

Answer **all** the questions.

1 Evaluate

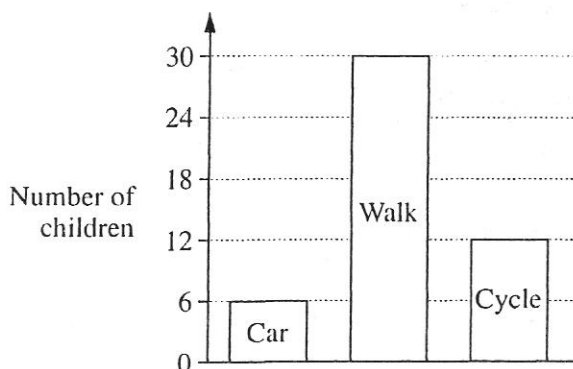
(a) $\frac{4.32}{32.8 \times 0.593}$,

(b) $(6.82 \times 10^5) \div (1.55 \times 10^{-2})$.
Give your answer in standard form.

Answer (a).....[1]

(b).....[1]

2



In a survey, 48 children were asked how they travelled to school.
The results of the survey are shown in the bar chart.

- (a) Express the total number of children who walked or cycled as a fraction of the total number of children.
Give your answer in its lowest terms.
- (b) The same information is to be shown in a pie chart.
Find the angle which represents the children who travelled by car.

Answer (a).....[1]

(b).....[1]

3 (a) Simplify $\left(\frac{2}{x}\right)^{-3}$.

(b) Given that $2^{34} \div 16 = 2^k$, find the value of k .

Answer (a).....[1]

(b) $k =$ [1]

4 A car travelled for 3 hours 41 minutes at an average speed of 50 km/h.

(a) Express 3 hours 41 minutes in hours.

(b) Find how far the car travelled.
Give your answer to the nearest kilometre.

Answer (a)hours [1]

(b) km [1]

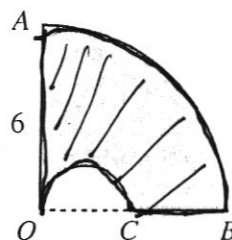
5 (a) A girl spent $\frac{3}{5}$ of her pocket money and had \$4.20 left.
How much did she spend?

(b) x grams of cheese cost 99 cents.
Find an expression for the number of grams of cheese that can be bought for y dollars.

Answer (a) \$.....[1]

(b).....[1]

- 6 The diagram shows a quadrant of a circle, centre O and radius 6 cm. C is the mid point of OB and a semi-circle is drawn with OC as diameter. Find the perimeter of the shaded region. Give your answer in the form $a + b\pi$.



Answer[2]

- 7 It is estimated that by 2070 the population of the world will be 1.03×10^{10} .

(a) 1.03×10^{10} can be written as k billion.
Find k .

(b) The population of the world in 2000 was 6.5×10^9 .
Find the estimated increase in the population from 2000 to 2070.
Give your answer in standard form.

Answer (a) $k =$ [1]

(b).....[1]

- 8 The line $3x + 2y = 8$ crosses the y -axis at the point A .

Find

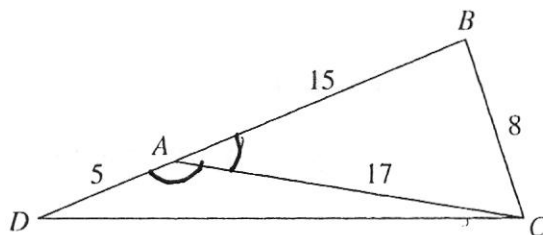
- (a) the coordinates of the point A ,
 (b) the gradient of the line.

Answer (a) (.....,) |1|

(b).....|1|

- 9 In triangle ABC , $AB = 15$ cm,
 $BC = 8$ cm and $AC = 17$ cm.

- (a) Explain why angle ABC is a right angle.
 (b) BA is produced to D and $AD = 5$ cm.



- (i) Find the area of triangle DAC .
 (ii) Write down $\cos \hat{DAC}$.

Answer (a).....

.....|1|

Answer (b)(i)..... cm^2 |1|

(ii) $\cos \hat{DAC} =$ |1|

10 Sandy and Roger took a multiple choice test.

The matrices show the results of the test and the marks awarded.

	Correct	No attempt	Incorrect
Sandy	14	5	1
Roger	15	0	5

	Marks
Correct	2
No attempt	0
Incorrect	-1

(a) Find $\begin{pmatrix} 14 & 5 & 1 \\ 15 & 0 & 5 \end{pmatrix} \begin{pmatrix} 2 \\ 0 \\ -1 \end{pmatrix}$.

(b) Explain what your answer to (a) represents.

Answer (a)

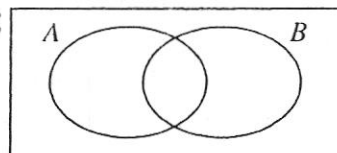
[2]

Answer (b).....

.....[1]

11 (a) On the Venn Diagram shown in the answer space, shade the set $A' \cup B$.

Answer (a) $\mathcal{C}$



[1]

- (b) $\mathcal{C} = \{x : x \text{ is an integer and } x \geq 2\}$
 $P = \{x : x \text{ is a prime number}\}$
 $S = \{x : x \text{ is a perfect square}\}$
 $T = \{x : x \text{ is an integer ending in 2}\}$

Find

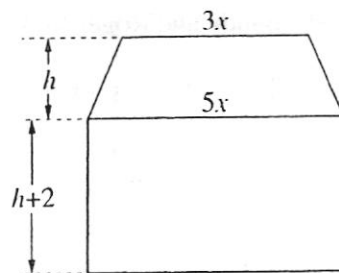
(i) $n(P \cap T)$,

(ii) $n(S \cap T)$.

Answer (b)(i).....[1]

(ii).....[1]

- 12 The figure consists of a trapezium and a rectangle.
The trapezium has parallel sides of length $3x$ and $5x$ and a height of h .
The rectangle has a base of $5x$ and a height of $h + 2$.



- (a) Show that the area, A , of the whole figure is given by the formula

$$A = 9xh + 10x.$$

Answer (a).....

.....

.....[1]

- (b) Rearrange the formula to express x in terms of A and h .

Answer (b) $x =$ [2]

- 13 The braking distance of a car is directly proportional to the square of its speed.
When the speed is p metres per second, the braking distance is 6 m.
When the speed is increased by 300%, find

- (a) an expression for the speed of the car,
(b) the braking distance,
(c) the percentage increase in the braking distance.

Answer (a).....m/s [1]

(b)..... m [1]

(c)..... % [1]

- 14 (a) A group of students took a test.
Their scores are shown in the stem-and-leaf diagram.

- (i) Write down the modal score.

- (ii) Find the median score.

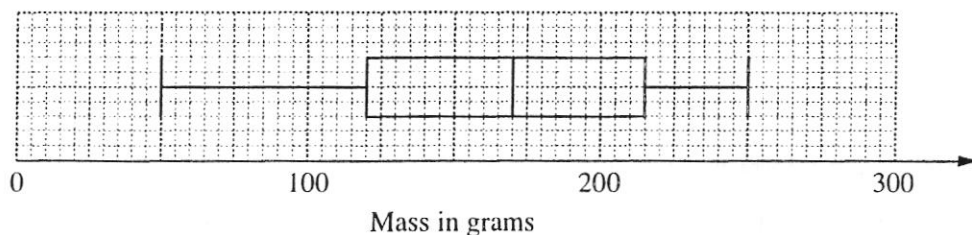
0	7	9							
1	0	6	8	9	9				
2	0	1	2	2	2	3	4	7	8

key 2 | 3 means 23

Answer (a)(i) | 1 |

(ii) [1]

- (b) The box-and-whisker diagram below shows the masses of a number of bananas.



Find the interquartile range.

Answer (b).....g [1]

- 15 (a)** Factorise completely $2x^3 - 13x^2 + 6x$.

Answer (a).....[2]

- (b) Simplify $9a^2 + 1 - (3a - 1)^2$.

Answer (b).....[2]

- 16 (a) A regular polygon has interior angles of 165° .
Find the number of sides of the polygon.
- (b) A 7-sided polygon has 6 interior angles of 125° .
Find the remaining interior angle.

Answer (a).....[2]

(b).....[2]

- 17 (a) (i) Express 1800 as the product of its prime factors.
- (ii) Given that $1800k$ is a perfect cube, write down the smallest possible value of k .
- (iii) Find the highest common factor of 1800 and 42.
- (b) The lights on three lightships flash at regular intervals.
The first light flashes every 12 seconds, the second every 27 seconds and the third every 90 seconds.
The three lights flash together at 0900.
At what time do they next flash together?

Answer (a)(i).....[1]

(ii) $k =$ [1]

(iii)[1]

(b).....[2]

18 (a) (i) Solve the inequality $2 - 2x > 9$.

(ii) Hence write down the greatest integer value of x which satisfies $2 - 2x > 9$.

Answer (a)(i) x [1]

(ii) [1]

(b) Solve the simultaneous equations.

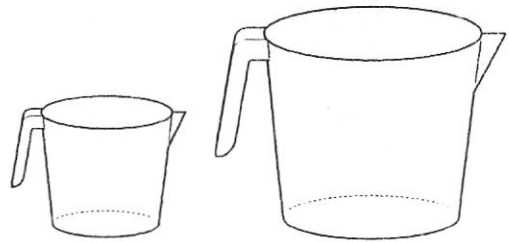
$$\begin{aligned}x - 2y &= 8 \\ 3x &= 19 + 4y\end{aligned}$$

Answer (b) $x =$

$y =$ [3]

19 Two similar jugs have base areas of 45 cm^2 and 125 cm^2 .

- (a) Find, in its simplest integer form, the ratio of the height of the smaller jug to the height of the larger jug.
- (b) The surface area of the top of the smaller jug is 63 cm^2 .
Find the surface area of the top of the larger jug.
- (c) The capacity of the larger jug is 2.5 litres.
Find the capacity of the smaller jug.
Give your answer in cubic centimetres.



Answer (a) : [1]

(b) cm^2 [2]

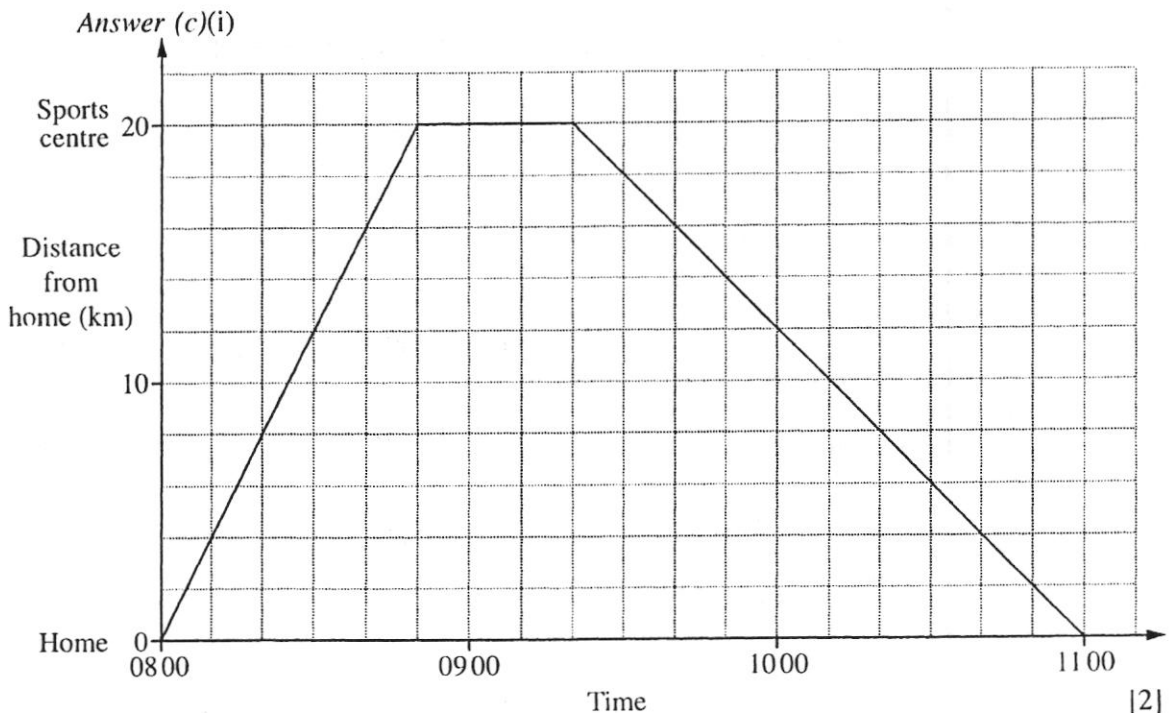
(c) cm^3 [2]

- 20 Alan left home at 08 00 and cycled 20 km to a sports centre.
He later returned home.
The diagram below is Alan's distance-time graph.

- (a) Calculate his speed on the journey from home to the sports centre.
- (b) How far from the sports centre was he at 09 40?
- (c) Alan's sister Brenda followed the same route as Alan to and from the sports centre.
She left home at 08 50 and drove to the sports centre at 60 km/h.
Later she returned home, driving at 60 km/h, arriving at 10 30.
- (i) On the same axes, draw the graph to represent Brenda's journey to and from the sports centre.
- (ii) At what time did Brenda pass Alan on the return journey?

Answer (a) km/h [1]

(b) km [1]

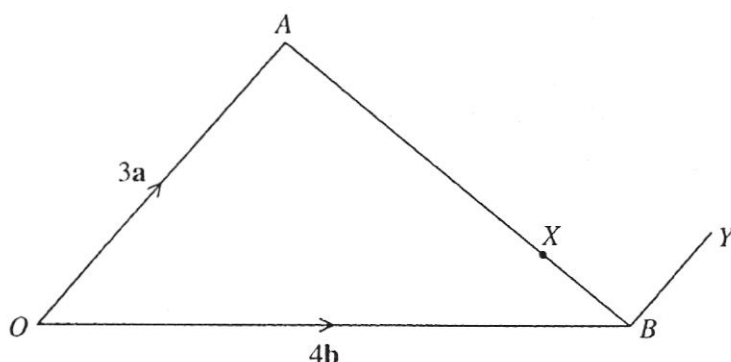


Answer (c)(ii) [1]

21 In the diagram, $\vec{OA} = 3\mathbf{a}$ and $\vec{OB} = 4\mathbf{b}$.

X is the point on AB such that $AX = \frac{3}{4}AB$.

Y is the point such that $\vec{BY} = \frac{1}{3}\vec{OA}$.



(a) Find, in the form $p\mathbf{a} + q\mathbf{b}$,

- (i) $\vec{AB}$,
- (ii) $\vec{AX}$,
- (iii) $\vec{OX}$,
- (iv) $\vec{XY}$.

(b) Use your answers to parts (a)(iii) and (a)(iv) to explain why O , X and Y lie in a straight line.

Answer (a)(i) $\vec{AB} = \dots\dots\dots[1]$

(ii) $\vec{AX} = \dots\dots\dots[1]$

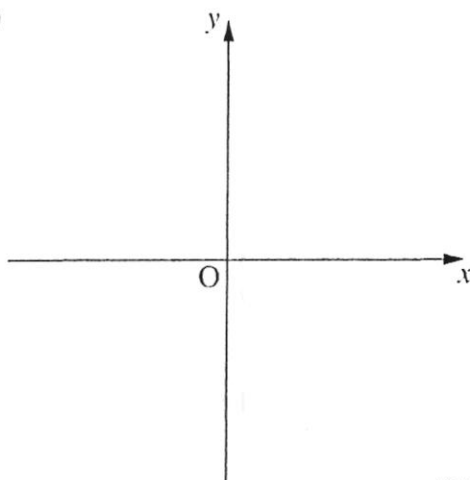
(iii) $\vec{OX} = \dots\dots\dots[1]$

(iv) $\vec{XY} = \dots\dots\dots[2]$

Answer (b).....
[1]

- 22 (a) (i) Sketch the graph of $y = x(3 - x)$.
(ii) Write down the equation of the line of symmetry of $y = x(3 - x)$.

Answer (a)(i)

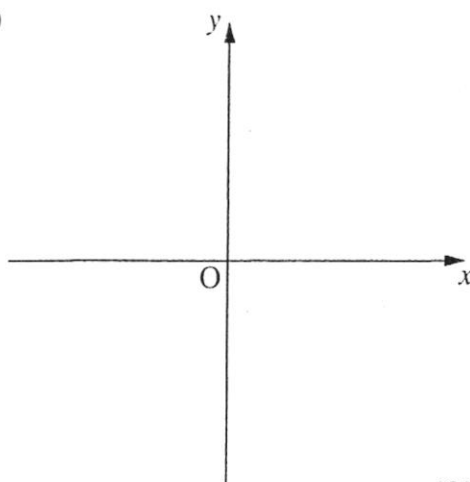


[2]

(ii) [1]

- (b) (i) Sketch the graph of $y = (x + 2)^2 - 1$.
(ii) Write down the coordinates of the minimum point of the curve.

Answer (b)(i)



[2]

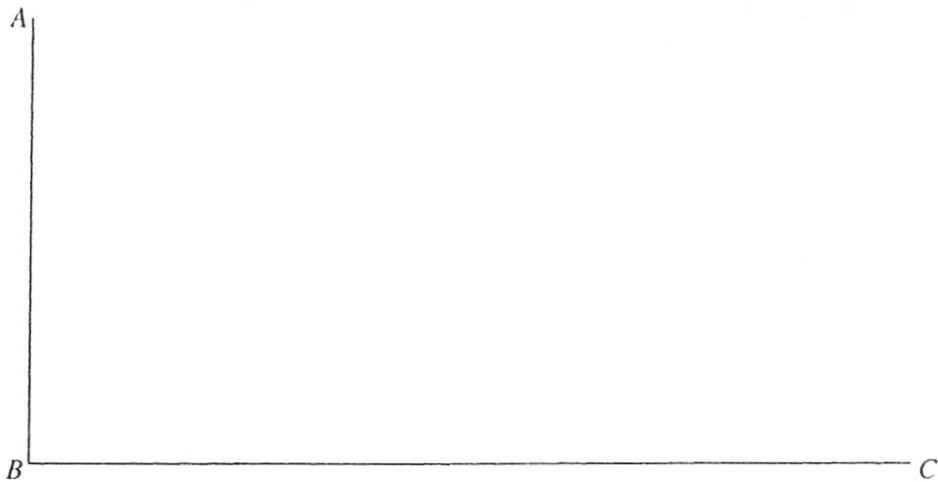
(ii) (.....,) [1]

- 23 The scale drawing in the answer space below shows the positions of the towns A , B and C . A is due North of B .
- (a) Find the bearing of C from A .

Answer (a).....[1]

- (b) The town D is on a bearing of 052° from A and on a bearing of 335° from C .
Find and label the position of the town D .
- (c) A television mast is to be erected equidistant from A , B and C .
By constructing perpendicular bisectors, find and label the position of the mast M .
- (d) Given that $AB = 60\text{ km}$, calculate the distance from D to the mast.

Answer (b) and (c)



[4]

Answer (d)..... km [1]

Answer **all** the questions.

1 (a) Simplify $\frac{7p^2 - 28}{p^2 + 2p}$. [2]

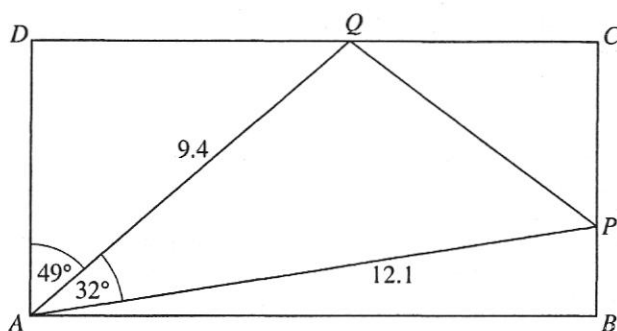
(b) Express as a single fraction in its simplest form,

$$1 - \frac{3f - g}{f + 2g}. \quad [2]$$

(c) (i) Express $x^2 + 11x - 15$ in the form $(x + a)^2 + b$. [1]

(ii) **Hence** solve the equation $x^2 + 11x - 15 = 0$, giving your answers correct to two decimal places. [3]

2



A rectangular advertising hoarding, $ABCD$, is strengthened by three struts, AQ , AP and PQ . $AQ = 9.4$ m, $AP = 12.1$ m, angle $PAQ = 32^\circ$ and angle $QAD = 49^\circ$.

Calculate

(a) AD , [2]

(b) PB , [2]

(c) the area of triangle APQ , [2]

(d) PQ . [3]

- 3 In 2006 the cost of making a souvenir was 90 cents.
- (a) Find the total cost of making 25 000 souvenirs. [1]
- (b) The cost of making **each** souvenir was divided between materials, wages and other expenses in the ratio 5 : 4 : 6 respectively.
- Find the cost of materials and the cost of wages needed to make each souvenir. [2]
- (c) John worked 7 hours per day for 5 days making souvenirs.
He received a wage of \$630 for this work.
- Calculate the number of souvenirs that he made in one hour. [2]
- (d) In 2007 the cost of materials increased by 50% and wages by 10%.
The other expenses remained the same.
- Giving your answer correct to 3 significant figures, calculate the percentage increase in the total cost of making a souvenir. [3]
- (e) A shopkeeper sold a souvenir for \$2.00.
He made a profit of 25% on the price he paid for it.
- Calculate how much he paid for the souvenir. [2]
-

- 4 The first four terms in a sequence of numbers, $u_1, u_2, u_3, u_4, \dots$, are given below.

$$u_1 = 2^0 + 1 = 2$$

$$u_2 = 2^1 + 3 = 5$$

$$u_3 = 2^2 + 5 = 9$$

$$u_4 = 2^3 + 7 = 15$$

- (a) Write down an expression for u_5 and show that $u_5 = 25$. [1]
- (b) Write down an expression for u_6 and evaluate it. [1]
- (c) Find an expression, in terms of n , for the n th term, u_n , of the sequence. [3]
- (d) Evaluate u_{20} . [1]
- (e) (i) Show that $2^{n-1} - 2^{n-2} = 2^{n-2}$. [1]
- (ii) Find, and simplify, an expression, in terms of n , for $u_n - u_{n-1}$. [2]
-

- 5 A trader bought m apples for \$12.

- (a) Find an expression, in terms of m , for the cost, in cents, of each apple. [1]
- (b) It was found that 3 of the apples were bad, and could not be sold.
The trader sold each remaining apple for 2 cents more than she paid for it.

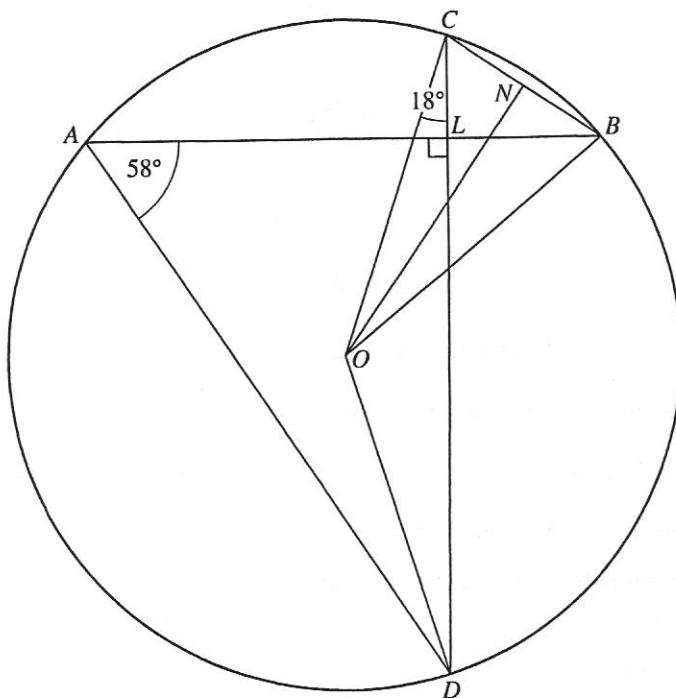
Write down an expression, in terms of m , for the total sum she received from the sale of the apples. [1]

- (c) She made a profit of 96 cents from the sale of the apples.

Write down an equation to represent this information, and show that it simplifies to

$$m^2 - 51m - 1800 = 0. \quad [3]$$

- (d) Solve the equation $m^2 - 51m - 1800 = 0$. [3]
- (e) Find the selling price of each apple. [2]
-



The diagram shows a circle, $ACBD$, with centre O .
 The chords AB and CD intersect at L .
 Angle $ALD = 90^\circ$.

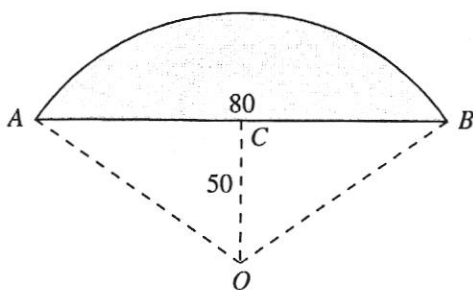
(a) Show that triangles LAD and LCB are similar. [3]

(b) N is the midpoint of BC .
 Angle $OCD = 18^\circ$ and angle $DAB = 58^\circ$.

Find

- | | |
|---------------------|-----|
| (i) angle CNO , | [1] |
| (ii) angle CON , | [1] |
| (iii) angle CBA , | [1] |
| (iv) angle ADO . | [2] |

7 (a)

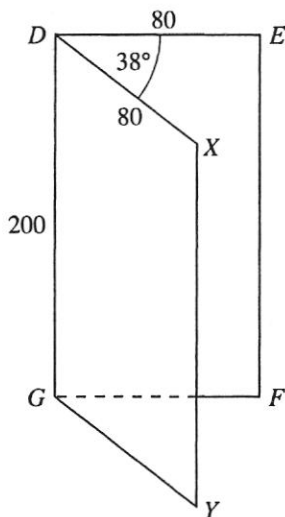


The diagram shows part of a circle, centre O , passing through A and B .
 C is the midpoint of AB .
 $AB = 80\text{ cm}$ and $OC = 50\text{ cm}$.

A window is in the form of a minor segment of the circle, as shaded in the diagram.

- (i) Calculate angle AOB in radians. [2]
- (ii) Calculate the area of the window. [3]

(b)



In the diagram, $DEFG$ represents a rectangular door frame.
 $DXYG$ represents a rectangular door which can turn about DG and fits into the door frame.
The door is opened through 38° , as shown.
 $DE = DX = 80\text{ cm}$ and $DG = 200\text{ cm}$.

Calculate

- (i) the length of the straight line EX , [2]
- (ii) angle FDY . [3]

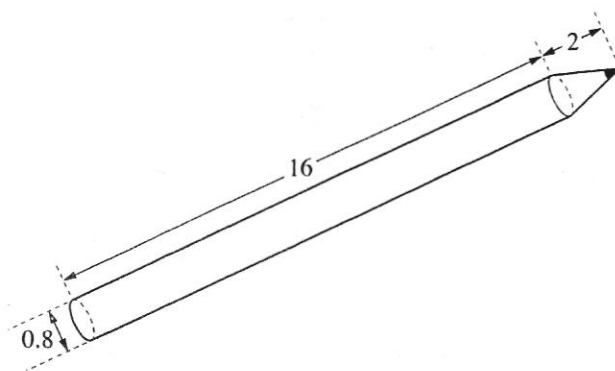


Diagram I

Diagram I shows a pencil.

It is made up of a cylinder, and a cone.

The cylinder has radius 0.4 cm and height 16 cm.

The cone has base radius 0.4 cm and height 2 cm.

(a) Calculate

(i) the slant height of the cone,

[2]

(ii) the total surface area of the pencil.

[3]

(b) Calculate the volume of the pencil.

[3]

(c)

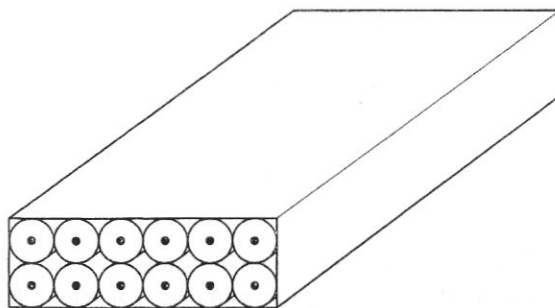


Diagram II

Diagram II shows twelve of these pencils, which just fit into a box.

(i) Show that the volume of the inside of the box is 138.24 cm^3 .

[2]

(ii) Calculate the percentage of the volume of the box that is **not** occupied by the pencils.

[2]

9 Answer the whole of this question on a sheet of graph paper.

The variables x and y are connected by the equation

$$y = \frac{1}{5}x(12 - x^2).$$

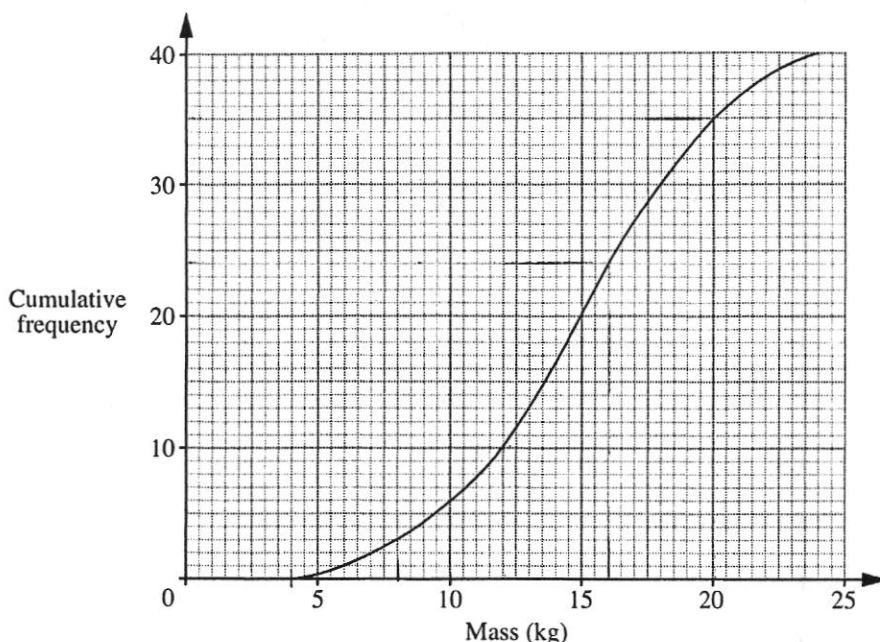
Some corresponding values of x and y are given in the following table.

x	-3	-2	-1	0	1	2	3	4
y	-1.8	-3.2	-2.2	0	2.2	3.2	1.8	p

- (a) Find the value of p . [1]
- (b) Using a scale of 2 cm to 1 unit, draw a horizontal x -axis for $-3 \leq x \leq 4$.
Using a scale of 2 cm to 1 unit, draw a vertical y -axis for $-4 \leq y \leq 4$.
On your axes, plot the points given in the table and join them with a smooth curve. [3]
- (c) Use your graph to find two solutions of $\frac{1}{5}x(12 - x^2) = 1$ in the range $-3 \leq x \leq 4$. [2]
- (d) By drawing a tangent, find the gradient of the curve at the point (3, 1.8). [2]
- (e) On the same axes, draw the graph of $2x + y = 2$ for $-1 \leq x \leq 3$. [2]
- (f) (i) Write down the x coordinate of the point where the two graphs intersect. [1]
(ii) This value of x is a solution of the equation $x^3 + Ax^2 + Bx + C = 0$.
Find the value of A , the value of B and the value of C . [1]
-

- 10 (a) The total mass of the tomatoes produced by each of 40 tomato plants was measured.

The cumulative frequency curve below shows the distribution of the masses.



- (i) Copy and complete the grouped frequency table of the mass of tomatoes on each plant.

Mass (x kg)	$4 \leq x < 8$	$8 \leq x < 12$	$12 \leq x < 16$	$16 \leq x < 20$	$20 \leq x < 24$
Frequency					

[2]

- (ii) Using your grouped frequency table, calculate an estimate of

(a) the mean mass of tomatoes produced by each plant,

[2]

(b) the standard deviation.

[2]

- (iii) The tomatoes produced by another group of 40 plants have the same median but a larger standard deviation.

Describe how the cumulative frequency curve will differ from the given curve.

[1]

- (b) A bag contains six identical balls numbered 1, 2, 3, 4, 5 and 6.
Two balls are drawn at random, one after the other, from the bag without replacement.

(i) Draw the possibility diagram to show the outcome of the draw. [1]

(ii) Find, as a fraction in its simplest form, the probability that

(a) both balls have an even number, [1]

(b) the sum of the numbers drawn is 8, [1]

(c) the product of the numbers drawn is 7, [1]

(d) at least one of the numbers drawn is a multiple of 3. [1]
