm

Assumption:

The cord lengths (between 80 cm and 120 cm) are distributed evenly.

(c) (i) Use the cumulative frequency diagram to estimate the median length of the electrical cords. [1]

Median 134 cm

(ii) The store manager realised that she had measured the shortest electrical cord incorrectly.
The cord actually measures 79 cm.
What impact does this have on the median?
You must give a reason for your answer. [1]

No effect. The length of the cord is still below the median.

15. The cost of a coat is reduced by 10% in a sale.
In the final clearance this coat is reduced by a further 25% of the sale price.
The final clearance price of the coat is £175.50.
Calculate the original price of the coat before any reduction in price. [3]

$x \times 0.9 \times 0.75 = 175.5$

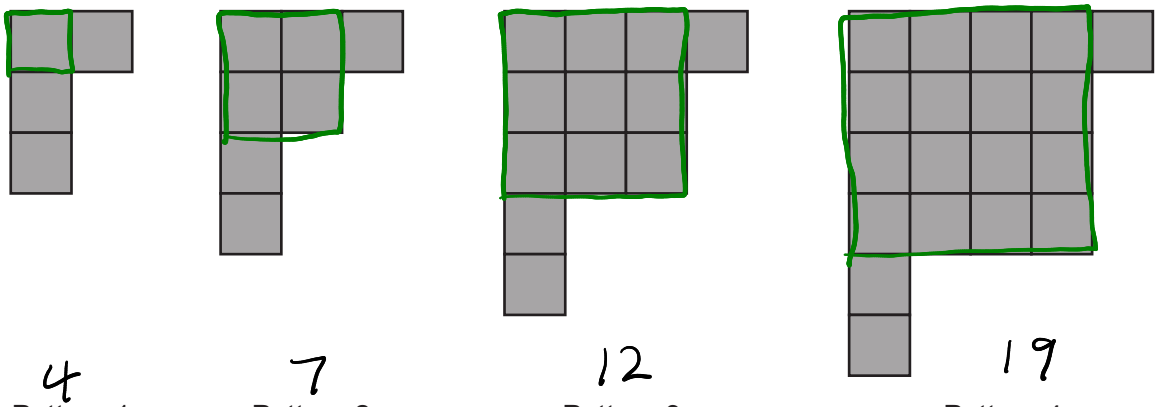
$x = \frac{175.5}{0.9 \times 0.75}$

$= 260$

Original price £ 260

Examiner only

16.



Pattern 1 Pattern 2 Pattern 3 Pattern 4

The diagram shows four patterns made using square grey tiles.
There are 4 tiles in Pattern 1.

(a) How many tiles are there in Pattern 5? [1]

$19 + 9 = 28$

(b) (i) Find an expression for the number of tiles in Pattern n. [2]

$n^2 + 3$

(ii) Describe how the arrangement of the tiles can be used to explain your expression in *(b)*(i). [1]

The arrangement is a square (n^2) with three additional tiles.

Examiner only

17. *(a)* Robin has a rectangular blanket made from 100% wool.
Robin knows that the wool in his blanket has a mass of 136 g per m^2.
The mass of his blanket is 952 g.
The width of his blanket is 2·5 m.
Calculate the length of Robin's blanket. [3]

$\frac{952}{136} = 7\ m^2$

$l \times w = 7$

$l \times 2.5 = 7$

$l = 7 \div 2.5$

Length of Robin's blanket is 2.8 m

(b) Rugs are made from a material that is a mix of polyester and recycled plastic.
The polyester in the material has a mass of 120 g per m^2.
The recycled plastic in the material has a mass of 140 g per m^2.

Dafina buys one of these rugs.
The rug is rectangular. Its width is 1·5 m and length is 2 m.
The label on the rug says it is made from 65% polyester and 35% recycled plastic.

Show that Dafina's rug has a mass of less than 400 g.
You must show all your working. [4]

$1.5 \times 2 = 3\ m^2$

$0.65 \times 3 = 1.95\ m^2$ (polyester)

$0.35 \times 3 = 1.05\ m^2$ (plastic)

$120 \times 1.95 + 140 \times 1.05 = 381$ g

$381 < 400$

Examiner only

18.

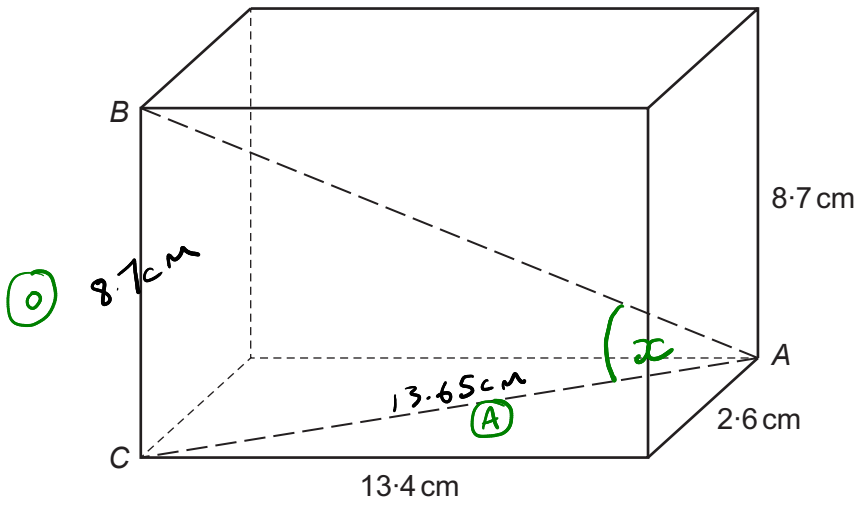


Diagram not drawn to scale

The diagram shows a cuboid.
A, *B* and *C* are all vertices of the cuboid.
Calculate the size of $C\hat{A}B$.
Give your answer correct to 3 significant figures. [5]

$2.6^2 + 13.4^2 = AC^2$

$AC = \sqrt{2.6^2 + 13.4^2}$

$= 13.65$

$\tan x = \frac{8.7}{13.65}$

$x = 32.5^\circ$

Examiner only

19. Fifty raffle tickets are sold.
The tickets sold are numbered from 1 to 50.
The raffle tickets are placed in a box for a draw.
One raffle ticket is selected at random and not replaced in the box.
A second ticket is then randomly selected.

(a) Find the probability that one of the tickets drawn is odd and the other is even. [3]

$P(\text{Even, Odd}) = \frac{25}{50} \times \frac{25}{49} = \frac{25}{98}$

$P(\text{Odd, Even}) = \frac{25}{50} \times \frac{25}{49} = \frac{25}{98}$

$\frac{25}{98} + \frac{25}{98} = \frac{25}{49}$

(b) Find the probability that at least one of the tickets drawn is even. [3]

$P(\text{Odd, Odd}) = \frac{25}{50} \times \frac{24}{49} = \frac{12}{49}$

$1 - \frac{12}{49} = \frac{37}{49}$

Examiner only

20. The vectors **OK**, **OL** and **OM** are shown in the diagram.

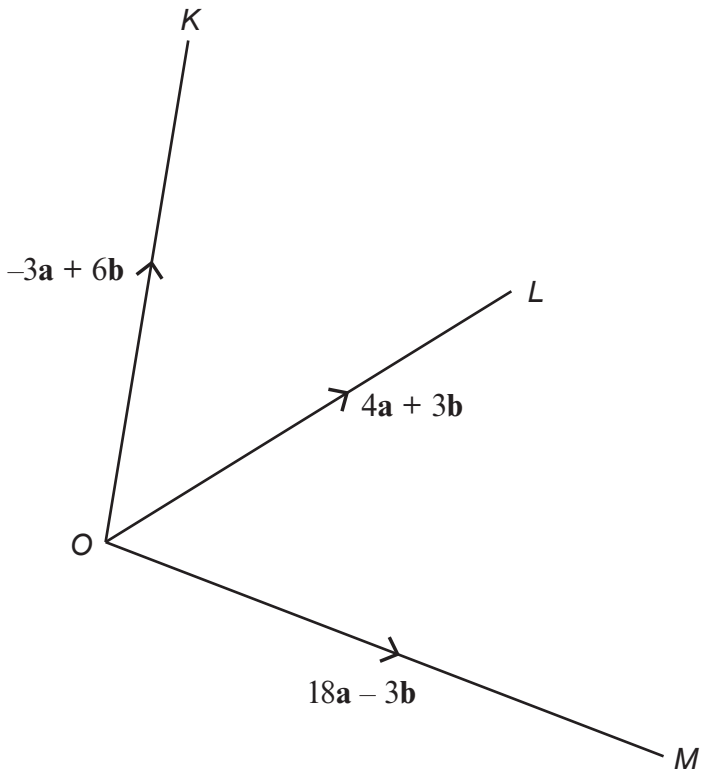


Diagram not drawn to scale

(a) Find each of the following vectors in terms of **a** and **b**.
Give each answer in its simplest form.

(i) **LM** [2]

$-(4a+3b) + 18a - 3b$

$-4a - 3b + 18a - 3b$

$14a - 6b$

(ii) **KL** [2]

$-(-3a + 6b) + 4a + 3b$

$3a - 6b + 4a + 3b$

$7a - 3b$

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(iii) What do your answers to (i) and (ii) tell you about the following? [2]

The lengths of the lines *LM* and *KL*.

LM is twice the length of KL

The points *K*, *L* and *M*.

They all lie on the same straight line.

(b) The point *Q* is the midpoint of the line *OL*.
Find **MQ** in terms of $\mathbf{a}$ and $\mathbf{b}$.
Give your answer in the form $x\mathbf{a} + y\mathbf{b}$. [3]

$\overrightarrow{MQ} = \overrightarrow{MO} + \overrightarrow{OQ}$

$\overrightarrow{OQ} = 2a + \frac{3}{2}b$

$\overrightarrow{MQ} = -18a + 3b + 2a + \frac{3}{2}b$

$= -16a + 4.5b$

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21.

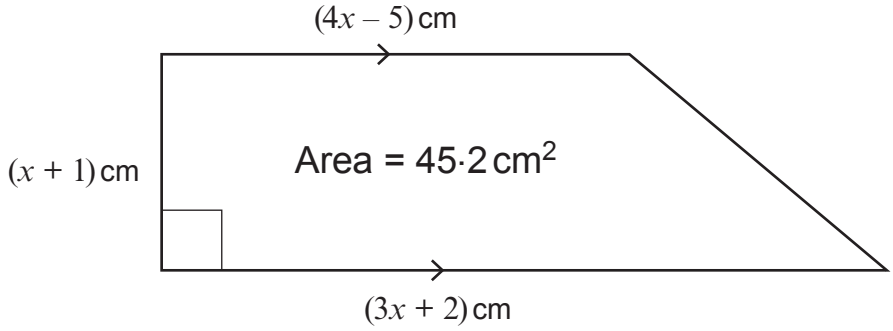

Diagram not drawn to scale

(a) Show that $7x^2 + 4x - 93{\cdot}4 = 0$. [3]

$\frac{1}{2}(a+b) \times h = \text{Area}$

$\frac{1}{2}(3x+2+4x-5)(x+1) = 45.2$

$\frac{1}{2}(7x-3)(x+1) = 45.2$

$(7x-3)(x+1) = 90.4$

$7x^2+7x-3x-3 = 90.4$

$7x^2+4x-3 = 90.4$

$7x^2+4x-93.4 = 0$

Examiner only

(b) Use the quadratic formula to solve $7x^2 + 4x - 93{\cdot}4 = 0$.
Give **both** of your answers correct to 2 decimal places. [3]

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

$$= \frac{-(4) \pm \sqrt{(4)^2 - 4(7)(-93{\cdot}4)}}{2(7)}$$

$$= 3.38 \quad \text{and} \quad -3.95$$

(c) Find each of the lengths of the parallel sides of the trapezium.
You must justify any decisions that you make. [3]

$4(3.38) - 5 = 8.51$ (or 8.52 if rounded number used.)

$3(3.38) + 2 = 12.1$

The lengths of the parallel sides are 8.51 cm and 12.1 cm.

Decision and justification:

x cannot be negative (cannot have a negative length)

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22.

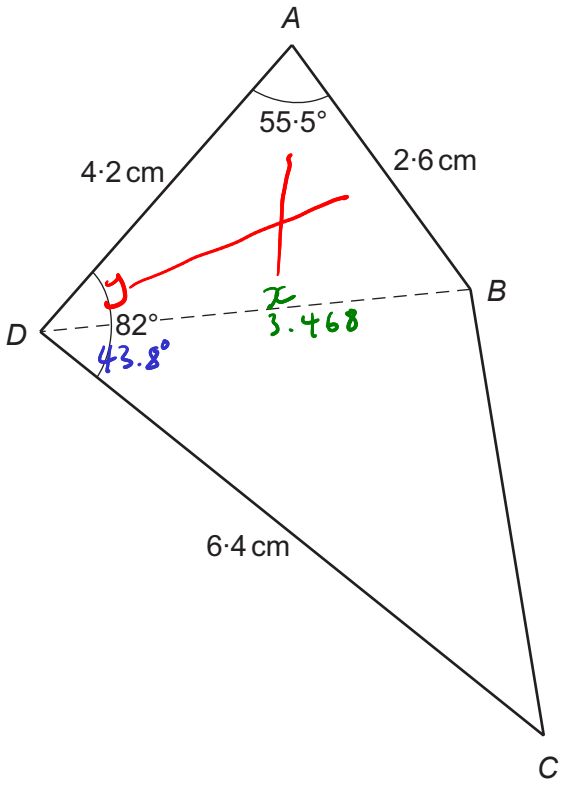

Diagram not drawn to scale

Calculate the area of triangle *BCD*. [9]

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

$x^2 = 4.2^2 + 2.6^2 - 2(4.2)(2.6)\cos(55.5)$

$= 12.0$

$x = 3.468$

$\frac{\sin y}{2.6} = \frac{\sin(55.5)}{3.468}$

$\sin y = \frac{\sin(55.5)}{3.468} \times 2.6$

$= 0.6177$

$y = \sin^{-1}(0.6177)$

$= 38.15^\circ$

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$BDC = 82 - 38.15$

$= 43.8°$

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

$= \frac{1}{2}(6.4)(3.468)\sin(43.8)$

$= 7.69\ cm^2$

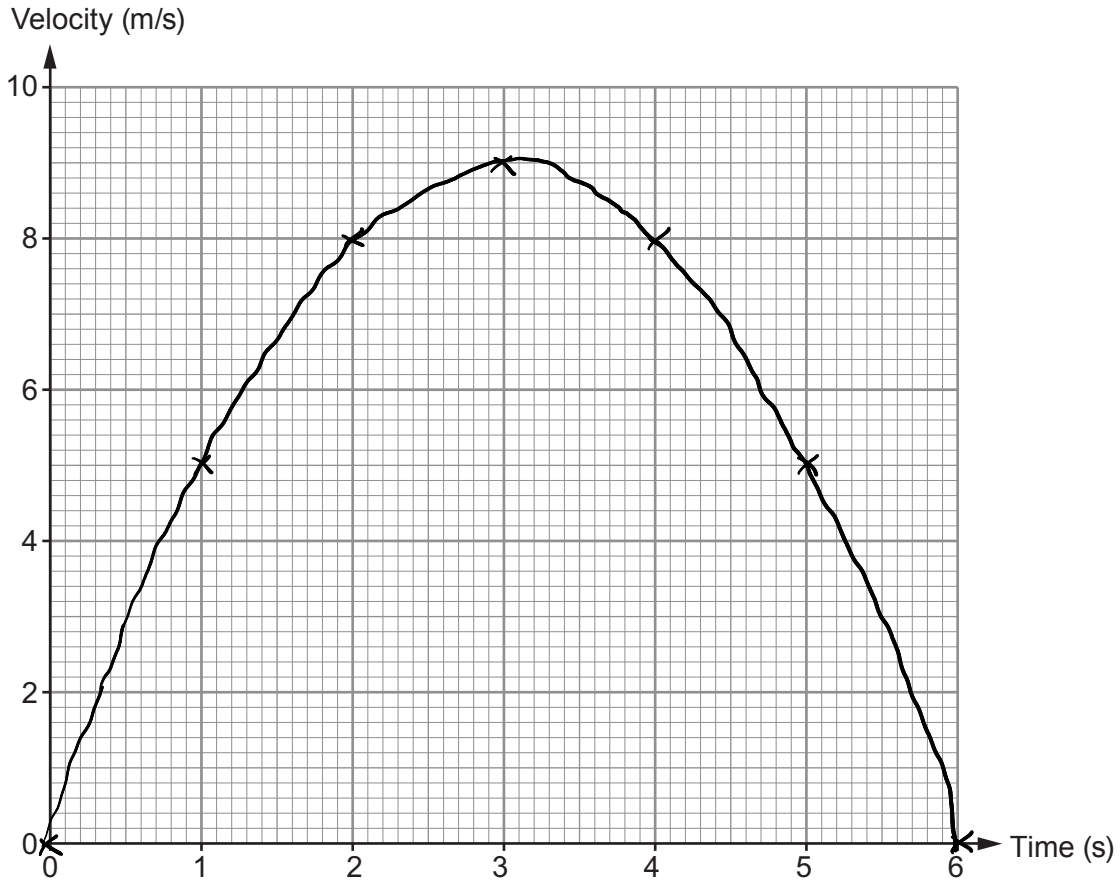
Examiner only

23. An experiment was carried out to record the velocity of a particle during the first 6 seconds of its journey.

- v is the velocity of the particle measured in m/s.
- t is the time in seconds.
- The relationship found was $v = 6t - t^2$.

(a) Draw a graph of $v = 6t - t^2$ for values of t from $t = 0$ to $t = 6$. [2]

t	0	1	2	3	4	5	6
v	0	5	8	9	8	5	0



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(b) (i) Calculate an estimate for the distance the particle travelled from $t = 0$ to $t = 6$.
You must use six regions, each of equal width, in your calculation. [3]

$1 \times \left(\frac{0}{2} + 5 + 8 + 9 + 8 + 5 + \frac{0}{2} \right)$

$= 35 \text{ m}$

(ii) Sharmin says,

The estimate for the distance calculated using six regions of equal width is less than the actual distance travelled by the particle.

Is Sharmin correct?
You must give a reason for your answer. [1]

Yes. There would be gaps between the trapeziums and the graph.

Examiner only

24. A thin piece of card, which is a sector of a circle with centre *O*, is shown below.

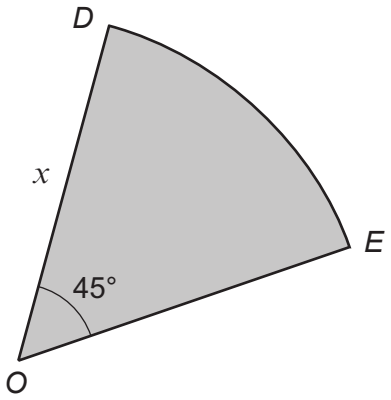

Diagram not drawn to scale

(a) Find an expression for the length of the arc *DE*.
Give your answer, in terms of x and π, in its simplest form. [2]

$\frac{45}{360} \times 2\pi x$

$\frac{1}{8} \times 2\pi x$

$\frac{1}{4}\pi x$

(b) The thin card is made into a cone by sticking edges *OD* and *OE* together without overlapping.

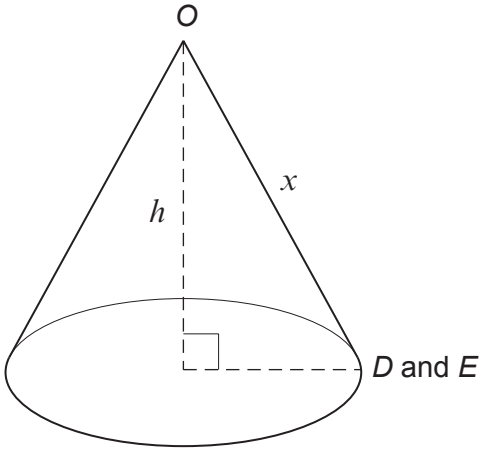

Diagram not drawn to scale

Show that the expression for the perpendicular height, h, of the cone in terms of x is given by $\frac{3\sqrt{7}x}{8}$. [5]

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Circumference $= \frac{1}{4}\pi x$

$2\pi r = \frac{1}{4}\pi x$

$r = \frac{1}{8}x$

$h^2 + \left(\frac{1}{8}x\right)^2 = x^2$

$h^2 + \frac{1}{64}x^2 = x^2$

$h^2 = \frac{63}{64}x^2$

$h = \frac{\sqrt{63}}{8}x$

$\sqrt{63} = \sqrt{9}\sqrt{7}$
$= 3\sqrt{7}$

$h = \frac{3\sqrt{7}}{8}x$

$h = \frac{3\sqrt{7}x}{8}$

END OF PAPER

Examiner only

For continuation only.