

*About*

## MATHEMATICS

(YEARLY)






### *About* **Thinking Process**

In solving mathematical problems, we always work backward. After indentifying our main target, we go 'backward' to look for the 'easier' targets until we are able to solve the problems.

Thinking process reveals how the teacher actually goes about solving a sum in the above-said manner.

### *About* **Teacher's Comments**

It reveals the extra but relevant information which is not required as part of the solutions but are extremely useful in knowing how the solutions are arrived.

 period	<b>2010 to 2022</b>
 contents	<b>June &amp; November, Paper 1 &amp; 2, Worked Solutions</b>
 form	<b>Year By Year</b>
 compiled for	<b>O Level</b>
 special features	<b>Thinking Process, Teacher's Comments</b>

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## 'O' Level Mathematics 4024 (Yearly)

# C O N T E N T S

### *Revised Syllabus*

-  June **2010** Paper 1 & 2  
November **2010** Paper 1 & 2
-  June **2011** Paper 1 & 2  
November **2011** Paper 1 & 2
-  June **2012** Paper 1 & 2  
November **2012** Paper 1 & 2
-  June **2013** Paper 1 & 2  
November **2013** Paper 1 & 2
-  June **2014** Paper 1 & 2  
November **2014** Paper 1 & 2
-  June **2015** Paper 1 & 2  
November **2015** Paper 1 & 2
-  June **2016** Paper 1 & 2  
November **2016** Paper 1 & 2
-  June **2017** Paper 1 & 2  
November **2017** Paper 1 & 2
-  June **2018** Paper 1 & 2  
November **2018** Paper 1 & 2
-  June **2019** Paper 1 & 2  
November **2019** Paper 1 & 2
-  June **2020** Paper 1 & 2  
November **2020** Paper 1 & 2
-  June **2021** Paper 1 & 2  
November **2021** Paper 1 & 2
-  June **2022** Paper 1 & 2  
November **2022** Paper 1 & 2

# J u n e 2 0 2 2

## PAPER 1

**⚡ means " before that, do this ! "**

Answer all questions.

Electronic Calculators Must Not Be Used In This Paper.

Omission Of Essential Working Will Result In Loss Of Marks.

**1** Topic: 1

Work out.

(a)  $\frac{2}{3} + \frac{1}{6}$  [1]

(b)  $0.4 \times 0.2$  [1]

**Thinking Process**

- (a) Make common denominator. Add.
- (b) evaluate  $4 \times 2$  and count the number of decimal places.

**Solution**

(a)  $\frac{2}{3} + \frac{1}{6}$   
 $= \frac{4+1}{6} = \frac{5}{6}$  Ans.

(b)  $4 \times 2 = 8$   
 $\therefore 0.4 \times 0.2 = 0.08$  Ans.

**2** Topic: 18

Asha asks a group of students about their favourite fruit.

The table and pictogram show some of the results.

Fruit	Apple	Banana	Orange	Melon
Frequency	8		5	

Apple	
Banana	○○○
Orange	
Melon	○○

Key: ○ represents 4 people

- (a) Complete the table and pictogram. [3]
- (b) Write down the mode. [1]

**Thinking Process**

- (a) Complete the table and pictogram by using the given key.
- (b) Look for the fruit that has the highest frequency.

**Solution**

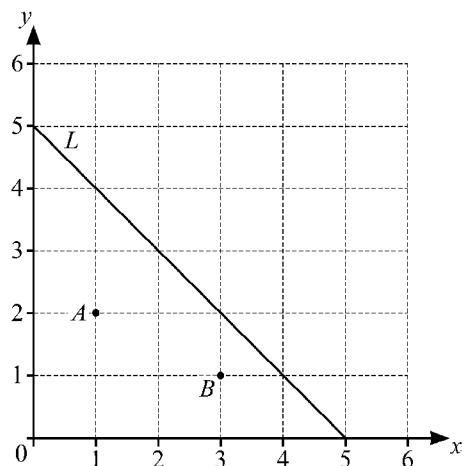
(a)

Fruit	Apple	Banana	Orange	Melon
Frequency	8	12	5	7

Apple	○○○
Banana	○○○○
Orange	○○
Melon	○○

(b) Mode = Banana Ans.

**3** Topic: 11



A and B are vertices of a quadrilateral. Line L is the line of symmetry of the quadrilateral. Find the coordinates of the other two vertices of the quadrilateral. [2]

**Thinking Process**

Note that,  $A(1, 2) \rightarrow (3, 4)$  and  $B(3, 1) \rightarrow (4, 2)$

**Solution**

The other two vertices are,  
(3, 4) and (4, 2) **Ans.**

**4** *Topic: 1a*

- (a) The temperature inside Luke's house is 18 °C.  
The temperature outside his house is -3 °C.  
Find the difference between these temperatures. [1]
- (b) Luke's thermometer measures the temperature correct to the nearest degree.  
At midnight, the thermometer measures the temperature outside as -6 °C.  
Find the upper bound of the temperature outside at midnight. [1]

**Thinking Process**

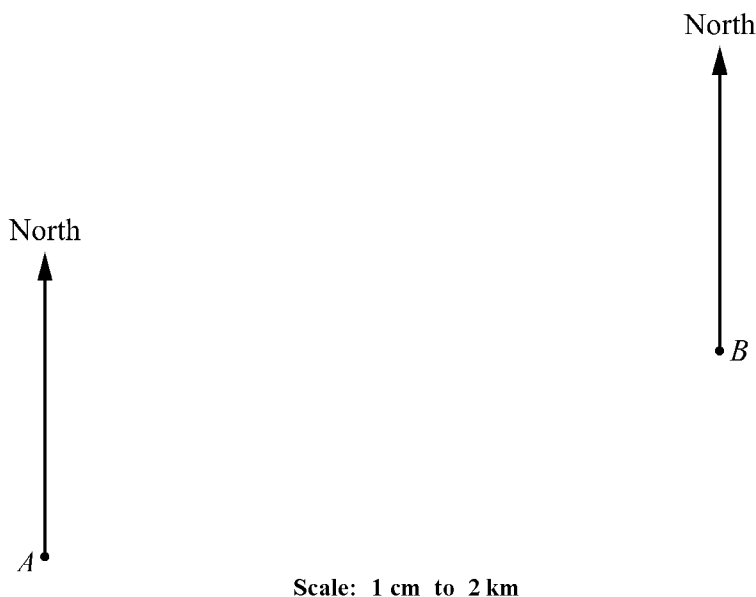
- (b) To find the upper bound ✎ add 0.5° (i.e. 1÷2) to -6 °C.

**Solution**

- (a) Difference =  $18 - (-3)$   
 $= 18 + 3 = 21$  °C
- (b) Upper bound of temperature  
 $= -6 + 0.5 = -5.5$  °C

**5** *Topic: 12*

The scale drawing shows the positions of two villages, *A* and *B*.  
The scale is 1 cm to 2 km.



- (a) Find the actual distance between village *A* and village *B*. [2]  
(b) Measure the bearing of *B* from *A*. [1]

**Thinking Process**

- (a) Measure *AB* from the figure in cm. Convert it into km according to the given scale.  
(b) Use protractor to measure the required bearing.

**Solution**

- (a) From figure  $AB = 9.3$  cm  
 $\therefore$  Actual distance between *A* and *B* =  $9.3 \times 2 = 18.6$  km **Ans.**
- (b) Bearing of *B* from *A* =  $073^\circ$  **Ans.**

6 *Topic: 1a*

Kabir invests \$250 in a savings account. The account pays simple interest at a rate of 1.5% per year. Calculate the total amount of interest he will receive at the end of 4 years. [2]

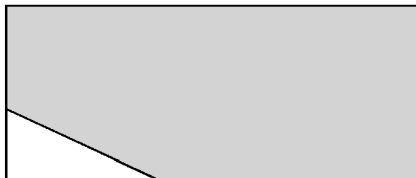
**Thinking Process**

Find the simple interest. Apply  $I = \frac{PRT}{100}$

**Solution**

$$\begin{aligned} \text{Simple interest} &= \frac{PRT}{100} \\ &= \frac{\$250 \times 1.5 \times 4}{100} = \$15 \quad \text{Ans.} \end{aligned}$$

7 *Topic: 10*



(Not to Scale)

The area of the rectangle is 9 cm<sup>2</sup>. The area of the triangle is 85 mm<sup>2</sup>. Calculate the shaded area. Give your answer in cm<sup>2</sup>. [2]

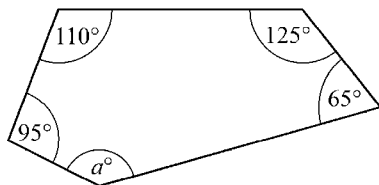
**Thinking Process**

Express 85 mm<sup>2</sup> in terms of cm<sup>2</sup>.

**Solution**

$$\begin{aligned} 85 \text{ mm}^2 &= \frac{85}{100} \text{ cm}^2 = 0.85 \text{ cm}^2 \\ \therefore \text{Shaded area} &= 9 - 0.85 \\ &= 8.15 \text{ cm}^2 \quad \text{Ans.} \end{aligned}$$

8 *Topic: 13*



The diagram shows a pentagon. Find the value of  $a$ . [3]

**Thinking Process**

To find  $a$  ✎ Find the sum of all angles in a pentagon.

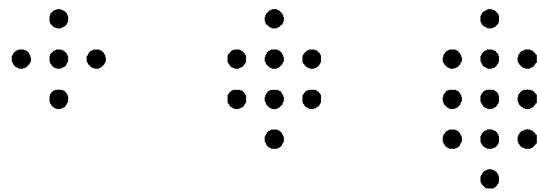
**Solution**

$$\begin{aligned} \text{Sum of all angles in a pentagon} &= (5 - 2)180^\circ \\ &= 540^\circ \end{aligned}$$

$$\begin{aligned} \therefore a^\circ + 65^\circ + 125^\circ + 110^\circ + 95^\circ &= 540^\circ \\ \Rightarrow a^\circ + 395^\circ &= 540^\circ \\ \Rightarrow a^\circ &= 540^\circ - 395^\circ = 145^\circ \quad \text{Ans.} \end{aligned}$$

9 *Topic: 22*

Shani makes a sequence of patterns using counters.



Pattern 1                      Pattern 2                      Pattern 3

(a) Complete the table.

Pattern number	1	2	3	4	5
Number of counters	5	8	11		

[1]

(b) Find an expression, in terms of  $n$ , for the number of counters in Pattern  $n$ . [2]

(c) Shani has 100 counters. She uses some of the counters to make Pattern 20.

She uses all the remaining counters to make Pattern  $k$ .

Find the value of  $k$ . [3]

**Thinking Process**

(a) Note that terms in the sequence differ by 3.

(c) Find the number of counters required to make pattern 20. Then find the remaining counters and equate it to the expression found in (b).

**Solution**

(a)

Pattern number	1	2	3	4	5
Number of counters	5	8	11	14	17

(b) No. of counters in pattern  $n = 3n + 2$  **Ans.**

(c) No. of counters needed for pattern 20

$$= 3(20) + 2 = 62$$

$$\text{Remaining counters} = 100 - 62 = 38$$

$$\text{No. of counters in pattern } k = 3k + 2$$

$$\Rightarrow 3k + 2 = 38$$

$$\Rightarrow 3k = 36 \Rightarrow k = 12 \quad \text{Ans.}$$

**10** Topic: 1

A bag contains red balls, blue balls and green balls.

The ratio red : blue = 3 : 8.

The ratio green : blue = 2 : 5.

Work out the fraction of the balls that are blue. [3]

**Solution**

red : blue : green

$$\begin{array}{ccc} 3 & : & 8 \\ & \nearrow & \searrow \\ & 5 & : & 2 \end{array}$$

⇒ red : blue : green = 15 : 40 : 16

Sum of ratios = 15 + 40 + 16 = 71

∴ Fraction of blue balls =  $\frac{40}{71}$  **Ans.**

**Thinking Process**

To find the fraction of blue balls  $\frac{\text{blue}}{\text{total}}$  express the ratios in the form red : blue : green.

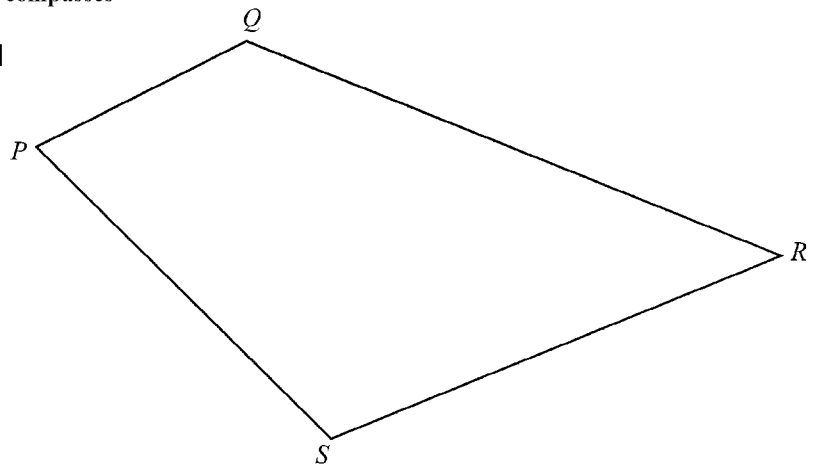
**11** Topic: 12

(a) Use a straight edge and compasses

only to construct the bisector of angle  $PSR$ . [2]

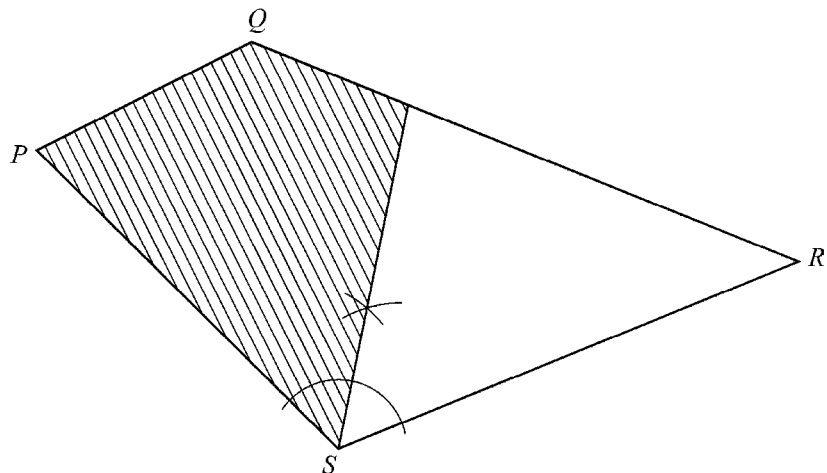
(b) Point  $X$  lies inside quadrilateral  $PQRS$  and is closer to  $PS$  than to  $RS$ .

Shade the region in which  $X$  must lie. [1]



**Solution**

(a) & (b)



# November 2022

## PAPER 2

means “ before that, do this ! ”

**Total** [100 marks]

*Answer all the questions.*

**1** *Topic: 1a*

- (a) Hala travels from London to Marseille by train. She must change trains in Paris. The journey from London to Paris takes 2 hours 28 minutes. The journey from Paris to Marseille takes 3 hours 30 minutes. The local time in Marseille and in Paris is 1 hour ahead of the local time in London.
- (i) Complete the timetable for Hala's journey.

Local time	
London depart	.....
Paris arrive	16 50

Local time	
Paris depart	19 31
Marseille arrive	.....

- [2]
- (ii) Work out how long Hala waits in Paris before the train to Marseille departs. [1]
- (b) The exchange rate between dollars (\$) and pounds (£) is \$1 = £0.75 . The exchange rate between dollars (\$) and euros (€) is \$1 = €r. Hala changes £250 into euros. She receives €290. Calculate the value of r. [3]
- (c) (i) Josef books a holiday for 3 people. The holiday costs \$420 per person. Josef pays a deposit of 20% of the total cost of the holiday. Calculate the amount Josef pays as the deposit. [2]
- (ii) Josef pays a total of \$85.68 for airport parking for 8 days. This price includes a reduction of 15% of the full price for booking early. Calculate the full price for airport parking for 1 day. [3]

### Thinking Process

- (a) (i) Subtract 02 28 from 16 50. Then subtract 1 hour from the answer to get the London local time. For Marseille arrival time, add 03 30 to 19 31.
- (ii) Subtract 16 50 from 19 31 Express 19 31 as 18 91.
- (b) Divide r by 0.75 to get £1 worth of euros. Similarly divide 290 by 250 to get £1 worth of euros. Equate the two equations to find r.
- (c) (ii) \$85.68 price is equivalent to 85%. Hence find 100% of the price. Then divide by 8 to find the parking price for one day.

### Solution

- (a) (i)  $16\ 50 - 02\ 28 = 14\ 22$   
 $\therefore$  London departure time =  $14\ 22 - 01\ 00$   
 $= 13\ 22$  **Ans.**
- Marseille arrival time =  $19\ 31 + 03\ 30$   
 $= 22\ 61 = 23\ 01$  **Ans.**
- (ii)  $1931 - 1650$   
 $= 18\ 91 - 16\ 50 = 02\ 41$   
 $\therefore$  Hala waits for 2 hours 41 minutes. **Ans.**
- (b) Given that, \$1 = £0.75 and \$1 = €r  
 $\Rightarrow \text{£}0.75 = \text{€}r \Rightarrow \text{£}1 = \text{€} \frac{r}{0.75}$  ..... (1)
- Hala receives €290 from £250  
 $\therefore \text{£}250 = \text{€}290 \Rightarrow \text{£}1 = \text{€} \frac{290}{250}$  ..... (2)
- From (1) and (2),  
 $\frac{r}{0.75} = \frac{290}{250}$   
 $\Rightarrow r = \frac{290}{250} \times 0.75 = 0.87$  **Ans.**
- (c) (i) Holiday cost for 3 people =  $\$420 \times 3 = \$1260$   
 $\therefore$  Deposit paid =  $\frac{20}{100} \times \$1260 = \$252$  **Ans.**
- (ii)  $100\% - 15\% = 85\%$   
 $85\% \text{ — } \$85.68$   
 $100\% \text{ — } \frac{\$85.68}{85} \times 100 = \$100.80$   
 Full price for 8 day parking = \$100.80  
 $\therefore$  Full price for 1 day parking =  $\frac{\$100.80}{8}$   
 $= \$12.60$  **Ans.**

2 Topic: 18

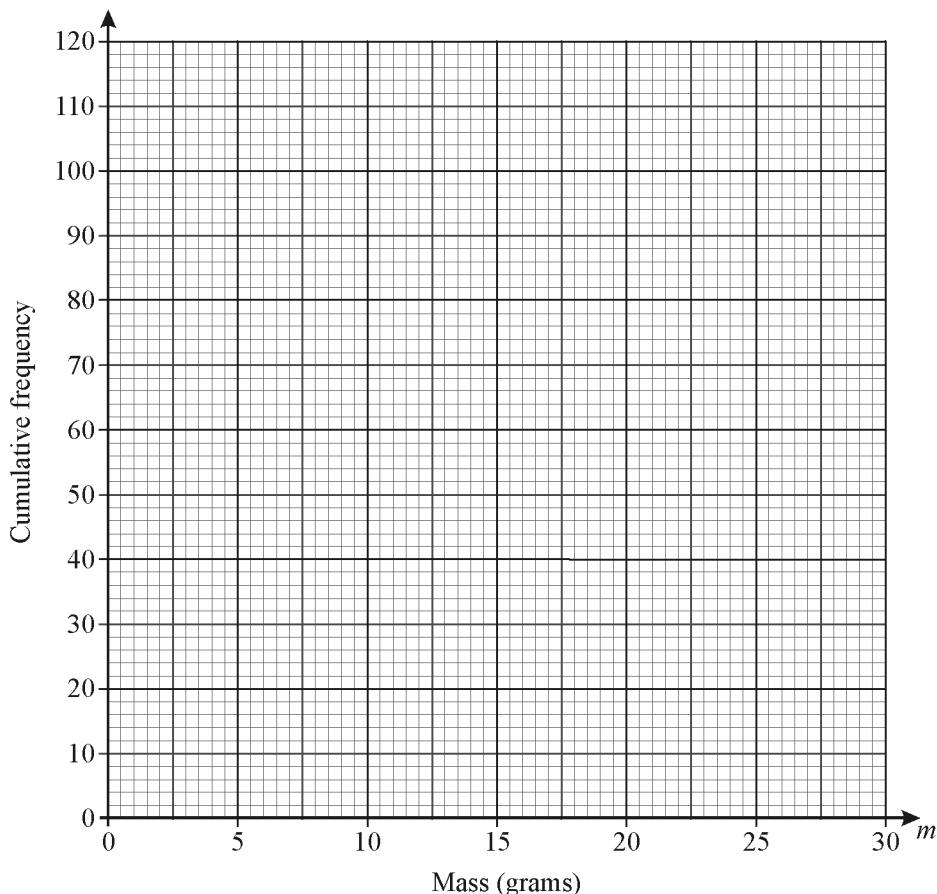
- (a) Marco grows two types of tomato plants, type A and type B.  
He counts the number of tomatoes growing on each tomato plant.  
The results for type A plants are shown in the table.

Number of tomatoes on plant	17	18	19	20	21	22
Frequency	5	2	7	3	2	1

- (i) Calculate the mean number of tomatoes per plant. [2]  
 (ii) Calculate the range. [1]  
 (iii) The mean number of tomatoes per plant for type B plants is 17.1 and the range is 8.  
 Make two comments comparing the number of tomatoes growing on type A and type B plants. [2]
- (b) Marco also grows strawberries.  
He records the masses,  $m$  grams, of 120 of his strawberries.  
The frequency table shows the results.

Mass ( $m$ grams)	$5 < m \leq 10$	$10 < m \leq 15$	$15 < m \leq 20$	$20 < m \leq 25$	$25 < m \leq 30$
Frequency	15	38	45	17	5

- (i) Draw a cumulative frequency diagram to represent these results. [3]



- (ii) Marco uses strawberries with a mass greater than 21 grams to make jam.  
Use your diagram to find an estimate for the percentage of strawberries he uses to make jam. [3]



**Thinking Process**

- (a) (i) To find mean ✎ divide the total number of tomatoes by the total frequency.
- (ii) To find the range ✎ subtract the least number of tomatoes from the largest number of tomatoes.
- (iii) To make comments ✎ Compare the mean and range of type A and type B plants.
- (b) (i) Add up the frequencies to find cumulative frequency of each class. Plot the points and draw a curve.
- (ii) From graph, find the number of strawberries that corresponds to 21 grams. Subtract it from 120 and express it as a percentage of the total number of strawberries.

**Solution**

(a) (i) Mean = 
$$\frac{(17 \times 5) + (18 \times 2) + (19 \times 7) + (20 \times 3) + (21 \times 2) + (22 \times 1)}{5 + 2 + 7 + 3 + 2 + 1}$$

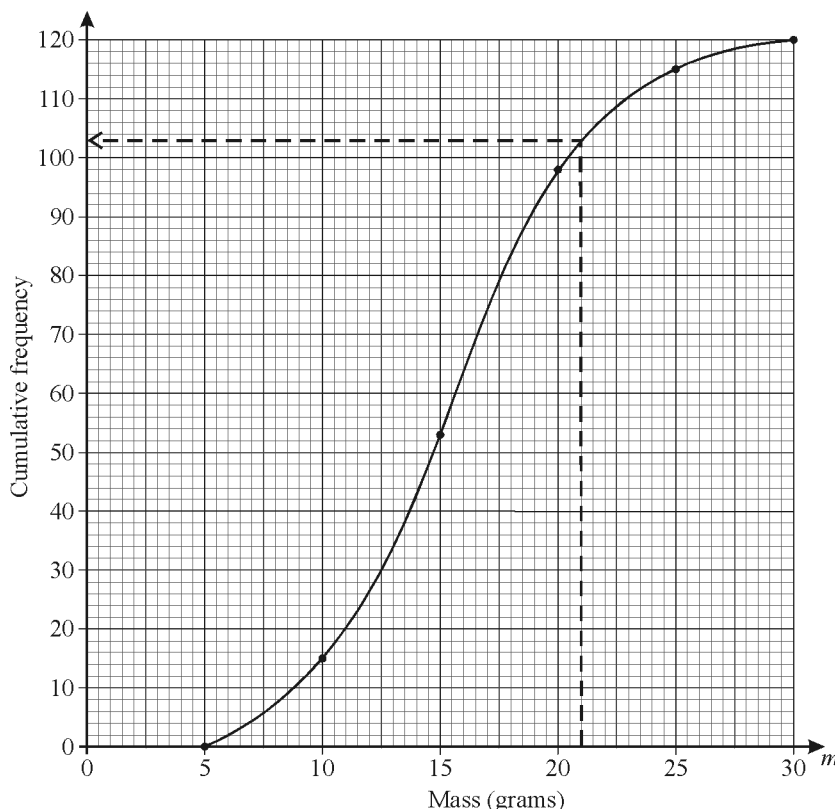
$$= \frac{85 + 36 + 133 + 60 + 42 + 22}{20} = \frac{378}{20} = 18.9 \text{ Ans.}$$

(ii) Range = 22 - 17 = 5 Ans.

- (iii) 1. Type A has more tomatoes per plant since the mean number of tomatoes per plant for type A is greater than type B
- 2. Number of tomatoes per plant is more consistent for type A since range of type A is smaller than range of type B.

(b) (i)

Mass ( $m$ grams)	$5 < m \leq 10$	$10 < m \leq 15$	$15 < m \leq 20$	$20 < m \leq 25$	$25 < m \leq 30$
Frequency	15	38	45	17	5
Cumulative freq.	15	53	98	115	120



- (ii) From graph, Number of strawberries with mass 21g = 103  
 $\therefore$  Number of strawberries with mass greater than 21g = 120 - 103 = 17

Percentage of strawberries used =  $\frac{17}{120} \times 100 = 14.2\% \text{ Ans.}$

**3** Topic: 7

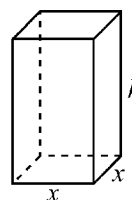
A cuboid has height  $h$  cm and a square base of edge  $x$  cm.  
The volume of the cuboid is  $60 \text{ cm}^3$ .

(a) Show that the surface area,  $A \text{ cm}^2$ , of the cuboid is given by

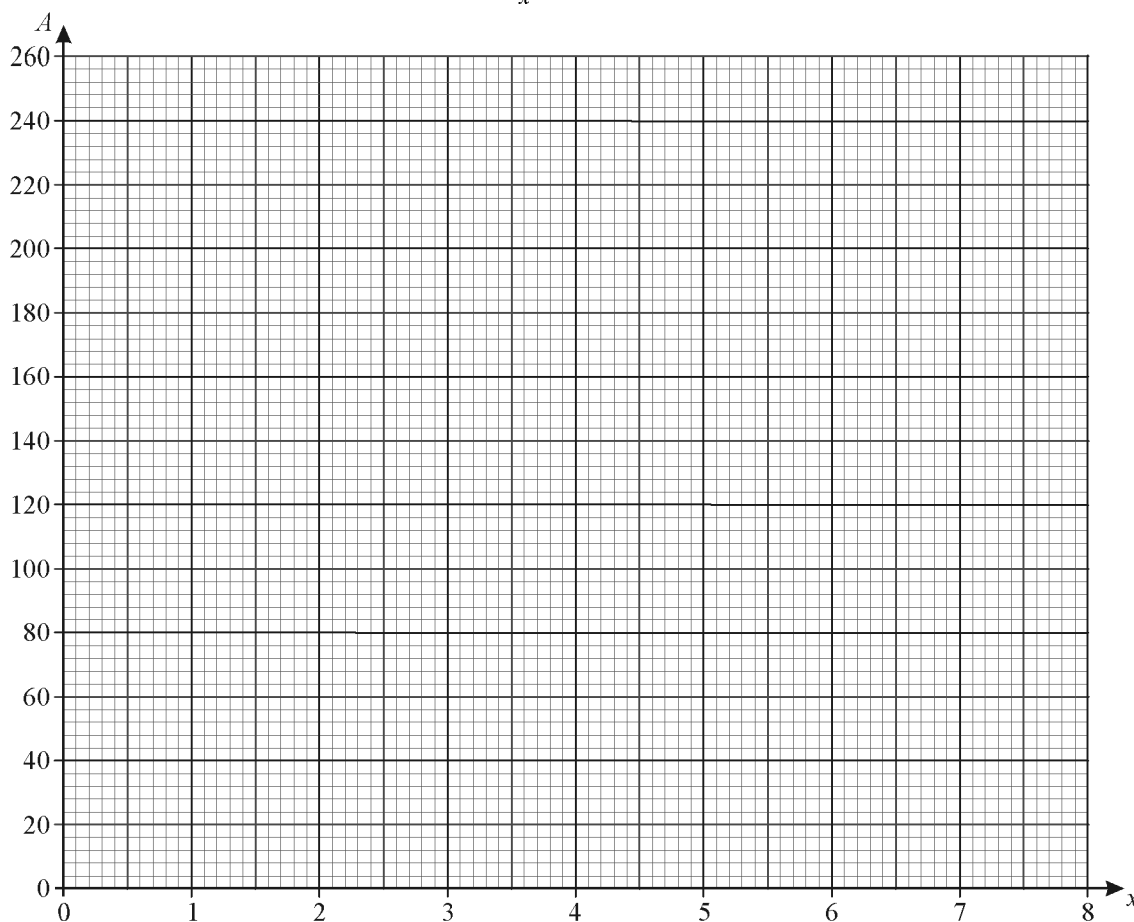
$$A = 2x^2 + \frac{240}{x} \quad [2]$$

(b) Complete the table for  $A = 2x^2 + \frac{240}{x}$ . [2]

$x$	1	2	3	4	5	6	7	8
$A$	242	128	98	92			132	158



(c) On the grid, draw the graph of  $A = 2x^2 + \frac{240}{x}$  for  $1 \leq x \leq 8$ . [3]



(d) Find the minimum possible surface area of the cuboid. [1]

(e) The cuboid has a surface area of  $120 \text{ cm}^2$ .

The height of the cuboid is greater than the length of the edge of its base.

Find the dimensions of the cuboid. [3]

**Thinking Process**

(a) Equate  $60 \text{ cm}^3$  to the formula for volume of cuboid to find  $h$ . Then Apply, surface area =  $2(LxW) + 2(LxH) + 2(WxH)$

(e) From graph, read the values of  $x$  when  $A$  is 120. Then use the minimum value of  $x$  to find the dimensions.

**Solution**

(a) Volume of cuboid =  $x \times x \times h$

$$\Rightarrow 60 = x^2 h \Rightarrow h = \frac{60}{x^2}$$

$$\text{Surface area} = 2(x \times x) + 2(x \times h) + 2(x \times h)$$

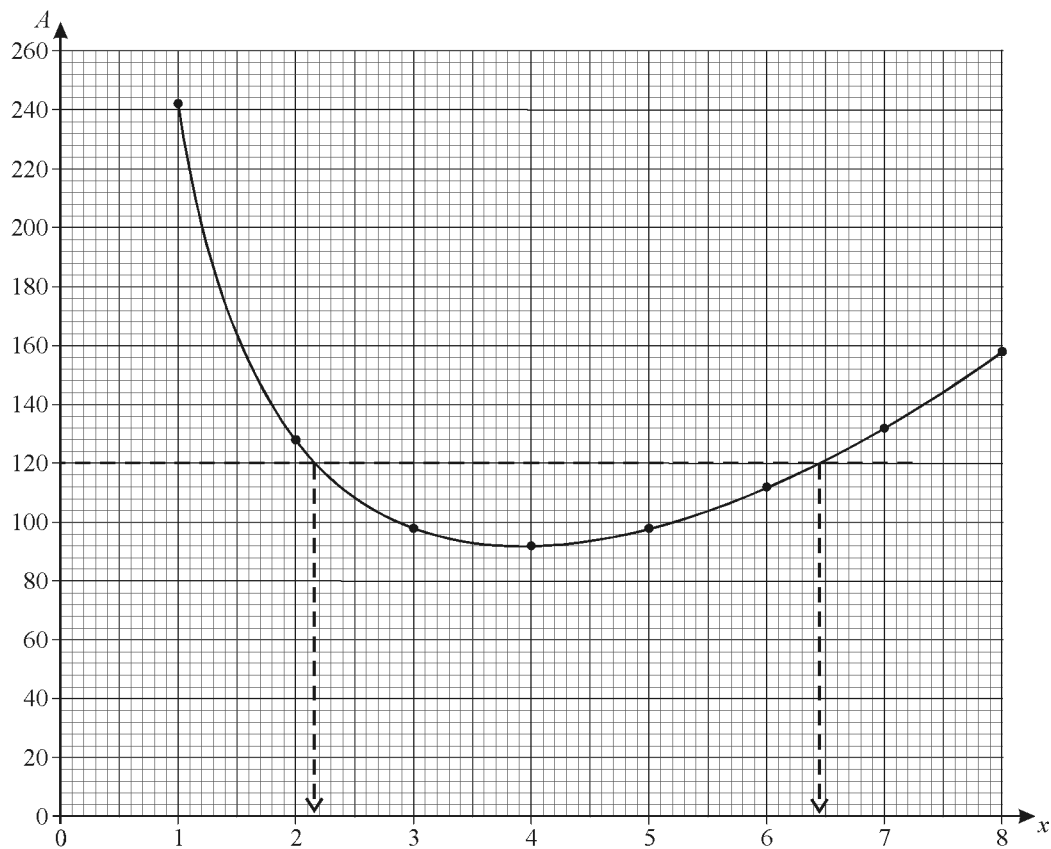
$$\Rightarrow A = 2x^2 + 4xh$$

$$\Rightarrow A = 2x^2 + 4x\left(\frac{60}{x^2}\right) \Rightarrow A = 2x^2 + \frac{240}{x} \quad \text{Shown.}$$

(b) When  $x = 5$ ,  $A = 2(5)^2 + \frac{240}{5} = 98$  **Ans.**

When  $x = 6$ ,  $A = 2(6)^2 + \frac{240}{6} = 112$  **Ans.**

(c)



(d) From graph,  
minimum surface area =  $92 \text{ cm}^2$  **Ans.**

(e) From graph, when  $A = 120 \text{ m}$ ,  
 $x = 2.15 \text{ cm}$  or  $x = 6.45 \text{ cm}$   
As the height of cuboid is greater than length  
 $\therefore x = 2.15 \text{ cm}$

$$\text{height, } h = \frac{60}{(2.15)^2} = 12.98 \approx 13 \text{ cm}$$

$\therefore$  Dimensions of cuboid are,  
2.15cm by 2.15cm by 13cm. **Ans.**