

Answer **all** the questions.

- 1 Evaluate  $\frac{(-0.692)^2 - \sqrt{7.318}}{-(2.873)^2}$ , giving your answer to 4 significant figures.

0.2697

**B1**

*Answer* ..... [1]

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- 2 Write the following in descending order.

$$\sqrt{0.64}, \frac{\pi}{4}, 0.85^{\frac{3}{2}}, 0.801$$

$$0.801, \sqrt{0.64}, \frac{\pi}{4}, 0.85^{\frac{3}{2}}$$

**B2 or B1 for 2 correct answers**

*Answer* ..... , ..... , ..... , ..... [2]

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- 3 Cherries cost  $c$  cents per gram.  
Amy buys  $p$  dollars worth of cherries.  
Find an expression, in terms of  $c$  and  $p$ , for the mass of the cherries, in grams, that Amy buys.

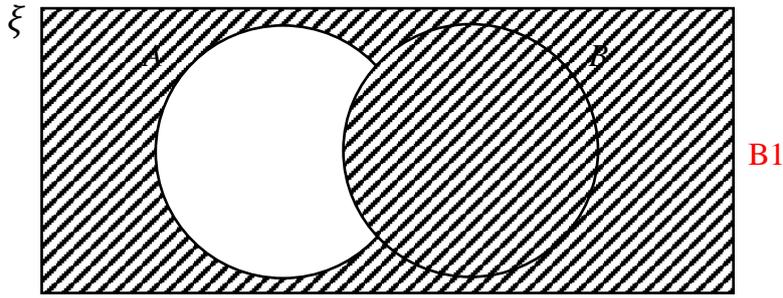
$$\text{mass} = \frac{100p}{c}$$

**M1 A1**– able to convert to cents/ dollars or  
**B2** (100p and p/c)

*Answer* ..... g [2]

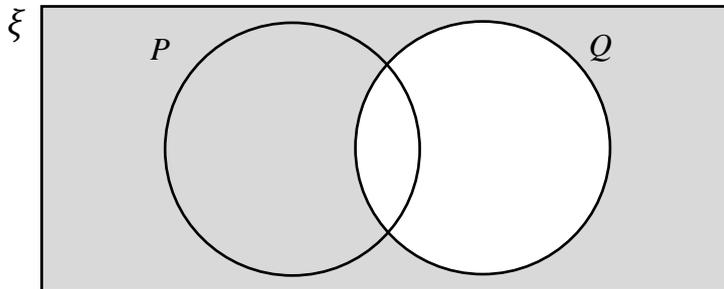
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4 (a) Shade  $(A \cap B)'$  in the Venn diagram below.



Answer ...*in the diagram*... [1]

(b) Express in set notation, the set represented by the shaded region below.



$Q'$

B1

Answer ..... [1]

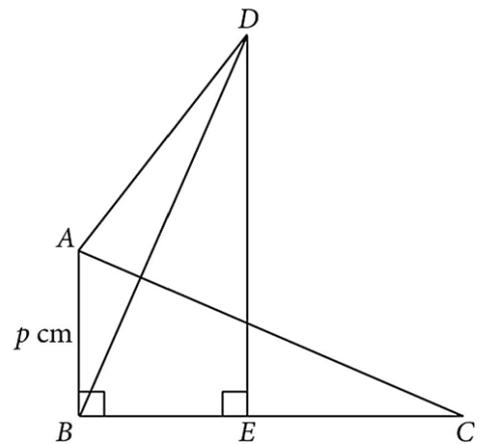
5 Triangle  $ABC$  is congruent to triangle  $BED$ .  
The point  $E$  divides  $BC$  into two equal parts and  $AB = p$  cm. Find an expression, in terms of  $p$ , for the area of the quadrilateral  $ADEB$ .

$$\begin{aligned}
 AB &= BE \\
 BC &= 2p \\
 \text{Area} &= \frac{1}{2}(2p + p)(p) \\
 &= \frac{3p^2}{2} / 1.5p^2
 \end{aligned}$$

M1 – able to find either  $BC$  or  $BE$

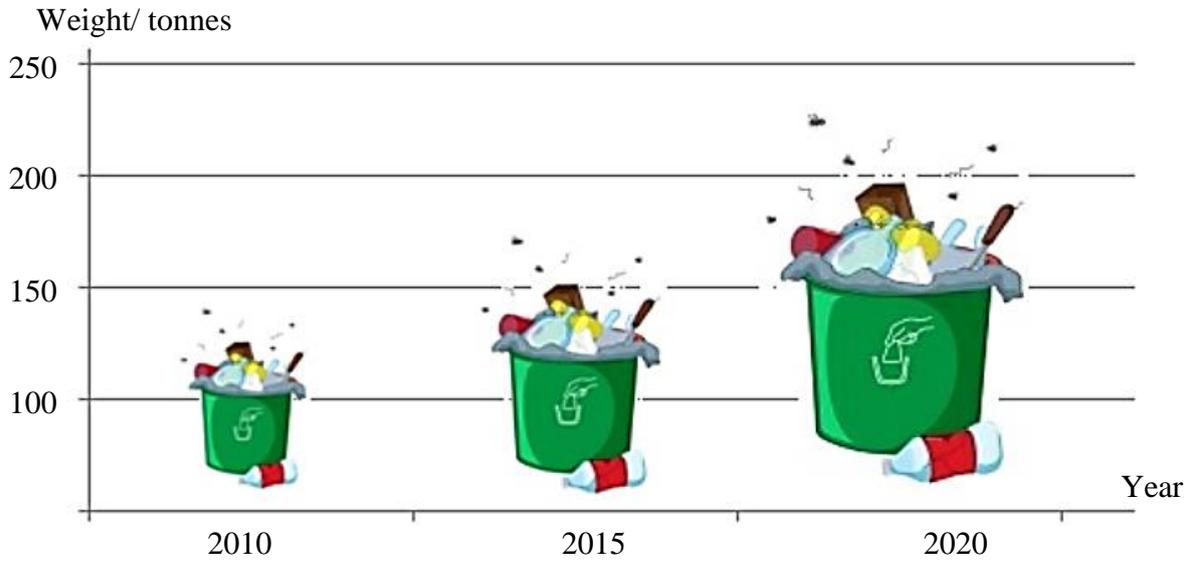
M1 – correct use of trapezium formula

A1



Answer .....  $\text{cm}^2$  [3]

6 The graph below shows the amount of trash generated by a city over the past 10 years.



(a) Explain how the graph above may be misleading.

From 2010 to 2020, the trash generated almost doubled but the picture shows like it quadrupled. (any explanation on size/area/proportion of size) – do not accept does not start from zero, or picture is confusing/flies/hard to read **B1**

Answer .....  
..... [1]

(b) Suggest an appropriate statistical diagram to better represent the graph above.

Graph chart OR line graph (do not accept histogram) **B1**

Answer ..... [1]

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7 (a) Factorise  $5x^2 + 3x - 8$ .

$$(5x+8)(x-1)$$

**B2**

Answer ..... [2]

(b) Hence factorise  $5(4y-1)^2 + 12y - 11$  completely.

$$5(4y-1)^2 + 3(4y-1) - 8$$

$$[5(4y-1)+8][4y-1-1]$$

$$(20y-5+8)(4y-2)$$

$$2(2y-1)(20y+3)$$

**M1** – able to use (a) answer to factorise  
Allow ECF

**M1** – able to simplify

**A1**

Answer ..... [3]

8 (a) Expressing your answer as a power of 7, find

(i)  $7^{17} \div 7^{-4}$ ,

$$7^{21} \quad \mathbf{B1}$$

Answer ..... [1]

(ii)  $\frac{1}{343}$ ,

$$7^{-3} \quad \mathbf{B1}$$

Answer ..... [1]

(iii)  $\sqrt[4]{7}$ .

$$7^{\frac{1}{4}} \quad \mathbf{B1}$$

Answer ..... [1]

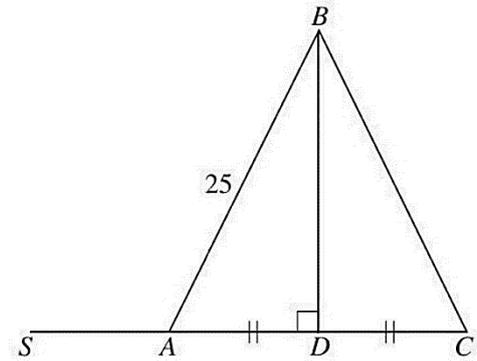
(b) Given that  $11^5 \times 11^n = 1$ , write down the value of  $n$ .

$$-5 \quad \mathbf{B1}$$

Answer  $n =$  ..... [1]

- 9 In the diagram,  $\angle ADB = 90^\circ$ ,  $AB = 25$  cm and  $D$  is the midpoint of  $AC$ .

Given that  $\cos \angle BAS = -\frac{7}{15}$ , find the length of  $BD$ , without evaluating any angles.



$$\cos \angle BAD = \frac{AD}{25}$$

$$\frac{7}{15} = \frac{AD}{25}$$

M1 – use of trigo ratio

$$AD = \frac{7}{15} \times 25$$

$$= \frac{35}{3}$$

$$BD^2 = 25^2 - \left(\frac{35}{3}\right)^2$$

M1 – use of Pythagoras' theorem

$$BD = 22.1$$

A1

Answer ..... cm [3]

- 10 A 45 cm tall statue is made from 7460 cm<sup>3</sup> of gold.

An accurate scale model of the statue is made from 38 g of gold.

Given that the density of gold is 19.3 g/cm<sup>3</sup>, calculate the height, in cm, of the model.

$$V_m = \frac{38}{19.3}$$

$$= \frac{380}{193}$$

M1 – able to find volume of model

$$\left(\frac{h_m}{45}\right)^3 = \frac{380}{193} \div 7460$$

M1 – use of volume of similar solids

$$h_m^3 = 45^3 \left(\frac{380}{193} \div 7460\right)$$

A1

$$h_m = 2.89$$

OR

Using mass;  $M = 1.93 \times 7460 = 143978$  g

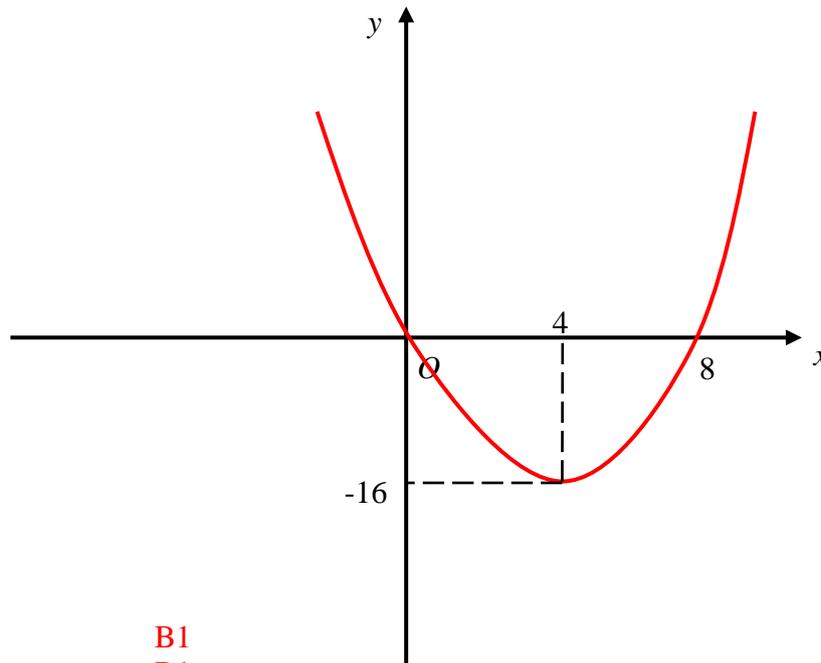
$$\sqrt[3]{\frac{38}{143978}} = \frac{h}{45}$$

$$h = 2.89$$

Answer..... cm [3]

**11 Sketch** the graph of  $y = x(x-8)$  on the axes below.

Indicate clearly the coordinates of the points where the graph crosses the axes and the minimum point on the curve.



Shape B1  
 x, y intercepts B1  
 Minimum point B1

*Answer ...in the diagram... [3]*

**12** Ming Hui can wash 70 plates in 2 hours.

Akila can wash 100 plates in 3 hours.

If Ming Hui and Akila work together, how long will it take for them to wash 200 plates?

Leave your answer in hours and minutes.

$$1\text{h} \rightarrow 35 + \frac{100}{3} \text{ plates}$$

$$200 \text{ plates} \rightarrow \frac{3}{205} \times 200 \\ = \frac{120}{41} \text{ h}$$

2h 56 min

M1 – able to find plate/h for at either Ming Hui or Akila

M1 – able to find time taken for 200 plates in hours

A1

*Answer ..... h ..... min [3]*

- 13 The diagram shows the plan of the ceiling of a kitchen.  
It is drawn to the scale of 1 cm to  $n$  metres.  
The actual area of the ceiling is  $72 \text{ m}^2$ .



- (i) Using the plan, find the value of  $n$ .

Plan Area =  $6 \times 3$   
 $18 \text{ cm}^2 : 72 \text{ m}^2$   
 $1 \text{ cm}^2 : 4 \text{ m}^2$   
 $1 \text{ cm} : 2 \text{ m}$

Plan Area =  $6.1 \times 3$   
 $18.3 \text{ cm}^2 : 72 \text{ m}^2$   
 $\sqrt{18.3} : \sqrt{72}$   
 $1 \text{ cm} : 1.98 \text{ m}$

M1 – able to find area of plan  
 A1

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

- (ii) Donald wants to paint the ceiling.  
The paint he has chosen is available in three different sizes.

S:	400 ml \$9.90	M:	1 litre \$21	L:	5 litres \$85
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1 litre of paint can cover  $10 \text{ m}^2$ .  
Explain how many cans of each size he should buy in order to keep his cost of painting to a minimum.

Amount of paint =  $\frac{72}{10}$   
 $= 7.2 \text{ litres}$

M1 – able to find amount of paint

Least amount =  $1(85) + 1(21) + 3(9.90)$   
 $= 135.70$

B1

He should buy 1 L, 1 M and 3 S to ensure minimal wastage and low cost.

A1

Answer .....

.....

..... [3]

14 The table show the time taken, in minutes, to clear 100 passengers embarking on a cruise at the Singapore Cruise Centre on a particular day.

Time taken (min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
Number of passengers	16	25	28	17	14

(a) Calculate the  
(i) mean,

Mean = 23.8 B1

Answer ..... mins [1]

(ii) standard deviation.

Mean = 12.7 B1

Answer ..... mins [1]

The following table shows the mean and standard deviation of the time taken to clear passengers at the Marina Bay Cruise Centre.

Mean = 21.9 min	Standard deviation = 13.5 min
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(b) A tour operator has a choice of starting his group’s journey from either the Singapore Cruise Centre or the Marina Bay Cruise Centre. Which cruise centre should he choose? Explain your answer.

Marina Bay Cruise Centre B1  
 The mean is lower than that of Singapore Cruise Centre. This means the tour operator can save on waiting time for his group B1

Answer .....  
 .....  
 ..... [2]

- 15 Riswan is planning a business trip to Paris and Los Angeles. He books 3 nights at a Paris hotel which charges €140 per night and 5 nights at a Los Angeles hotel that charges US\$245 per night. Riswan uses his credit card to pay for the bookings. He is offered a reimbursement of S\$ 2500 for his trip. Justify with relevant working if that amount can cover the cost of the hotel booking.

<p><b>Exchange rate:</b>                  Singapore dollars (S\$) and US dollars (US\$) is S\$ 1 = US\$0.73                   Euros (€) and US dollars is €1 = US\$1.18   <i>*For accounting purposes, all expenses are to be charged in USD to credit cards. There will be an additional charge of 3.5% for currency conversion.</i></p>
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Paris hotel cost =  $140 \times 3 \times 1.18$   
 = US\$495.60

In SGD =  $\frac{495.60}{0.73}$   
 = S\$678.9041

M1 – able to find Paris cost in SGD

LA hotel cost =  $245 \times 5$   
 = US\$1225

In SGD =  $\frac{1225}{0.73}$   
 = S\$1678.0821

M1 – able to find LA cost in SGD

Total with CC charge =  $\frac{103.5}{100} \times 2356.9862$   
 = S\$2439.48

M1 – able to find 3.5% of total cost

Yes. The total cost is S\$2439.48, which is below S\$2500.

A1 with explanation

Alternatively : US\$ comparison

US\$ 1720.60  $\times$  103.5 = 1780.82  
 SGD 2500 = US\$1825

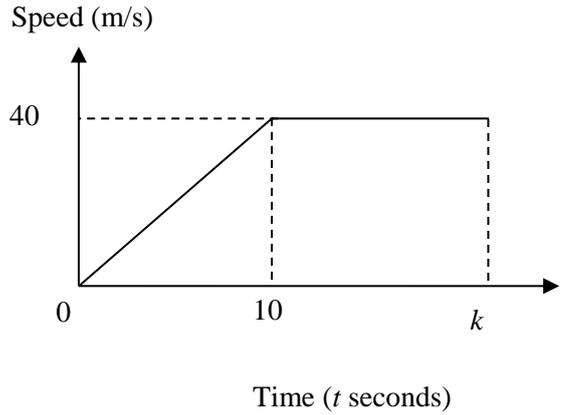
Answer .....

..... [4]



18 The diagram is the speed-time graph for the first  $k$  seconds of the motion of an object.

The object accelerated uniformly for the first 10 seconds from rest to reach a speed of 40 m/s. It then maintained the same speed to  $k$  seconds.



(a) Given that the distance travelled in the first  $k$  seconds is 420 m, find the value of  $k$ .

$$\frac{1}{2} \times 10 \times 40 + 40 \times (k - 10) = 420$$

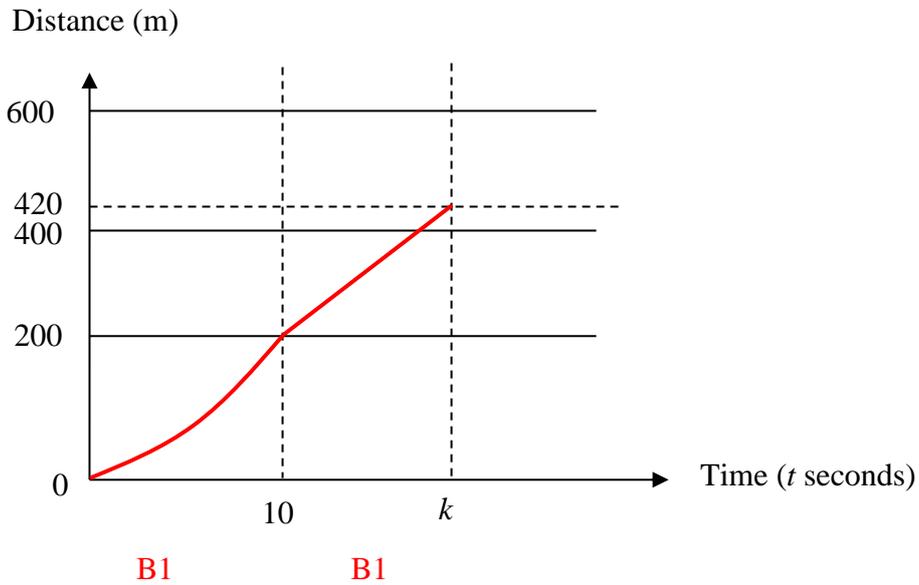
$$k = 15.5$$

M1 – use of area under graph

A1

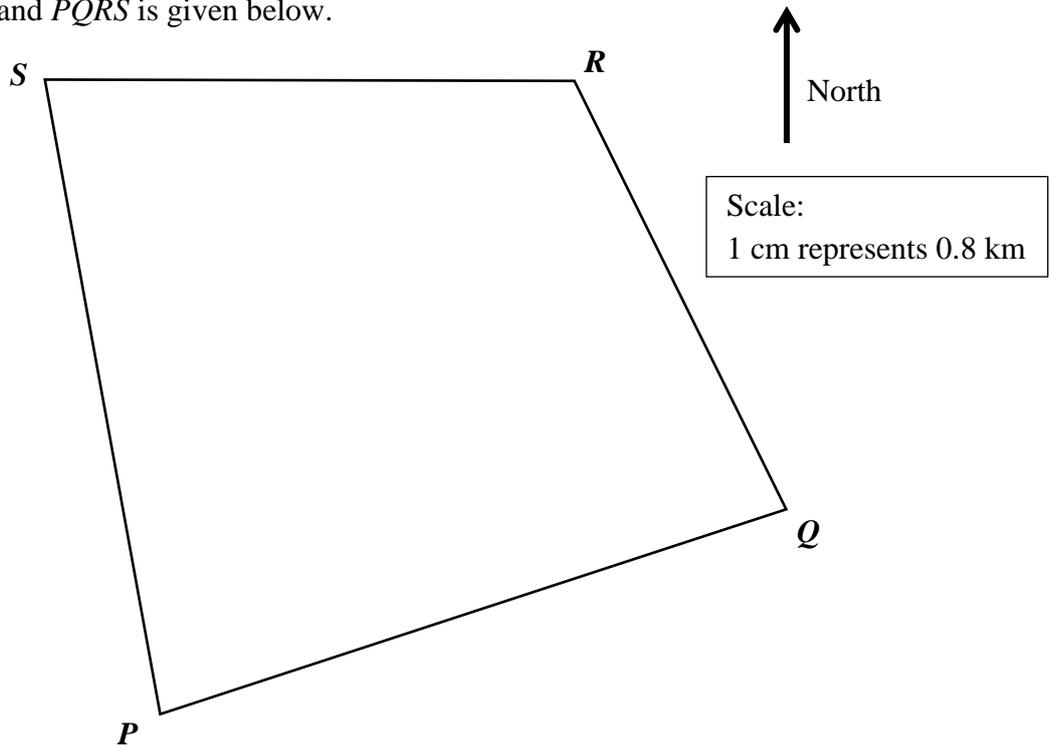
Answer  $k = \dots\dots\dots$  [2]

(b) On the axes given below, sketch the distance-time graph for the first  $k$  seconds of the motion of the object.



Answer .....shown on diagram..... [2]

19 A plot of land  $PQRS$  is given below.



- (i) A business tycoon would like to fix a position for his building in that plot of land. The building is on a bearing of  $120^\circ$  from  $S$  and is equidistant from  $R$  and  $Q$ . By construction, using protractor, compasses and ruler, find and label the position of the building with a  $X$ .

*Answer .....shown on diagram..... [2]*

- (ii) When the tycoon stands at  $P$  and looks at the top of the building, his angle of elevation is  $1.8^\circ$ . By measuring the length of  $PX$ , find the actual height of the building, in metres.

$$7 \times 0.8 = 5.6 \text{ km}$$

$$\tan 1.8^\circ = \frac{\text{height}}{5.6}$$

$$\begin{aligned} \text{height} &= 5.6 \tan 1.8^\circ \\ &= 0.17598 \text{ km} \\ &= 176 \text{ m} \end{aligned}$$

M1 – use of scale (allow 6.9 to 7.1 for  $PX$ )

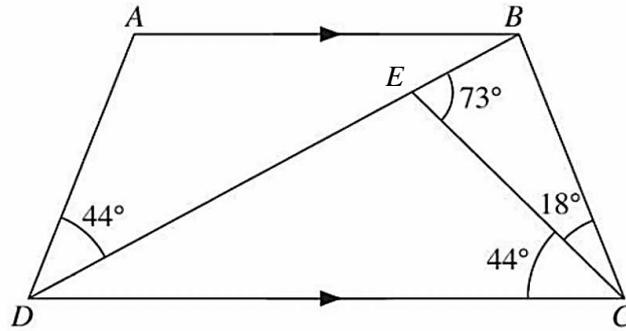
M1 – use of trigo ratio

Allow ECF

A1 (173 to 179)

*Answer ..... m [3]*

20 In the diagram given below,  $ABCD$  is a trapezium and  $DEB$  is a straight line.  $\angle ADB = \angle ECD = 44^\circ$ ,  $\angle BEC = 73^\circ$  and  $\angle ECB = 18^\circ$ .



(a) Calculate, stating reasons clearly

(i)  $\angle ABD$ ,

$$\begin{aligned} \angle BDC &= 73^\circ - 44^\circ \text{ (ext } \angle = \text{ sum of opp int } \angle \text{ in } \Delta) \\ &= 29^\circ \end{aligned}$$

$$\angle ABD = 29^\circ \text{ (alt } \angle \text{s, } AB \parallel DC)$$

B2. Minus 1  
for no reasons

Answer ..... $^\circ$  [2]

(ii) reflex  $\angle DAB$ .

$$\begin{aligned} \angle DAB &= 180^\circ - 29^\circ - 44^\circ \text{ (sum of } \angle \text{ in } \Delta) \\ &= 107^\circ \end{aligned}$$

$$\begin{aligned} \text{Reflex } \angle DAB &= 360^\circ - 107^\circ \text{ (}\angle \text{s at a point)} \\ &= 253^\circ \end{aligned}$$

B2. Minus 1  
for no reasons

Answer ..... $^\circ$  [2]

(b) Explain why a semicircle, with  $DC$  as a diameter, does not pass through  $B$ .

$$\begin{aligned} \angle DBC &= 180^\circ - 73^\circ - 18^\circ \text{ (sum of } \angle \text{ in } \Delta) \\ &= 89^\circ \end{aligned}$$

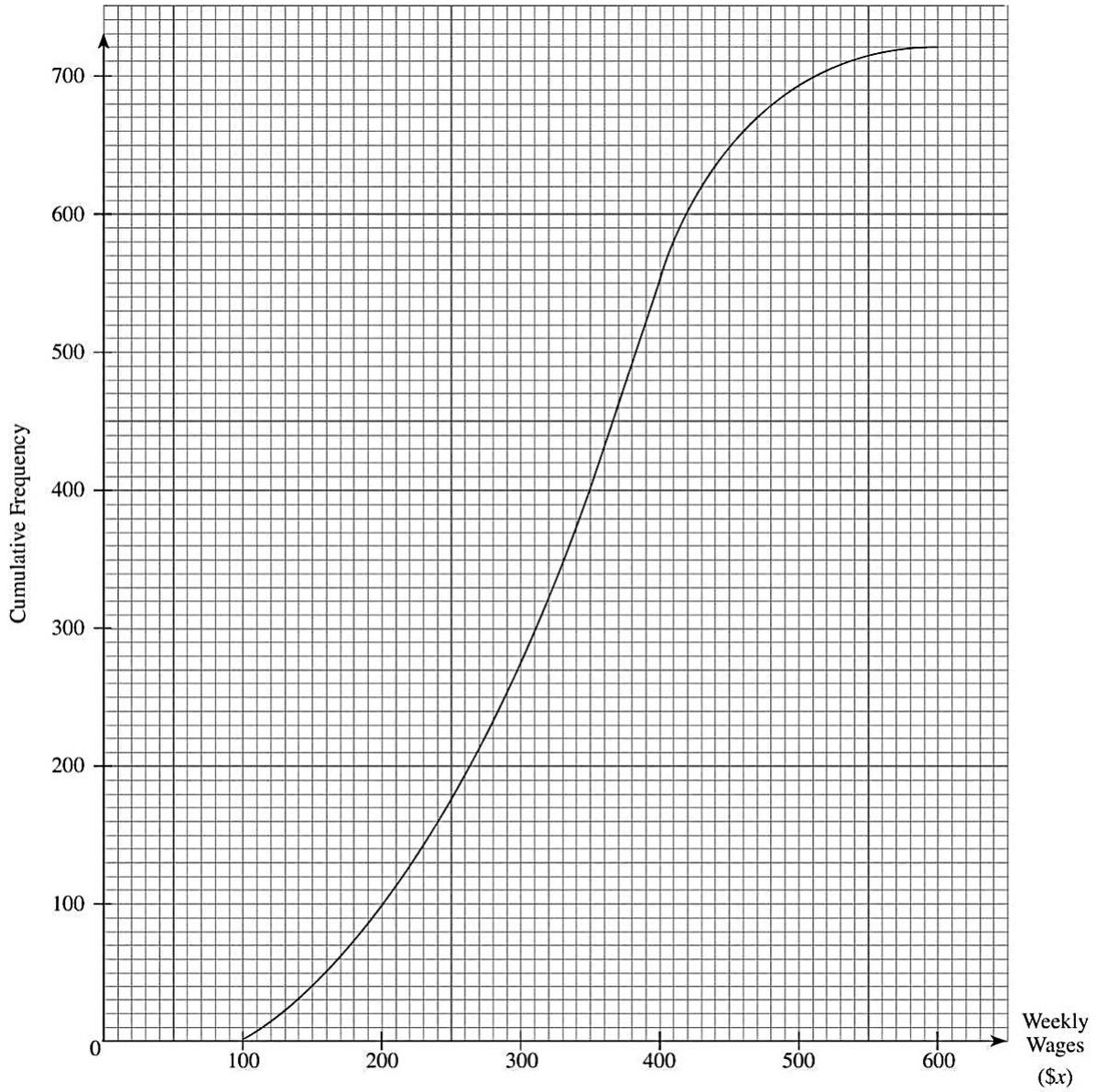
$$\angle DBC \neq 90^\circ.$$

Therefore  $B$  is not on the circumference of the circle with  $DC$  as a diameter. A1

Answer .....

..... [1]

21 The cumulative frequency curve below gives the weekly wages of 720 factory workers in factory A.



Use the graph to find

(a) the number of workers earning \$240 or less a week,

160

B1

Answer ..... [1]

(b) the median weekly wage,

335

B1

*Answer* \$ ..... [1]

(c) the interquartile range,

395 – 250

= 145

M1 – able to find either LQ or UQ

A1

*Answer* \$ ..... [2]

(d) the percentage of workers earning more than \$420 a week.

720 – 600 = 120

$\frac{120}{720} \times 100\% = 16.7\% / 16\frac{2}{3}\%$

M1 – able to find workers earning more than \$420

A1

*Answer* .....% [2]

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- 22 The average number of plain waffle, peanut waffle and chocolate waffle sold per day at 2 outlets on weekdays is given by matrix **P** and the average number of waffles sold on weekends is given by matrix **Q**.

$$P = \begin{pmatrix} 71 & 53 & 89 \\ 80 & 24 & 92 \end{pmatrix} \quad Q = \begin{pmatrix} 22 & 35 & 52 \\ 22 & 42 & 45 \end{pmatrix}$$

- (a) Evaluate the matrix **T** = **5P** + **2Q**.

$$T = 5 \begin{pmatrix} 71 & 53 & 89 \\ 80 & 24 & 92 \end{pmatrix} + 2 \begin{pmatrix} 22 & 35 & 52 \\ 22 & 42 & 45 \end{pmatrix}$$

$$T = \begin{pmatrix} 399 & 335 & 549 \\ 444 & 204 & 550 \end{pmatrix} \quad \text{B2}$$

Answer **T** = ..... [2]

- (b) The price of a plain waffle is \$1.60, peanut waffle is \$2.20 and a chocolate waffle is \$2.00. Represent the prices by a 3×1 column matrix **S**.

$$S = \begin{pmatrix} 1.6 \\ 2.2 \\ 2 \end{pmatrix} \quad \text{B1}$$

Answer **S** = ..... [1]

- (c) Evaluate the matrix **R** = **TS**.

$$R = \begin{pmatrix} 399 & 335 & 549 \\ 444 & 204 & 550 \end{pmatrix} \begin{pmatrix} 1.6 \\ 2.2 \\ 2 \end{pmatrix}$$

$$R = \begin{pmatrix} 2473.40 \\ 2259.20 \end{pmatrix} \quad \text{B2 – Allow full ECF}$$

Answer **R** = ..... [2]

- (d) Explain what the elements of **R** represent.

They represent the total amount collected (sales/revenue) by selling waffles for 7 days by 2 outlets respectively. B1

Answer .....

.....[1]