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Answer **all** questions.

- 1 (a) Calculate the exact value of  $(-2 + 0.25)^2$ .

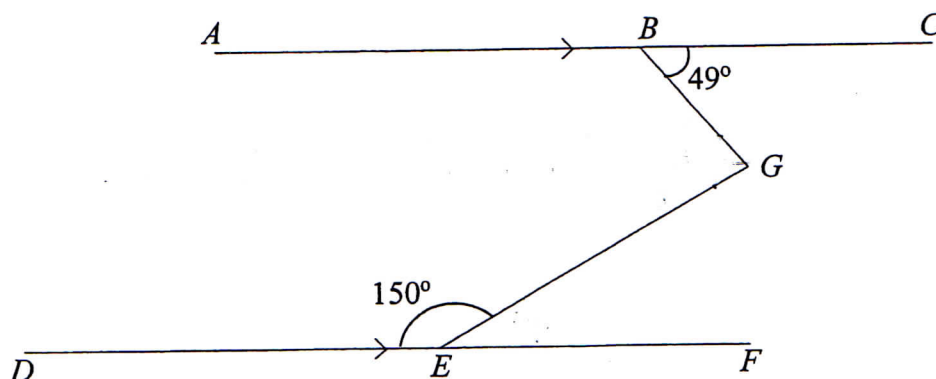
Answer (a) \_\_\_\_\_ [1]

- (b) Calculate  $\frac{\sqrt{241.97}}{3.88} + 5$ .

Give your answer correct to 2 decimal places.

Answer (b) \_\_\_\_\_ [1]

2



In the diagram, line  $AC$  is parallel to line  $DF$ , angle  $GBC = 49^\circ$  and angle  $DEG = 150^\circ$ .

Show, giving reasons, that angle  $EGB$  is  $79^\circ$ .

Answer \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

- 3 (a) Solve the inequality  $1 - 2x > 5$ .

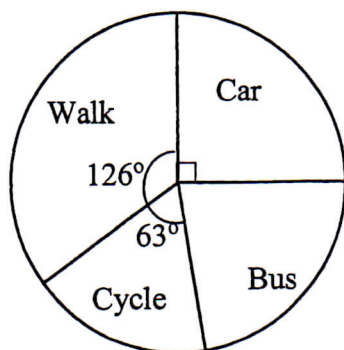
Answer (a) \_\_\_\_\_ [1]

- (b) Represent the solution of  $1 - 2x > 5$  on the number line below.

Answer



- 4 A survey was done with a class of students to find out the mode of transport they take to school.  
The results are represented in the pie chart below.



A student was selected at random.  
Find the probability that the student selected

- (a) comes to school by car,

Answer (a) \_\_\_\_\_ [1]

- (b) takes the bus to school.

Answer (b) \_\_\_\_\_ [1]

- 5 Make  $n$  the subject of the formula  $m = t(2n + 1)$ .

Answer  $n =$  \_\_\_\_\_ [2]

- 6 The first six terms of a number sequence are 7, 3,  $a$ ,  $b$ ,  $-9$  and  $c$ .

- (a) Find the values of  $a$ ,  $b$  and  $c$ .

Answer (a)  $a =$  \_\_\_\_\_  
 $b =$  \_\_\_\_\_  
 $c =$  \_\_\_\_\_ [1]

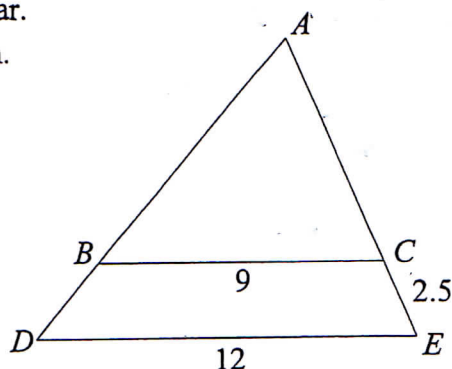
- (b) Ali observes that all the terms in the sequence are odd.  
 He says that  $-67$  is also a term of this sequence.  
 Do you agree with him? Explain your answer.

Answer

[1]

- 7 Triangle  $ABC$  and triangle  $ADE$  are similar.  
 $BC = 9$  cm,  $DE = 12$  cm and  $CE = 2.5$  cm.

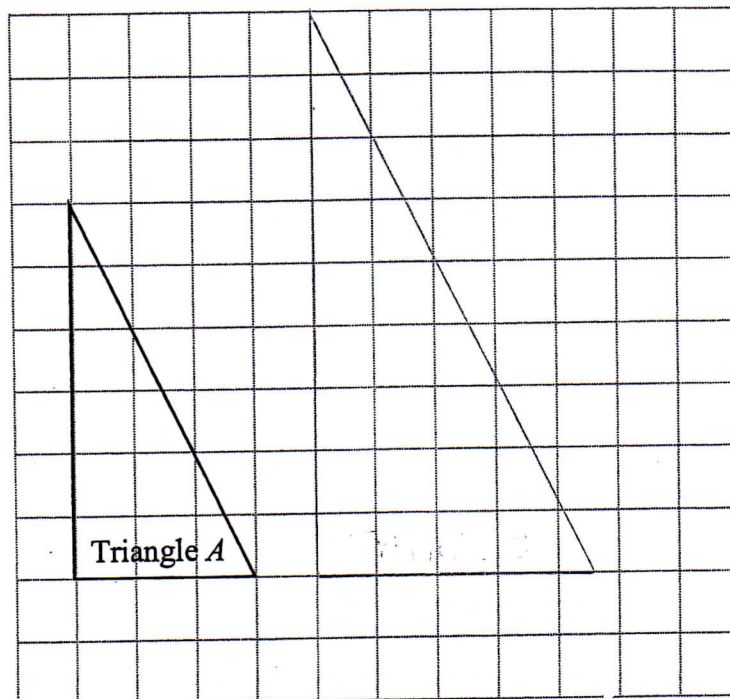
Find the length of  $AC$ .



Answer \_\_\_\_\_ cm [2]

Draw triangle  $C$  on the same grid.

*Answer*



[2]

- 9 In an octagon, three of the interior angles are  $(x + 50)^\circ$ ,  $(2x - 15)^\circ$  and  $3x^\circ$ . The rest of the interior angles are  $x^\circ$ .

(a) Find the value of  $x$ .

[2]

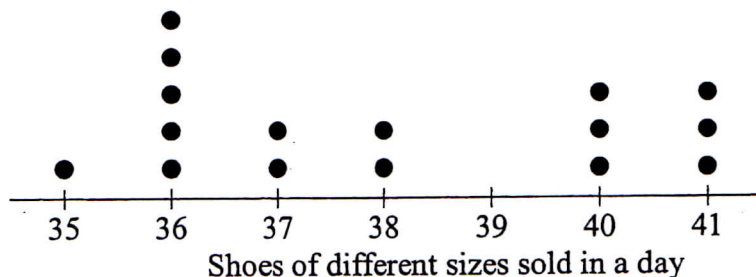
(b) Hence, write down the largest exterior angle.

*Answer (b)* \_\_\_\_\_  $^\circ$  [1]

- 10 A cylindrical cup has a radius of 5 cm and height 13 cm.  
The external surface of the cup is to be painted with gold paint.  
Find the total surface area to be painted. Leave your answer in terms of  $\pi$ .

Answer \_\_\_\_\_  $\pi$  cm<sup>2</sup> [3]

11



The dot diagram above shows the shoes of different sizes sold in a shop on a particular day.

- (a) Find the modal shoe size.

Answer (a) \_\_\_\_\_ [1]

- (b) Find the median shoe size.

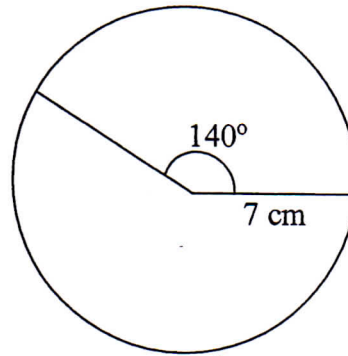
Answer (b) \_\_\_\_\_ [1]

- (c) The mean shoe size of the shoes sold is 38.  
Is it advisable for the shop owner to stock up on size 38 shoes?  
Explain your answer.

Answer \_\_\_\_\_

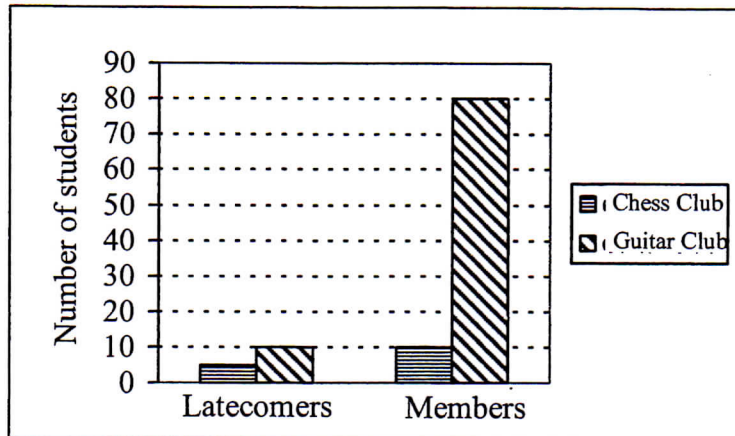
[1]

- 12 The diagram shows a circle with radius 7 cm.  
Find the perimeter of the major sector.



Answer \_\_\_\_\_ cm [3]

13



The bar chart above shows the number of latecomers and the total number of members from the Chess Club and Guitar Club respectively.

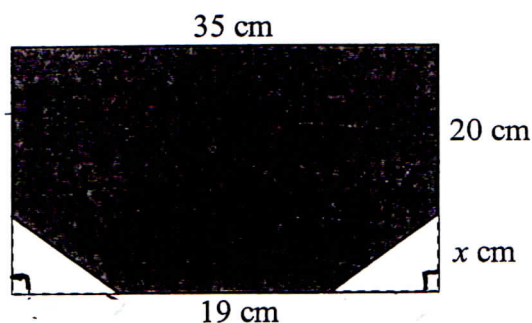
Raymond claims that students in the Chess Club are more punctual as there are less latecomers from the Chess Club.

With the use of appropriate calculations, explain why Raymond is wrong.

Answer \_\_\_\_\_

[3]

14



In the figure above, two congruent triangles are cut off from a rectangle.  
Given that the **shaded** area is  $862 \text{ cm}^2$ , find the value of  $x$ .

Answer  $x =$  \_\_\_\_\_ [3]

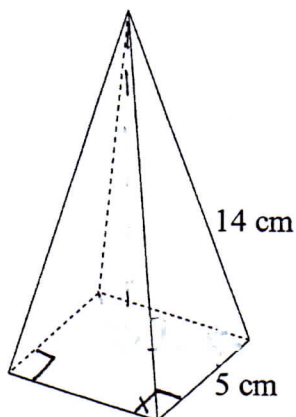
15 Solve the simultaneous equations.

$$4x - 3y = 2$$

$$y = 2x + 1$$

Answer  $x =$  \_\_\_\_\_  
 $y =$  \_\_\_\_\_ [3]

16



The diagram shows a pyramid with a square base of sides 5 cm and slant height 14 cm.

Find the volume of the pyramid.

Answer \_\_\_\_\_ cm<sup>3</sup> [3]

- 17 (a) Write as a single fraction in its simplest form  $\frac{1}{2a} + \frac{1}{3a}$ .

Answer (a) \_\_\_\_\_ [1]

- (b) Simplify  $\frac{4x+10}{4x^2-25}$ .

Answer (b) \_\_\_\_\_ [2]

- 18 The frequency table below shows the speed of 80 cars travelling along Punggol Road.

|                  |    |
|------------------|----|
| $30 \leq x < 40$ | 12 |
| $40 \leq x < 50$ | 37 |
| $50 \leq x < 60$ | 24 |
| $60 \leq x < 70$ | 6  |
| $70 \leq x < 80$ | 1  |

- (a) Calculate an **estimate** of the mean speed of the cars travelling along Punggol Road.

Answer (a) \_\_\_\_\_ km/h [3]

- (b) The estimated mean of 60 cars travelling along Sengkang Road is 52.4 km/h.  
On which road are the cars travelling at a higher speed?  
Give a reason for your answer.

Answer \_\_\_\_\_ [1]

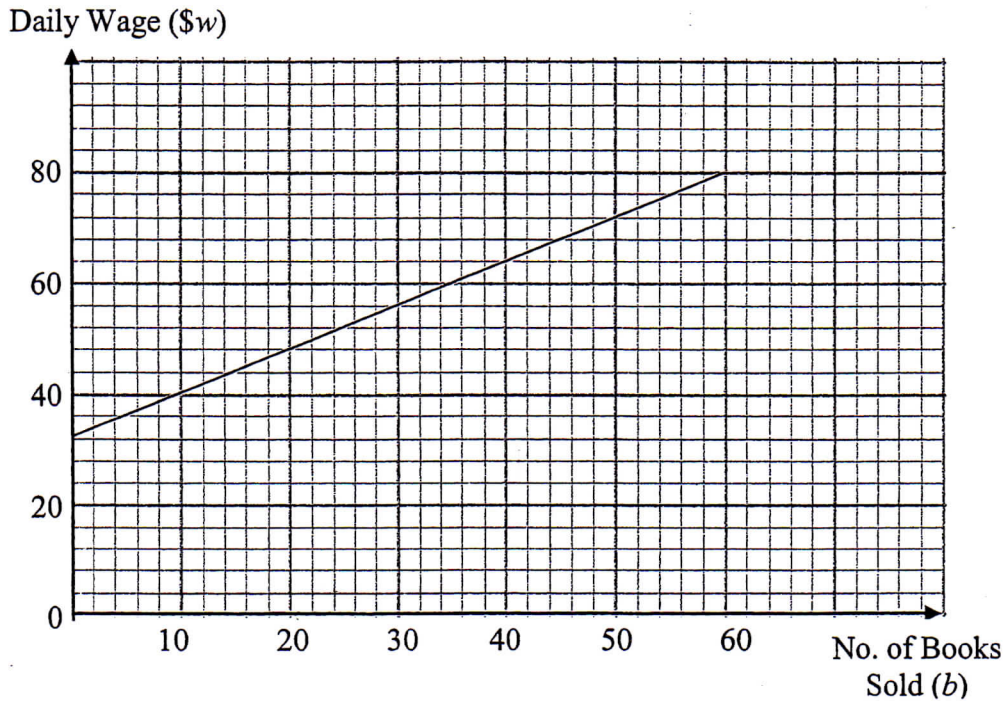
- 19 (a) The population of Singapore is 5.7 million in 2017.  
This population figure is a 46% increase from 2010.  
Find the population of Singapore in 2010.  
Give your answer in million.

Answer (a) \_\_\_\_\_ million [2]

- (b) The cost of a smartphone is \$ $p$ .  
During the Great Singapore Sale, there is a storewide discount of 20% and members are given an additional 5% off.  
Express the total discount in terms of  $p$ .

Answer (b) \_\_\_\_\_ [2]

- 20 Sally is a sales assistant at a book shop.  
Her daily wage consists of a basic wage  $\$p$ , and commission of  $\$q$  for every book she sells.  
The graph below shows her daily wage.



- (a) Find Sally's wage if she sells 20 books.

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

- (b) Find the value of  $p$  and of  $q$ .

Answer (b)  $p =$  \_\_\_\_\_  
 $q =$  \_\_\_\_\_ [2]

- (c) Lisa is a sales executive who works at the same shop.  
She has no basic wage and receives  $\$1.60$  for every book she sells.  
By drawing a line to represent Lisa's daily wage against the number of books sold, find the number of books she must sell in order to earn the same amount as Sally.

Answer (c) \_\_\_\_\_ [1]

21 The line  $l$  has equation  $2y = x - 12$ .

- (a) Line  $l$  cuts the  $x$ -axis at  $A$  and cuts the  $y$ -axis at  $B$ .  
Find the coordinates of points  $A$  and  $B$ .

Answer (a)  $A$  (     ,     )  
 $B$  (     ,     ) [2]

- (b) Point  $C(4, k)$  lies on line  $l$ . Find the value of  $k$ .

Answer (b)  $k =$  \_\_\_\_\_ [1]

- (c) Line  $m$  is parallel to line  $l$  and passes through the point  $(0, -1)$ .  
Write down the equation of line  $m$ .

Answer (c) \_\_\_\_\_ [1]

22 The floor plan of a school is drawn to the scale of 1 : 200.

- (a) The actual dimension of a classroom is 10 m by 12.5 m.  
Find the dimension, in cm, of the same classroom on the plan.

Answer (a) \_\_\_\_\_ cm by \_\_\_\_\_ cm [2]

- (b) The school hall is represented by  $28 \text{ cm}^2$ .  
Work out the area, in  $\text{m}^2$ , of the hall on the plan.

Answer (b) \_\_\_\_\_  $\text{m}^2$  [2]

23  $R$  is the point  $(3, -2)$  and  $S$  is the point  $(-1, 4)$ .

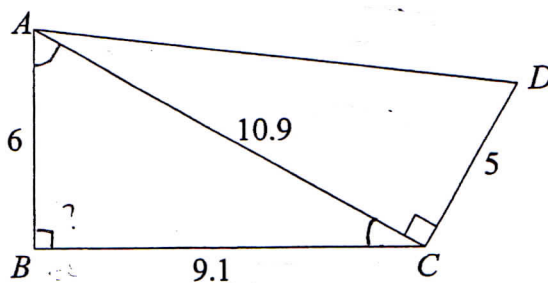
(a) Calculate the length of  $RS$ .

Answer (a) \_\_\_\_\_ units [2]

(b) Find the equation of the line  $RS$ .

Answer (b) \_\_\_\_\_ [3]

- 24 The diagram shows a piece of land  $ABCD$ .  
Triangle  $ACD$  is a right-angled triangle.  
 $AB = 6$  m,  $BC = 9.1$  m,  $AC = 10.9$  m and  $CD = 5$  m.



- (a) Show that angle  $ABC = 90^\circ$ .

Answer

[2]

- (b) Calculate angle  $BCD$ .

Answer (b) \_\_\_\_\_ [2]

- (c) Find the perimeter of the land.

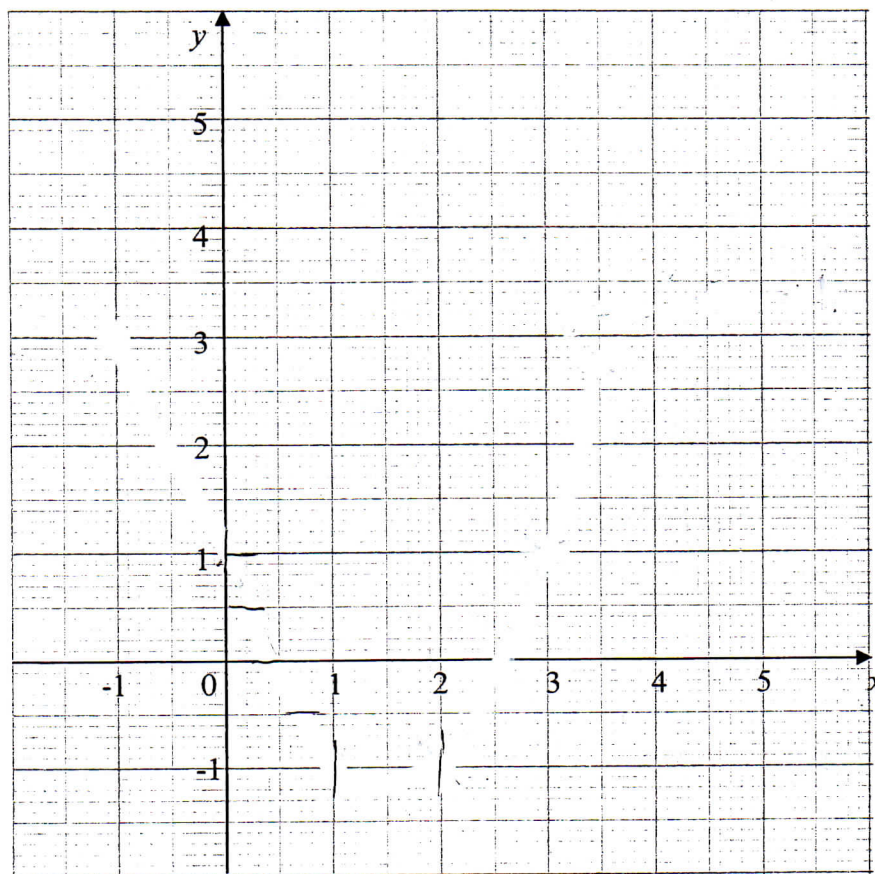
Answer (c) \_\_\_\_\_ m [2]

- 25 (a) Complete the table for  $y = x^2 - 3x + 1$ .

|  |    |   |    |    |   |     |
|--|----|---|----|----|---|-----|
|  | -1 | 0 | 1  | 2  | 3 | 3.5 |
|  |    | 1 | -1 | -1 | 1 |     |

[1]

- (b) Draw the graph of  $y = x^2 - 3x + 1$ .



[3]

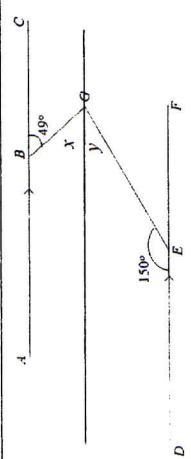
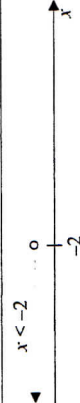
- (c) (i) On the same axes, draw the graph of  $y = -x + 2$ .

[1]

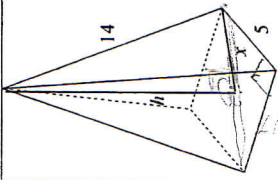
- (ii) Hence, write down the solution(s) of  $x^2 - 2x - 1 = 0$ .

Answer (cii)  $x =$  \_\_\_\_\_ [1]

-End of Paper-

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                      | Mark Scheme                                                                                            |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 1 a      | $3.0625, 3\frac{1}{16}, \frac{49}{16}$                                                                                                                                                                                                                                                                                                                                      | B1<br>Do not accept 3.06                                                                               |
| b        | 9.01                                                                                                                                                                                                                                                                                                                                                                        | B1                                                                                                     |
| 2 a      |  <p> <math>\angle x = 49^\circ</math> (alt <math>\angle</math>s)<br/> <math>\angle y = 180^\circ - 150^\circ</math> (int <math>\angle</math>s)<br/> <math>= 30^\circ</math><br/> <math>\angle ECB = 49^\circ + 30^\circ</math><br/> <math>= 79^\circ</math> (shown)                 </p> | B1 – correct working with angles labelled (or indicated in diagram)<br><br>B1 – correct reasons        |
| 3 a      | $1 - 2x > 5$<br>$-2x > 4$<br>$x < -2$                                                                                                                                                                                                                                                                                                                                       | B1                                                                                                     |
| b        |  <p><math>x &lt; -2</math></p>                                                                                                                                                                                                                                                           | B1                                                                                                     |
| 4 a      | $\frac{1}{4}$ or 0.25                                                                                                                                                                                                                                                                                                                                                       | B1<br>Accept $\frac{90}{360}$                                                                          |
| b        | $\angle(\text{Bus}) = 360 - 90 - 126 - 63$<br>$= 81^\circ$<br>$P(\text{Bus}) = \frac{81}{360}$<br>$= \frac{9}{40}$ or 0.225                                                                                                                                                                                                                                                 | B1<br>Accept $\frac{81}{360}$                                                                          |
| 5        | $m = (2n + 1)$<br>$m = 2nt + t$<br>$m - t = 2nt$<br>$n = \frac{m-t}{2t}$                                                                                                                                                                                                                                                                                                    | Accept<br>$n = \frac{m-t}{2t}$<br><br>M1<br>A1<br>1 mark for $n = \frac{m-t}{2t}$                      |
| 6 a      | $a = -1, b = -5, c = -13$                                                                                                                                                                                                                                                                                                                                                   | B1                                                                                                     |
| b        | General Term: $4n - 11$<br>$4n - 11 = -67$<br>$4n = 78$<br>$n = 19.5$<br>Since $n$ is not a positive integer, $-67$ is not a term of the sequence.                                                                                                                                                                                                                          | Accept explanation by listing.<br>$\dots -65, -69, -73, \dots$<br>$-67$ is not a term of the sequence. |

| Question | Answer                                                                                                                                                    | Mark Scheme                                                                                                                          |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 7        | $\frac{AC}{AC + 2.5} = \frac{9}{12}$<br>$12AC = 9AC + 22.5$<br>$3AC = 22.5$<br>$AC = 7.5$                                                                 | M1<br>Accept working by ratio method<br><br>A1<br>BC:DE = 9:12<br>$\rightarrow$ AC:AE = 3:4<br>AC:CE = 3:1<br>AC = 2.5cm x 3 = 7.5cm |
| 8        | Right-angled triangle with base 4.5 units & height 9 units.                                                                                               | B2<br>B1 – Scale factor of 1.5 (working) seen Or B1 – Triangle B drawn correctly<br><br>B1 – only one of the sides correct           |
| 9 a      | Sum of int. angles = $(8 - 2) \times 180^\circ$<br>$= 1080^\circ$<br>$x + 50 + 2x - 15 + 3x + 5x = 1080$<br>$11x + 35 = 1080$<br>$11x = 1045$<br>$x = 95$ | M1                                                                                                                                   |
| b        | Largest Ext Angle = $180 - 95$<br>$= 85^\circ$                                                                                                            | A1                                                                                                                                   |
| 10       | Curved Surface Area = $2\pi(5)(13)$<br>$= 130\pi$<br><br>Base Area = $\pi(5)^2$<br>$= 25\pi$<br><br>Total Area = $130\pi + 25\pi$<br>$= 155\pi$           | B1<br>Allow logical ECF<br><br>M1<br><br>M1<br><br>A1<br>No A1 for 486.95...                                                         |
| 11 a     | Mode = 36                                                                                                                                                 | B1                                                                                                                                   |
| b        | Median = 37.5                                                                                                                                             | B1                                                                                                                                   |
| c        | No. He should stock up on the modal size 36 instead. (or size 38 is not the size that is mostly sold, etc)                                                | B1<br>Accept any other logical answers                                                                                               |
| 12       | Major arc length = $\frac{360 - 140}{360} \times \pi(7)^2$<br>$= 26.8780$<br>Perimeter = $26.8780 + 7 + 7$<br>$= 40.8780$<br>$= 40.9$                     | M1<br>M1(ecf)<br><br>A1                                                                                                              |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                               | Mark Scheme                                                                                                             |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 13       | <p>%age of latecomers (chess) = <math>\frac{5}{10} \times 100\% = 50\%</math></p> <p>%age of latecomers (guitar) = <math>\frac{10}{80} \times 100\% = 12.5\%</math></p> <p>The students in the Chess Club are less punctual as the percentage of latecomers is higher.</p>                                                                                                                                           | <p>BI — Accept 40% or 60% (for chess club)</p> <p>BI —</p> <p>BI — Award B1 as long as they mention % or proportion</p> |
| 14       | <p><math>35(20+x) = 862 + 2 \times \frac{1}{2} \times 8 \times x</math></p> <p><math>700 + 35x = 862 + 8x</math></p> <p><math>27x = 162</math></p> <p><math>x = 6</math></p>                                                                                                                                                                                                                                         | <p>M2 — Award M1 if <math>35(20+x)</math> or <math>2 \times \frac{1}{2} \times 8 \times x</math> seen</p> <p>A1</p>     |
| 15       | <p><math>4x - 3y = 2</math> — (1)</p> <p><math>y = 2x + 1</math> — (2)</p> <p>Sub (2) into (1),</p> <p><math>4x - 3(2x + 1) = 2</math></p> <p><math>4x - 6x - 3 = 2</math></p> <p><math>-2x = 5</math></p> <p><math>x = -2.5</math></p> <p>Sub <math>x = -2.5</math> into (2),</p> <p><math>y = 2(-2.5) + 1</math></p> <p><math>y = -4</math></p>                                                                    | <p>M1 — (or elimination method)</p> <p>A1</p> <p>A1</p>                                                                 |
| 16       |  <p><math>x^2 = 2.5^2 + 2.5^2</math></p> <p><math>x = \sqrt{12.5} = 3.5355</math></p> <p><math>h^2 + (\sqrt{12.5})^2 = 14^2</math></p> <p><math>h = \sqrt{183.5} = 13.546</math></p> <p><math>vol = \frac{1}{3} \times (5 \times 5) \times \sqrt{183.5}</math></p> <p><math>= 112.885</math></p> <p><math>= 113</math> (3sf)</p> | <p>M1 — Award if they use their own/wrong height</p> <p>A1</p>                                                          |
| 17 a     | <p><math>\frac{1}{2a} + \frac{1}{3a} = \frac{3}{6a} + \frac{2}{6a}</math></p> <p><math>= \frac{5}{6a}</math></p>                                                                                                                                                                                                                                                                                                     | <p>BI</p>                                                                                                               |

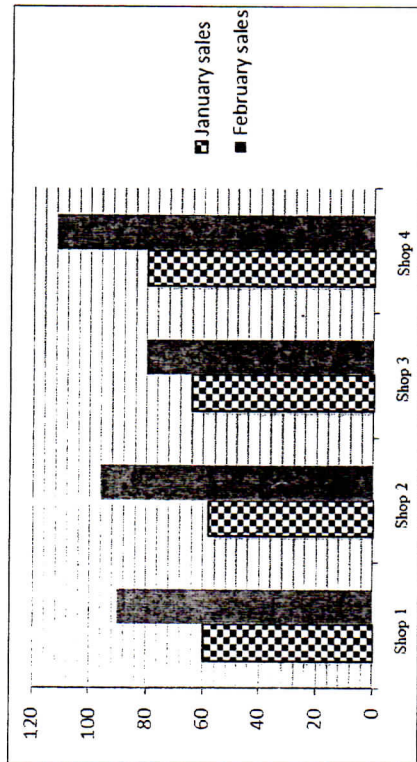
| Question | Answer                                                                                                                                                                                                                                                                             | Mark Scheme                                                                                                                       |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| b        | <p><math>\frac{4x+10}{4x^2-25}</math></p> <p><math>= \frac{2(2x+5)}{(2x+5)(2x-5)}</math></p> <p><math>= \frac{2}{2x-5}</math></p>                                                                                                                                                  | <p>M1 — For factorising the denominator</p> <p>A1</p>                                                                             |
| 18 a     | <p>Estimated Mean = <math>\frac{3870}{80}</math></p> <p><math>= 48.375</math></p>                                                                                                                                                                                                  | <p>M2 — M1 for <math>\sum f_x</math></p> <p>A1</p>                                                                                |
| b        | Sengkang Road as the mean speed is higher.                                                                                                                                                                                                                                         | BI — Award ECF from (a)                                                                                                           |
| 19 a     | <p><math>\frac{100}{146} \times 5.7</math> mil</p> <p><math>= 3.9041</math> mil</p> <p><math>= 3.90</math> mil (3sf)</p>                                                                                                                                                           | <p>M1</p> <p>A1</p>                                                                                                               |
| b        | <p>Price after 20% discount = <math>\frac{80}{100} \times p</math></p> <p><math>= 0.8p</math></p> <p>Additional 5% discount = <math>\frac{5}{100} \times 0.8p</math></p> <p><math>= 0.04p</math></p> <p>Total discount = <math>0.04p + 0.2p</math></p> <p><math>= 0.24p</math></p> | <p>M1 — Award M1 for 0.8p or 0.2p seen.</p> <p>A1 — Award 1 mark if 24% / 0.24 seen or if they sub in values for p.</p> <p>A1</p> |
| 20 a     | $\$48$                                                                                                                                                                                                                                                                             | BI                                                                                                                                |
| b        | <p><math>p = 32</math></p> <p><math>q = 0.8</math></p>                                                                                                                                                                                                                             | <p>BI — Allow ECF from (a)</p> <p>BI</p>                                                                                          |
| c        | 40 books                                                                                                                                                                                                                                                                           | BI                                                                                                                                |
| 21 a     | <p>When <math>y=0</math>,</p> <p><math>0 = x - 12</math></p> <p><math>x = 12</math></p> <p>When <math>x=0</math>,</p> <p><math>2y = -12</math></p> <p><math>y = -6</math></p> <p><math>A(12, 0)</math></p> <p><math>B(0, -6)</math></p>                                            | <p>BI</p> <p>BI</p>                                                                                                               |
| b        | <p>When <math>x=4, y=k</math>,</p> <p><math>2k = 4 - 12</math></p> <p><math>k = -4</math></p> <p><math>2y = x - 12</math></p>                                                                                                                                                      | <p>BI</p>                                                                                                                         |
| c        | <p><math>y = \frac{1}{2}x - 6 \Rightarrow m = \frac{1}{2}</math></p> <p>Ans: <math>y = \frac{1}{2}x - 1</math></p>                                                                                                                                                                 | <p>BI</p>                                                                                                                         |

| Question | Answer                                                                                                                                                          | Mark Scheme                                            |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| 22 a     | 1 cm : 200 cm<br>1 cm : 2 m<br>Ans: 5 cm by 6.25 cm                                                                                                             | M1<br>A1 Accept 6.25 cm by 5 cm                        |
| b        | 1 cm : 2 m<br>1 cm <sup>2</sup> : 4 m <sup>2</sup><br>28 cm <sup>2</sup> : 4 × 28 m <sup>2</sup><br>= 112 m <sup>2</sup>                                        | M1<br>A1                                               |
| 23 a     | $RS = \sqrt{(3 - (-1))^2 + (-2 - 4)^2}$<br>= 7.21                                                                                                               | M1<br>A1                                               |
| b        | $m = \frac{4 - (-2)}{-1 - 3}$<br>$m = -1.5$<br>$y = -1.5x + c$ , sub in (3, -2)<br>$-2 = -1.5(3) + c$<br>$-2 = -4.5 + c$<br>$c = 2.5$<br>Ans: $y = -1.5x + 2.5$ | M1<br>M1 — Award even if their gradient is wrong<br>A1 |
| 24 a     | $AB^2 + BC^2 = 6^2 + 9.1^2 = 118.81$<br>$AC^2 = 10.9^2 = 118.81$<br>Since $AB^2 + BC^2 = AC^2$ , by converse of Pythagoras Theorem, $\angle ABC = 90^\circ$     | B1<br>B1                                               |
| b        | $\sin \angle BCA = \frac{6}{10.9}$<br>$\angle BCA = 33.398$<br>$\angle BCD = 33.398 + 90$<br>= 123.4°                                                           | M1<br>A1                                               |
| c        | $AD^2 = 10.9^2 + 5^2$<br>$AD = 11.992$<br>Perimeter = 11.992 + 6 + 9.1 + 5<br>= 32.092<br>= 32.1 m                                                              | M1<br>A1                                               |
| 25       | Refer to attached graph                                                                                                                                         |                                                        |

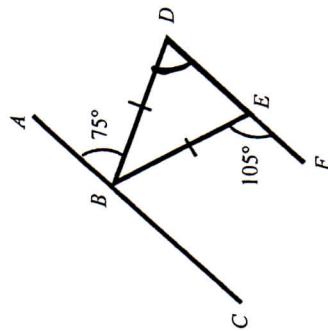
## Section A (52 marks)

Answer all the questions in this section.

- 1 A company owns 4 shops selling a food product. The bar chart shows the sales in the month of January and February.



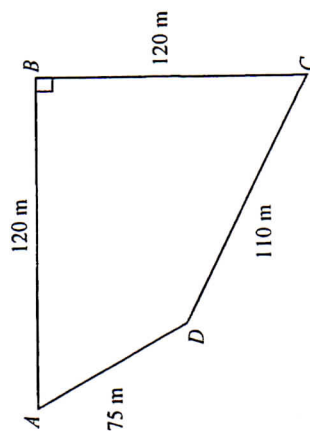
- (a) Find the difference in sales between January and February for Shop 1. [1]
- (b) The owner decided to close down one of the shops due to insufficient cash flow. His son told him to close down Shop 3. Do you agree? Explain your answer. [1]
- 2 A car travelled at a uniform speed of 80 km/h for 45 min. It then travelled for 120 km at a uniform speed of 90 km/h. Calculate
- (a) the total distance, in kilometres, for the whole journey. [1]
- (b) the total time, in hours, for the whole journey. [1]
- (c) the average speed for the whole journey. [2]



In the diagram above,  $ABC$  and  $DEF$  are straight lines and  $BD = BE$ . Angle  $ABD$  and angle  $BEF$  are  $75^\circ$  and  $105^\circ$  respectively.

- (a) Find
- (i) angle  $BDE$ , [1]
- (ii) angle  $DBE$ . [1]
- (b) Using your answers to part (a), explain why  $AC \parallel DF$ . [2]
- Show all your working.
- 4 Calculate
- (a) (i)  $\sqrt{(-6)^2 - 2(2)(-3)}$ , [1]
- (ii)  $\frac{3.76 + 12.88}{42.44 - 8.99}$ . [1]
- (b) 7.6 billion people consume 100 million cans of carbonated drinks.
- (i) Express 7.6 billion in standard form. [1]
- (ii) Calculate the average number of cans consumed per person, giving your answer in standard form. [2]

- 5 The diagram shows a sketch of a plot of land  $ABCD$ .



- (a) Make an accurate scale drawing of the plot of land. Use a scale of 1 cm to represent 10 m. [3]

- (b) A statue,  $S$ , is built inside the plot of land. It is on the perpendicular bisector of  $CD$  and also on the bisector of angle  $BAD$ . [2]

Construct and label the position of the statue on your scale drawing.

- 6 (a) Express 156 and 360 as the product of their prime factors. [2]  
 (b) Find the lowest common multiple of 156 and 360. [2]  
 (c) Is 147 a prime number? Explain your answer. [1]

- 7 (a) Which of these ratios are equivalent to the ratio  $2a : 3$ ? [2]  
 $2a + 2 : 3 + 2$        $2ab : 3b$        $\frac{a}{3} : \frac{1}{2}$        $4a : 9$

- (b) The ratio of boys to girls in a group of children was 3 : 4. The total number of children in the group was 49.

- (i) How many girls were there? [1]  
 (ii) When more girls joined the group, the ratio of boys to girls became 7 : 10. How many girls joined the group? [2]

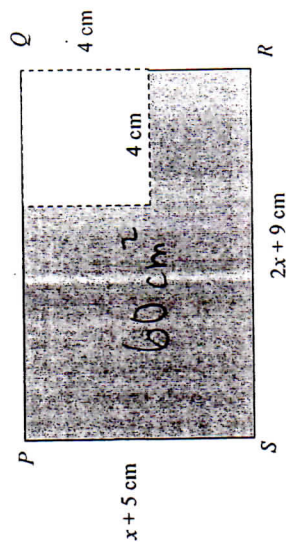
- 8 (a) Simplify, leaving your answers in positive index form,  $\left(\frac{27}{8x}\right)^{-\frac{1}{3}}$ . [2]

- (b) Factorise completely

(i)  $10rs - 15s + 8ru - 12tu$ , [2]

(ii)  $4x^2 - 10x - 14$ . [2]

- 9 The diagram shows a rectangle  $PQRS$  of length  $2x + 9$  cm and breadth  $x + 5$  cm.



A square of side 4 cm is cut out from the rectangle at corner  $Q$ , as shown in the diagram.

- (a) Given that the area of the shaded region is  $60 \text{ cm}^2$ , form an equation in  $x$  and show that it reduces to  $2x^2 + 19x - 31 = 0$ . [3]  
 (b) Solve the equation  $2x^2 + 19x - 31 = 0$ , giving your answers correct to 2 decimal places. [3]  
 (c) Calculate the length of rectangle  $PQRS$ . [2]

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- 10 The annual waste and recycling statistics from the National Environment Agency shows the amount of food waste generated in Singapore from 2014 to 2016. The total population of Singapore was 5.61 million in 2016.

| Year | Non-recyclable Food Waste (tonnes) | Recyclable Food Waste (tonnes) | Total Food Waste Generated (tonnes) |
|------|------------------------------------|--------------------------------|-------------------------------------|
| 2014 | 687 200                            | 101 400                        | 788 600                             |
| 2015 | 681 400                            | 104 100                        | 785 500                             |
| 2016 | 679 900                            | 111 100                        | 791 000                             |

1 Tonne = 1000 kg

The table below shows the estimated average mass of food servings (in kg) for the 3 meals of an individual per day in 2016.

| Breakfast | Lunch | Dinner |
|-----------|-------|--------|
| 0.6       | 0.8   | 1.1    |

- (a) What was the average mass, in kg, of total food waste generated per individual in 2016, [2]  
(i) in 2016, [1]  
(ii) per day in 2016? [1]
- (b) Find the estimated total mass of daily food servings by an individual in 2016. [1]
- (c) Hence, estimate the percentage mass of food that is wasted per day by an individual in 2016. [2]

(d)

- The non-recyclable food waste generated in 2016 can fill up 500 Olympic-sized swimming pools.
- The volume of an Olympic-sized swimming pool is 2500 m<sup>3</sup>.

Based on the information given above, estimate the density of non-recyclable food waste in kg/m<sup>3</sup>. [2]

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Section B (8 marks)

Answer one question from this section. Each question carries 8 marks.

11. (a) Five cards are numbered 2 to 6. Two cards are drawn at random without replacement. [2]

Find the probability that

- (i) both cards are even numbered. [2]  
(ii) no even cards are drawn. [2]

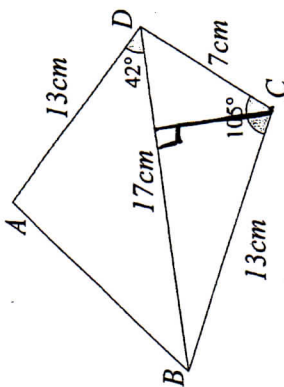
- (b) The masses of 6 grapes are measured and recorded.

The following information is available:

- Three of the grapes weigh 6.2 g, 6.4 g and 7 g respectively.
- The median mass is 6.55 g.
- The mode is 7 g.
- The mean is 6.6 g.

Find the mass of each of the remaining 3 grapes. [4]

12. (a) In the diagram,  $AD = 13$  cm,  $DC = 7$  cm,  $BD = 17$  cm and  $BC = 13$  cm. Angle  $ADB = 42^\circ$  and angle  $BCD = 105^\circ$ .



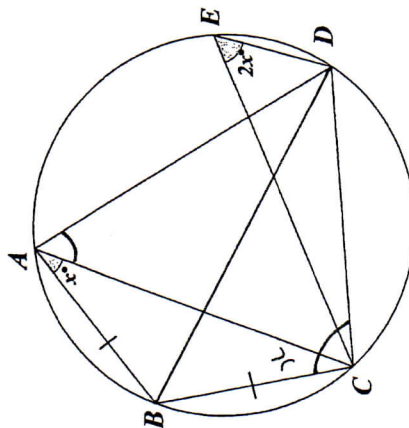
Calculate

- (i) the length  $AB$ ,  
(ii) the area of the triangle  $BCD$ .

[3]

[2]

- (b) In the figure,  $AB = BC$ , angle  $BAC = x^\circ$  and angle  $CED = 2x^\circ$ .



- (a) Find, in terms of  $x$ ,

- (i) angle  $CAD$ ,  
(ii) angle  $BCD$ .

[1]

[1]

- (b) Given that  $BD$  is the diameter of the circle, find  $x$ .

[1]

End of paper



2018 Prelim Sec 4NA Math P2  
Mark Scheme

|        |                                                                                                                                                 |                                                             |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
|        | No. Since 147 can be expressed as the product of its prime factors.<br>No. Since $147 = 3 \times 7^2$                                           | Total: 5marks                                               |
| 7(a)   | $2ab : 3b$<br>$\frac{a}{3} : \frac{1}{2}$                                                                                                       | B1<br>B1<br>(Minus 1 mark for each additional wrong answer) |
| 7(bi)  | Number of girls = $\frac{4}{7} \times 49 = 28$                                                                                                  | B1                                                          |
| 7(bii) | Number of boys = $49 - 28 = 21$<br>Number of girls now = $\frac{10}{7} \times 21 = 30$<br>Number of girls that joined the group = $30 - 28 = 2$ | M1<br>A1                                                    |
| 8(a)   | $= \left(\frac{8x}{27}\right)^{\frac{1}{3}}$<br>$= \frac{2x^{\frac{1}{3}}}{3}$                                                                  | Total: 8marks<br>M1<br>A1                                   |
| 8(bi)  | $= 5s(2r - 3t) + 4u(2r - 3t)$<br>$= (5s + 4u)(2r - 3t)$                                                                                         | M1<br>A1                                                    |
| 8(b)   | $2(2x^2 - 5x - 7)$<br>$= 2(2x - 7)(x + 1)$                                                                                                      | M1<br>A1                                                    |
| 9(a)   | $(x+5)(2x+9) - 4^2 = 60$<br>$2x^2 + 9x + 10x + 45 - 16 = 60$<br>$2x^2 + 19x - 31 = 0$                                                           | Total: 6marks<br>M1<br>M1<br>A1                             |
| 9(b)   | $2x^2 + 19x - 31 = 0$<br>$x = \frac{-19 \pm \sqrt{(19)^2 - 4(2)(-31)}}{2(2)}$<br>$x = 1.42$ or $x = -10.92$                                     | M1<br>A1, A1                                                |
| 9(c)   | Length of PQRS<br>$= (2x+9) = 2(1.419) + 9$<br>$= 11.8cm$                                                                                       | M1<br>A1                                                    |
|        |                                                                                                                                                 | Total: 8marks                                               |

2018 Prelim Sec 4NA Math P2  
Mark Scheme

|         |                                                                                                                                                                                                                                                                                             |                    |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 10(ai)  | Average mass of food wasted per individual in 2016<br>$= 791\,000 \times 1000 + (5.61 \times 10^6)$<br>$= 140.998$<br>$= 141\text{ kg}$                                                                                                                                                     | M1<br>A1           |
| 10(aii) | Average mass of food wasted per individual per day in 2016<br>$= 140.998 + 365$<br>$= 0.3863$ (accept 366 days)<br>$= 0.386\text{ kg}$                                                                                                                                                      | B1(ecf)            |
| 10(b)   | Average mass of food intake by an individual<br>$= 0.6 + 0.8 + 1.1$<br>$= 2.5\text{ kg}$                                                                                                                                                                                                    | B1                 |
| 10(c)   | Percentage of mass of food wasted by an individual in 2016<br>$= \frac{0.3863}{2.5} \times 100\%$<br>$= 15.452\%$<br>$= 15.5\%$                                                                                                                                                             | M1(ecf)<br>A1(ecf) |
| 10(d)   | Food waste produced<br>$= 679\,900\text{ tonnes}$<br>$= 679900000\text{ kg}$<br>Volume of 500 Olympic pools<br>$= 500 \times 2500$<br>$= 1250000\text{ m}^3$<br>Density of food waste<br>$= \frac{\text{mass}}{\text{volume}}$<br>$= \frac{679900000}{1250000}$<br>$= 534.92\text{ kg/m}^3$ | M1<br>A1           |
|         |                                                                                                                                                                                                                                                                                             | Total: 8marks      |
|         |                                                                                                                                                                                                                                                                                             | Total: 52 marks    |
|         |                                                                                                                                                                                                                                                                                             | Section A          |
| 11(ai)  | Even no. = 2, 4, 6<br>Odd no = 3, 5<br>Probability that both cards are even numbered<br>$= \frac{3}{5} \times \frac{2}{4}$<br>$= \frac{3}{10}$                                                                                                                                              | M1                 |

2018 Prelim Sec 4NA Math P2  
Mark Scheme

|            |                                                                                                    |                      |
|------------|----------------------------------------------------------------------------------------------------|----------------------|
| 11(a)(iii) | Probability that no even cards are drawn<br>$= \frac{2}{5} \times \frac{1}{4}$<br>$= \frac{1}{10}$ | M1<br>A1             |
| 11(b)      | Showing<br>$= 6.6 \times 6 = 39.6$ or $6.55 \times 2 = 13.1$<br>7 g<br>6.7 g<br>6.3 g              | B1<br>B1<br>B1<br>B1 |
|            |                                                                                                    | Total: 8 marks       |
| 12(ai)     | $AB^2 = 13^2 + 17^2 - 2(13)(17) \cos 42$<br>$AB^2 = 129.5299871$<br>$AB = 11.4$                    | M1<br>M1<br>A1       |
| (a)(ii)    | Area = $\frac{1}{2} \times 7 \times 13 \times \sin 105$<br>$= 43.9 \text{ cm}^2$                   | M1<br>A1             |
| (b)(ai)    | $2x^\circ$                                                                                         | B1                   |
| (b)(a)(ii) | $180^\circ - 3x^\circ$                                                                             | B1                   |
| (b)(b)     | $x + 2x = 90^\circ$<br>$3x = 90^\circ$<br>$x = 30^\circ$                                           | B1                   |
|            |                                                                                                    | Total: 8 marks       |
|            | Section B                                                                                          | Total: 8 marks       |
|            |                                                                                                    | Overall: 60 marks    |
|            |                                                                                                    |                      |
|            |                                                                                                    |                      |