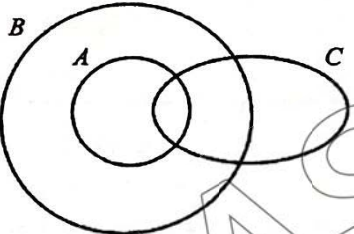
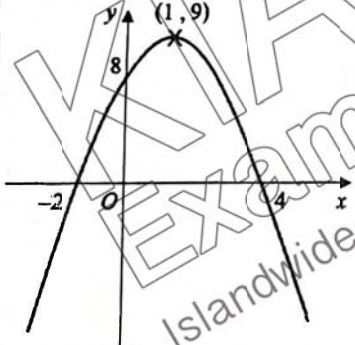
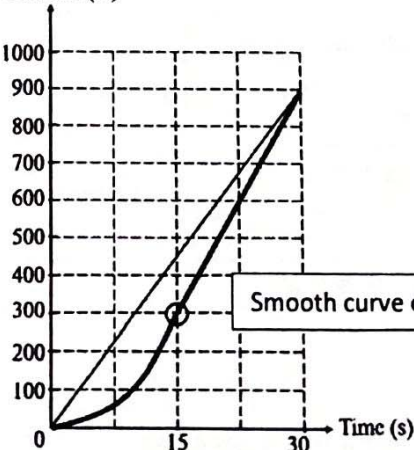
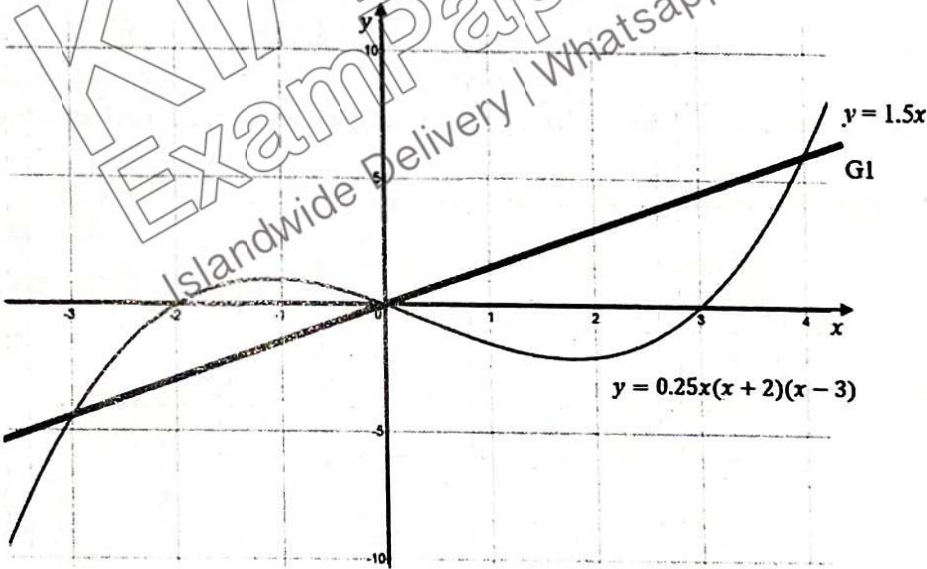


Answers

1	$4^{3k} \times 4^2 = 4^0$ $3k + 2 = 0$ $k = -\frac{2}{3} \text{ exact only!}$
2	<p>Median = 36                      Interquartile Range = 18  <math>Q_1 = 46 - 18 = 28</math>  <math>X = 8 \rightarrow</math> digit in the ones place.</p>
3	<p>HCF = 6 = <math>2 \times 3</math>                      LCM = 60 = <math>2^2 \times 3 \times 5</math></p> <p><math>p = 2^2 \times 3 = 12</math>  <math>q = 2 \times 3 \times 5 = 30</math></p>
4	
5	
6	$\frac{1.79}{10} = \frac{179}{1000}$ $\frac{17.9}{2 \times 50} = \frac{179}{1000}$ $\frac{26.85}{150} = \frac{179}{1000}$ <p style="border: 1px solid black; padding: 5px; display: inline-block;">Must show for all three!</p> <p>Since <math>\frac{\text{cost}}{\text{volume}} = \text{constant}</math>, the cost is directly proportional to its volume.</p>
7	$0.05x > 0.03x + 8 \text{ or } 1.05x > 1.03x + 8$ $0.02x > 8$ $x > 400$
8	$\frac{2x+1-3x}{x(2x+1)} = 1$ $1 - x = 2x^2 + x$ $2x^2 + 2x - 1 = 0$ <p style="border: 1px solid black; padding: 5px; display: inline-block;">Must show quad formula with values subbed in.</p> $x = \frac{-2 \pm \sqrt{(2)^2 - 4(2)(-1)}}{2(2)} = 0.366 \text{ or } -1.37$
9	$y^2 = \frac{2x+y}{3x-5}$ $3xy^2 - 5y^2 = 2x + y$ $3xy^2 - 2x = 5y^2 + y$ $x(3y^2 - 2) = 5y^2 + y$ $x = \frac{y(5y+1)}{3y^2-2} \text{ or } \frac{5y^2+y}{3y^2-2} \text{ or } \frac{5y^2+y}{2-3y^2}$
10	$10\,000 \left(1 + \frac{2.75-4}{100}\right)^{3 \times 4} - 10\,000$ $= 10\,856.92 - 10\,000$ $= 856.92$ $= \$857$ <p style="border: 1px solid black; padding: 5px; display: inline-block;">Quarterly is 4 times!</p>
11	$\left(\frac{3}{5}\right)^2 = \frac{9}{25}$ $\frac{9}{25} \times 200 = 72 \text{ ml}$ <p style="border: 1px solid black; padding: 5px; display: inline-block;">Not cube because one of the component is constant!!</p>
12a	$\frac{80 \text{ km}}{1 \text{ h}} = \frac{80 \times 1000 \text{ m}}{3600 \text{ s}} = \frac{200}{9} = 22 \frac{2}{9}$ <p style="border: 1px solid black; padding: 5px; display: inline-block;">Mixed number or 3sf only!!</p>
12b	$\frac{40}{15} = 2 \frac{2}{3}$
12c	<p>Distance (m)</p>  <p style="border: 1px solid black; padding: 5px; display: inline-block;">Smooth curve only!</p> <p>Time (s)</p>

13	$\overline{PR} = \overline{PQ} + \overline{QR} = \begin{pmatrix} -3 \\ 4 \end{pmatrix} + \begin{pmatrix} 12 \\ 5 \end{pmatrix} = \begin{pmatrix} 9 \\ 9 \end{pmatrix}$ $ \overline{PR}  = \sqrt{9^2 + 9^2} = \sqrt{162} = 12.7 \text{ units}$	<p>PQ is not perpendicular to PS!</p> <p>Length PR <math>\neq</math> length PQ + length QR!</p>										
14	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"><math>3^1 = 3</math></td> <td style="width: 50%;"><math>8^1 = 8</math></td> </tr> <tr> <td><math>3^2 = 9</math></td> <td><math>8^2 = 64</math></td> </tr> <tr> <td><math>3^3 = 27</math></td> <td><math>8^3 = 512</math></td> </tr> <tr> <td><math>3^4 = 81</math></td> <td><math>8^4 = 4096</math></td> </tr> <tr> <td><math>3^5 = 243</math></td> <td><math>8^5 = 32768</math></td> </tr> </table> <p>Last digit for <math>3^n</math> is 3, 9, 7, 1                      Last digit for <math>8^n</math> is 8, 4, 2, 6</p> <p><math>\frac{31}{4} = 7\frac{3}{4} \rightarrow</math> Remainder = 3 <math>\rightarrow</math> Last digit = 7</p> <p><math>\frac{16}{4} = 4 \rightarrow</math> Remainder = 0 <math>\rightarrow</math> Last digit = 6</p> <p>Last digit of <math>3^{31} - 8^{16} = 7 - 6 = 1</math></p>	$3^1 = 3$	$8^1 = 8$	$3^2 = 9$	$8^2 = 64$	$3^3 = 27$	$8^3 = 512$	$3^4 = 81$	$8^4 = 4096$	$3^5 = 243$	$8^5 = 32768$	<p style="border: 1px solid black; padding: 5px; display: inline-block;">We must see that you had chosen the digit "7" and "6"</p>
$3^1 = 3$	$8^1 = 8$											
$3^2 = 9$	$8^2 = 64$											
$3^3 = 27$	$8^3 = 512$											
$3^4 = 81$	$8^4 = 4096$											
$3^5 = 243$	$8^5 = 32768$											
15	<p><math>\frac{1}{4}x(x+2)(x-3) = \frac{6}{4}x</math></p> <p>Plot <math>y = \frac{3}{2}x</math></p>	<p style="border: 1px solid black; padding: 5px;">Equation of line must be seen in this page. Or else, we will take it as you use calculator mode 3, 4.</p> <div style="text-align: center;">  </div> <p><math>x = -3</math> or <math>0</math> or <math>4 \rightarrow</math> only accept exact answers.</p>										

2019 MYE EM P1 Solutions

16	Draw perpendicular bisector of $LC$ . Draw angle bisector of $AC$ . Unit 518.	
17	Let $M$ be the midpoint of $RS$ . $OM = \sqrt{13^2 - 12^2} = 5$ (Perpendicular bisector of chord) $OK = \sqrt{5^2 + 5^2} = 7.07$ (Equal chords)	Leave answer in 3sf as you are finding length!
18	$20 \leq \frac{(n-2) \times 180 - 100 - 20}{n-2} \leq 100$ $20(n-2) \leq (n-2) \times 180 - 120 \leq 100(n-2)$ $20n - 40 \leq 180n - 360 - 120 \leq 100n - 200$ $20n - 40 \leq 180n - 480 \text{ or } 180n - 480 \leq 100n - 200$ $440 \leq 160n \text{ or } 80n \leq 280$ $2.75 \leq n \text{ or } n \leq 3.5$ $2.75 \leq n \leq 3.5$ $n = 3$	Guess & check allowed for this qn.
19a	$2x^2 - 4x - 7x + 14 - 9 = 2x^2 - 11x + 5 = (2x - 1)(x - 5)$	Factorise, not completing the square! Read carefully.
19b	$2(y - 1)^2 - 11(y - 1) + 5 = 0$ $x = y - 1 \rightarrow$ must be seen! Read question. It says "Hence". $y - 1 = \frac{1}{2}$ or 5 $y = 1.5$ or 6	
20	$\frac{x+8}{y} = 4$ $x + 8 = 4y$ $\frac{x}{y} = 2 + \frac{8}{y}$ $x = 2y + 6$ $2y + 6 + 8 = 4y$ $2y = 14$ $y = 7$ $x = 20$	Do not write mixed number for algebra!!  Recall: dividend = (divisor)(quotient) + remainder
21	$\angle BCD = 180 - 54 = 126$ ( $\angle$ s in opp segment) $\angle DCP = 180 - 126 = 54$ (adj $\angle$ on a straight line) $\angle ADC = 27 + 54 = 81$ (ext $\angle$ of $\Delta$ ) $\angle AQD = 180 - 54 - 81 = 45$ ( $\angle$ sum of $\Delta$ )	Easier method: $\angle ABP = 180 - 54 - 27 = 99$ ( $\angle$ sum of $\Delta$ ) $\angle ADQ = 180 - 99 = 81$ ( $\angle$ s in opposite segment) $\angle AQD = 180 - 54 - 81 = 45$ ( $\angle$ sum of $\Delta$ )
22	$\pi r l = 2\pi r^2$ $l = 2r$ $h = \sqrt{(2r)^2 - r^2} = \sqrt{3}r$  Volume = $\pi r^2(\sqrt{3}r + 2r) - \frac{1}{3}\pi r^2(\sqrt{3}r) - \frac{2}{3}\pi r^3$ $= \pi r^3\left(\sqrt{3} + 2 - \frac{\sqrt{3}}{3} - \frac{2}{3}\right)$ $= 7.82r^3$	Vertical height and slanted length are different!  Refer to cover page if you had left your answers in $\pi$ .

2019 MYE EM P1 Solutions

23a	<table border="1"> <thead> <tr> <th>Length of stay (days)</th> <th>Numbers of tourists</th> </tr> </thead> <tbody> <tr> <td><math>0 &lt; x \leq 5</math></td> <td>10</td> </tr> <tr> <td><math>5 &lt; x \leq 10</math></td> <td>10</td> </tr> <tr> <td><math>10 &lt; x \leq 15</math></td> <td>10</td> </tr> <tr> <td><math>15 &lt; x \leq 20</math></td> <td>2</td> </tr> <tr> <td><math>20 &lt; x \leq 25</math></td> <td>2</td> </tr> <tr> <td><math>25 &lt; x \leq 30</math></td> <td>3</td> </tr> <tr> <td><math>30 &lt; x \leq 35</math></td> <td>3</td> </tr> <tr> <td><math>35 &lt; x \leq 40</math></td> <td>3</td> </tr> </tbody> </table>	Length of stay (days)	Numbers of tourists	$0 < x \leq 5$	10	$5 < x \leq 10$	10	$10 < x \leq 15$	10	$15 < x \leq 20$	2	$20 < x \leq 25$	2	$25 < x \leq 30$	3	$30 < x \leq 35$	3	$35 < x \leq 40$	3
Length of stay (days)	Numbers of tourists																		
$0 < x \leq 5$	10																		
$5 < x \leq 10$	10																		
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$15 < x \leq 20$	2																		
$20 < x \leq 25$	2																		
$25 < x \leq 30$	3																		
$30 < x \leq 35$	3																		
$35 < x \leq 40$	3																		
23b	$\frac{13}{43}$																		
23c	Mean = $13\frac{77}{86}$ or 13.9 SD = 11.0 <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 100px;">3sf only! Do not round to nearest integer!</div>																		
24a	$(x-2)^4(x^2-4x+4) = (x-2)^4(x-2)^2 = (x-2)^6 \rightarrow$ <b>must be seen!</b> Since the power 6 is both a <b>multiple of 2</b> and of <b>3</b> , it is both a perfect cube and a perfect square.																		
24b	$2x + 2y = 20$ $x + y = 10$ $2x^2 + 2y^2 = 140$ $x^2 + y^2 = 70$ $(x+y)^2 = x^2 + y^2 + 2xy$ $2xy = 100 - 70$ $xy = 15$ <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 100px;">Alternative method is to solve of x and y to get 8.16 or 1.84 and find <math>xy = 15.0 \text{ cm}^2</math>.</div>																		
25a	$P = \begin{pmatrix} 32 & 27 & 20 \\ 44 & 45 & 38 \end{pmatrix}$																		
25b	$PQ = \begin{pmatrix} 319.9 \\ 525.7 \end{pmatrix}$																		
25c	$R = \begin{pmatrix} \frac{3}{4} & 0 & 0 \\ 0 & \frac{2}{3} & 0 \\ 0 & 0 & \frac{1}{2} \end{pmatrix}$ <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 100px;">Work with exact! This is percentage, not money hence, it should not be 2dp! Only accept exact or 3sf.</div>																		
25d	$S = \begin{pmatrix} 32 & 27 & 20 \\ 44 & 45 & 38 \end{pmatrix} \begin{pmatrix} \frac{3}{4} & 0 & 0 \\ 0 & \frac{2}{3} & 0 \\ 0 & 0 & \frac{1}{2} \end{pmatrix} \begin{pmatrix} 3.2 \\ 4.5 \\ 4.8 \end{pmatrix} = \begin{pmatrix} 24 & 18 & 10 \\ 33 & 30 & 19 \end{pmatrix} \begin{pmatrix} 3.2 \\ 4.5 \\ 4.8 \end{pmatrix} = \begin{pmatrix} 205.8 \\ 331.8 \end{pmatrix}$																		
25e	They represent the <b>total money collected from Childcare Centre A and B respectively</b> for the sales of cakes after discount.																		
Money collected from sales is not money earned! The word "earned/earnings" relates to profit.																			

Name:

Register Number:

Class:



南僑中學

**NAN CHIAU HIGH SCHOOL**

**MID-YEAR EXAMINATION 2019  
SECONDARY FOUR EXPRESS**

# MARKING SCHEME

For Marker's Use

**MATHEMATICS**

**Paper 2**

Candidates answer on the Question Paper.

4048/02

9 May 2019, Thursday

2 hours 30 minutes

2019 Sec 4 MYE EM P2 Solution

1. (a) Simplify  $\frac{4b^3}{3a} \div \frac{(-4ab^3)^2}{2a^{-4}b^2}$ . Give your answer in positive indices. [2]

$$\begin{aligned} & \frac{4b^3}{3a} \div \frac{(-4ab^3)^2}{2a^{-4}b^2} \\ &= \frac{4b^3}{3a} \times \frac{2a^{-4}b^2}{16a^2b^6} \quad \text{----- [M1] convert expression to multiplication \& use of power} \\ &= \frac{b^3}{3a} \times \frac{b^2}{2a^6b^6} \\ &= \frac{1}{6a^7b} \quad \text{----- [A1]} \end{aligned}$$

- (b) Factorise  $14xb + 3ay - 2xy - 21ab$  completely. [2]

$$\begin{aligned} & 14xb + 3ay - 2xy - 21ab \\ &= 14xb - 2xy - 21ab + 3ay \\ &= 2x(7b - y) - 3a(7b - y) \quad \text{----- [M1] factorise common terms} \\ &= (7b - y)(2x - 3a) \quad \text{----- [A1]} \end{aligned}$$

- (c) Solve the inequality  $\frac{x}{5} < \frac{x+2}{3} \leq \frac{3-2x}{4}$ . [3]

$$\begin{array}{lll} \frac{3-2x}{4} \geq \frac{x+2}{3} & \text{and} & \frac{x+2}{3} > \frac{x}{5} \\ 3(3-2x) \geq 4(x+2) & \text{and} & 5(x+2) > 3x \\ 9-6x \geq 4x+8 & \text{and} & 5x+10 > 3x \\ 1 \geq 10x & \text{and} & 2x > -10 \\ x \leq \frac{1}{10} & \text{----- [M1] and} & x > -5 \quad \text{----- [M1]} \end{array}$$

$$-5 < x \leq \frac{1}{10} \quad \text{----- [A1]}$$

(d) Simplify  $\frac{2x(1-6x)}{4x^2-1} - \frac{2}{2x+1}$

[3]

$$\begin{aligned} & \frac{2x(1-6x)}{4x^2-1} - \frac{2}{2x+1} \\ &= \frac{2x(1-6x)}{(2x+1)(2x-1)} - \frac{2(2x-1)}{(2x+1)(2x-1)} \quad \text{----- [M1] common denominator} \\ &= \frac{2x-12x^2-4x+2}{(2x+1)(2x-1)} \\ &= \frac{-12x^2-2x+2}{(2x+1)(2x-1)} \quad \text{----- [M1] simplify numerator} \\ &= \frac{-2(6x^2+x-1)}{(2x+1)(2x-1)} \\ &= \frac{-2(3x-1)(2x+1)}{(2x+1)(2x-1)} \quad \text{----- [M1] factorise numerator} \\ &= \frac{-2(3x-1)}{2x-1} \quad \text{----- [A1]} \end{aligned}$$

(e) Express  $2x^2 + 6x - 15$  in the form  $a(x + b)^2 + c$ , where  $a$ ,  $b$  and  $c$  are constants.

Hence, solve the equation  $2x^2 + 6x - 15 = 0$ , giving your answers correct to four decimal places.

[4]

$$\begin{aligned} & 2x^2 + 6x - 15 \\ &= 2\left(x^2 + 3x - \frac{15}{2}\right) \\ &= 2\left[\left(x + \frac{3}{2}\right)^2 - \frac{9}{4} - \frac{15}{2}\right] \quad \text{----- [M1] ability to do completing the square} \\ &= 2\left[\left(x + \frac{3}{2}\right)^2 - \frac{39}{4}\right] \\ &= 2\left(x + \frac{3}{2}\right)^2 - \frac{39}{2} \quad \text{----- [A1]} \end{aligned}$$

$$2x^2 + 6x - 15 = 0$$

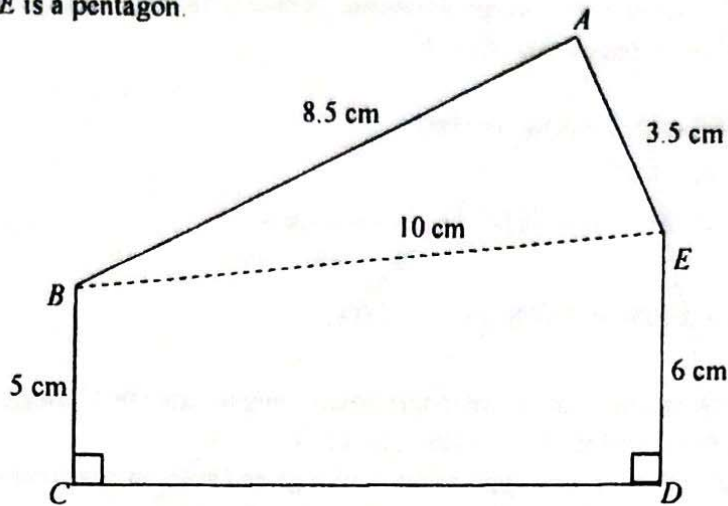
$$2\left(x + \frac{3}{2}\right)^2 - \frac{39}{2} = 0$$

$$\left(x + \frac{3}{2}\right)^2 = \frac{39}{4} \quad \text{----- [M1] solving using completing the square}$$

$$x + \frac{3}{2} = \pm \sqrt{\frac{39}{4}}$$

$$x = 1.6225 \text{ or } x = -4.6225 \quad \text{----- [A1]}$$

2.  $ABCDE$  is a pentagon.



(a) Calculate the area of the pentagon  $ABCDE$ .

[5]

$$10^2 = 8.5^2 + 3.5^2 - 2(8.5)(3.5)\cos\hat{BAE} \text{ ----- [M1] use of cosine rule}$$

$$\cos\hat{BAE} = \frac{8.5^2 + 3.5^2 - 10^2}{2(8.5)(3.5)}$$

$$\cos\hat{BAE} = -0.260504$$

$$\alpha = 74.90^\circ$$

$$\hat{BAE} = 105.1^\circ \text{ or } 285.1^\circ \text{ (rej) ----- [M1] ability to find angle } \hat{BAE}$$

Or

$$\hat{ABE} = 19.75^\circ \text{ or } 340.25^\circ \text{ (rej)}$$

$$\hat{BEA} = 55.15^\circ \text{ or } 304.85^\circ \text{ (rej)}$$

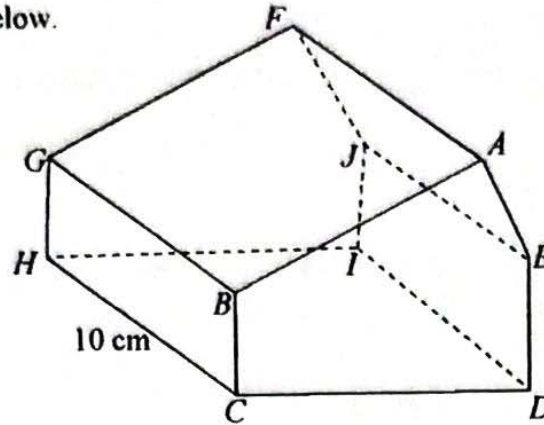
$$\begin{aligned} \text{area of } \triangle ABE &= \frac{1}{2}(8.5)(3.5)\sin 105.1^\circ \text{ ----- [M1] finding area of triangle} \\ &= 14.36 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} BE &= \sqrt{10^2 - 3.5^2} \\ &= \sqrt{99} \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Area of } BCDE &= \frac{1}{2}(5 + 6)(\sqrt{99}) \text{ ----- [M1] finding area of trapezium} \\ &= 54.72 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of } ABCDE &= 14.36 + 54.72 \\ &= 69.1 \text{ cm}^2 \text{ ----- [A1]} \end{aligned}$$

- (b) The pentagon  $ABCDE$  is a cross-section of a prism which is a model of a house as shown below.



- (i) Calculate the total surface area of the model, including the base. [2]

$$\begin{aligned}
 &\text{total surface area} \\
 &= 2(69.08) + 10(5 + 8.5 + 3.5 + 6 + \sqrt{99}) \\
 &= 468 \text{ cm}^2 \quad \text{----- [A1]}
 \end{aligned}$$

[M1] area of all surface area (excluding cross-sectional area)

- (ii) Calculate the angle of depression of  $H$  from  $E$ . [3]

Let the angle of depression be  $\theta$

Student use

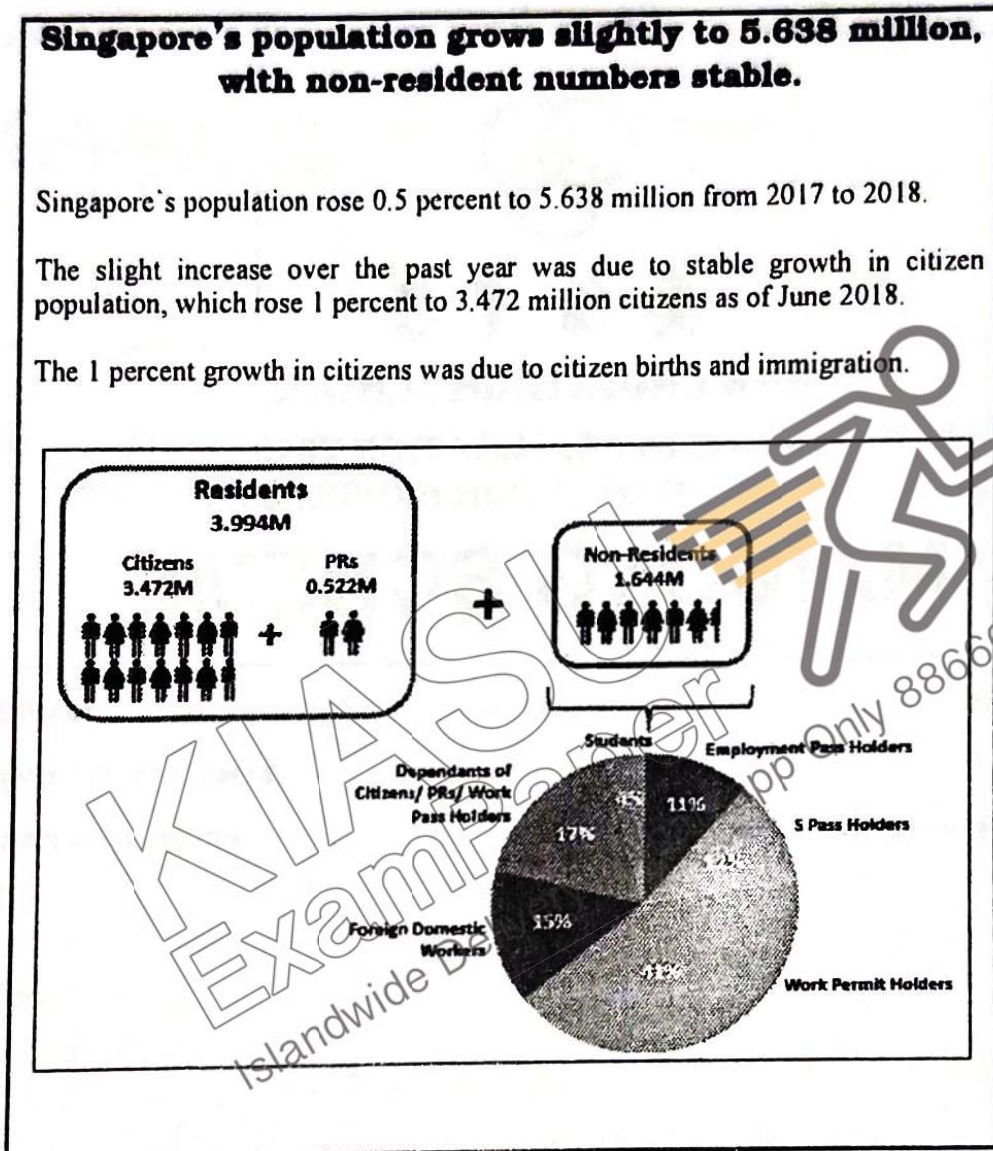
- (i) angle of depression = angle of elevation or  
(ii) angle of depression =  $90^\circ - 57.5^\circ$

$$\begin{aligned}
 HD &= \sqrt{10^2 + 99} \quad \text{----- [M1] finding length HD} \\
 &= \sqrt{199} \text{ cm}
 \end{aligned}$$

$$\tan \theta = \frac{6}{\sqrt{199}} \quad \text{----- [M1] finding relevant angle (either angle EHD or HED)}$$

$$\theta = 23.0^\circ \quad \text{----- [A1]}$$

3. There was a newspaper article on Singapore's population published in 2018.



Source: <https://www.channelnewsasia.com/news/singapore/singapore-s-population-grows-slightly-to-5-64m-with-non-resident-10763132>

- (a) Calculate the Singapore's total population in 2017. [2]

$$\begin{aligned}
 100.5\% &\rightarrow 5.638 \text{ million} \\
 100\% &\rightarrow \frac{100}{100.5} \times 5.638 \text{ million} \text{ ----- [M1] showing } \frac{100}{100.5} \times 5.638 \\
 &= 5.61 \times 10^6 \text{ ----- [A1] or 5.61 million}
 \end{aligned}$$

- (b) Express the number of Foreign Domestic Workers as a percentage of the Singapore's total population in 2018. [2]

Number of foreign domestic workers  
 $= \frac{15}{100} \times 1.644 \times 10^6$   
 $= 0.2466 \times 10^6$  ----- [M1] must in  $10^6$  or million

$\frac{0.2466 \times 10^6}{5.638 \times 10^6} \times 100\% = 4.37\%$  ----- [A1]

- (c) Based on the information shown in this article, do you agree that "Singapore's total population will reach 6.3 million by 2030?"  
 Support your answer with appropriate workings and state an assumption that you have made in your calculation. [3]

2030 – 2018 = 12 years

Population of citizen by 2030  
 $= (1.01)^{12} \times 3.472 \times 10^6$  ----- [M1] finding the increase of citizen only  
 $= 3.912 \times 10^6$

total population by 2030  
 $= (3.912 + 0.522 + 1.644) \times 10^6$   
 $= 6.08 \times 10^6$  ----- [A1]

Assumption:

There is no increase for PRs and Non-Residents or

There is a constant growth of citizens at 1% per year ----- [M1]

- (d) State one aspect of the diagram that may be misleading and explain how this may lead to a misinterpretation. [2]

Accept any logical answer

(i) Pictogram used alternate of a male and female figure --- [B1]  
 [Reason] misleading readers that there is an equal number of male and female population. --- [B1]

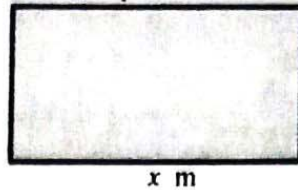
(ii) Inaccurate use of  $\frac{1}{2}$  pictogram "figure" for "non-resident" &  $\frac{3}{4}$  in "citizen"  
 --- [B1]

[Reason]

in PRs : if 1 figure  $\rightarrow$  0.261 M

in citizen : 3.472 M should be represented by 13.3 figures  
 not  $13 + \frac{3}{4}$  figure --- [B1]

4. The diagram shows a rectangular table top



The area of the table top is 5 square metres.  
 The length of the table top is  $x$  metres.  
 The perimeter of the table top is  $y$  metres.

- (a) Show that  $y = 2x + \frac{10}{x}$ . [2]

Width of table top =  $\frac{5}{x}$  ----- [M1]

Perimeter,  $y = x + \frac{5}{x} + x + \frac{5}{x}$  ----- [M1]

$$y = 2x + \frac{10}{x}$$

- (b) The variables  $x$  and  $y$  are connected by the equation  $y = 2x + \frac{10}{x}$ .

$x$	0.5	1	1.5	2	4	6	8
$y$	$p$	12	$q$	9	10.5	13.7	17.3

Find the value of  $p$  and of  $q$ .

$$p = 21$$

$$q = 9.7 \text{ (accept also 9.67)} \text{ ----- [B1] for both answers}$$

- (c) Using a scale of 1 cm to represent 1 unit, draw a horizontal  $x$ -axis for  $0 \leq x \leq 8$ .  
 Using a scale of 1 cm to represent 1 unit, draw a vertical  $y$ -axis for  $0 \leq y \leq 22$ .  
 On your axes, plot the points given in the table and join them with a smooth curve. [3]



- (d) Use your graph to find the possible width of the table top if the perimeter of the table top is 16 m. [2]

When  $P = 16$ ,

$x = 0.7 (\pm 0.1)$  ----- [B1] answer must be rejected as length is longer  
or  $x = 7.3 (\pm 0.1)$  ----- [B1]

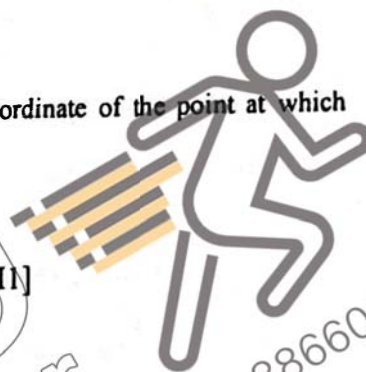
- (e) By drawing a suitable straight line, find the  $x$ -coordinate of the point at which gradient of the curve is  $\frac{1}{3}$ . [2]

Draw a line with grad =  $\frac{1}{3}$  on the graph ----- [M1]

$x$ -coordinate = 2.3 ( $\pm 0.1$ ) ----- [A1]

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5. Given equation of a line  $L$  is  $3x - 2y = 8$ .

(a) State the gradient of line  $L$ .

[1]

$$2y = 3x - 8$$

$$y = \frac{3}{2}x - 4$$

$$\text{Gradient} = \frac{3}{2} \text{ ----- [B1]}$$

(b) If  $P(k, -2)$  is a point on the line  $L$ , find the value of  $k$ .

[1]

$$3k - 2(-2) = 8$$

$$k = \frac{4}{3} \text{ ----- [B1]}$$

(c) Find the equation of another line that is parallel to the  $x$ -axis and passes through  $P$ .

[1]

$$y = -2 \text{ ----- [B1]}$$

(d) Calculate the perpendicular distance from the origin,  $O$ , to the line  $L$ .

[4]

$$3x - 2y = 8$$

$$\text{When } x = 0, y = -4 \quad (0, -4)$$

$$\text{When } y = 0, x = \frac{8}{3} \quad (\frac{8}{3}, 0)$$

----- [M1] finding relevant coordinates

Distance between 2 points

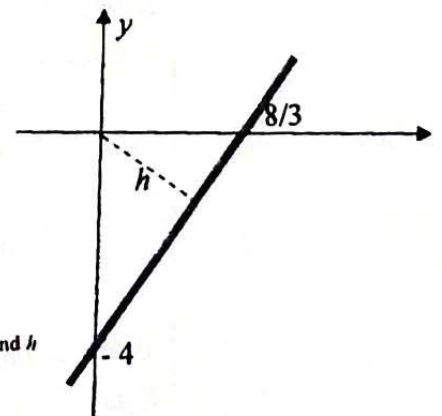
$$= \sqrt{(\frac{8}{3})^2 + (4)^2} \text{ ----- [M1]}$$

$$= 4.8074 \text{ units}$$

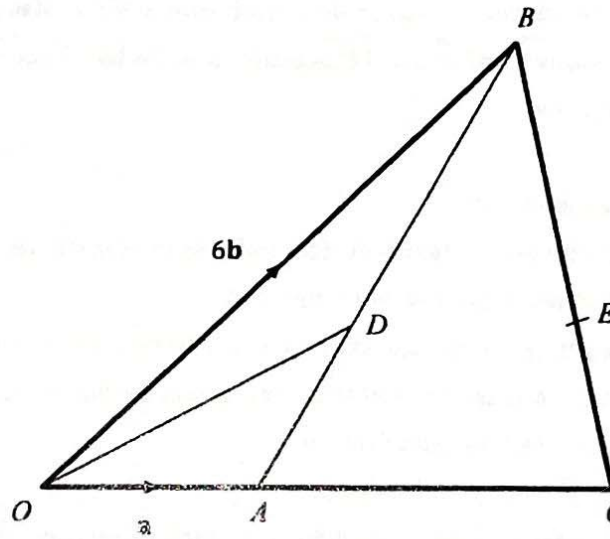
Let the perpendicular distance be  $h$ .

$$\frac{1}{2}(4)(\frac{8}{3}) = \frac{1}{2}(h)(4.8074) \text{ ----- [M1] suitable method to find } h$$

$$h = 2.22 \text{ units ----- [A1] accept } h = 2.21 \text{ units}$$



6.



In the diagram,  $\vec{OA} = \mathbf{a}$ ,  $\vec{OB} = 6\mathbf{b}$  and  $\vec{OA} = \frac{1}{3}\vec{OC}$ .

$D$  is a point on  $AB$  such that  $3\vec{AD} = 2\vec{DB}$  and  $E$  is a point on  $BC$  such that  $\vec{CE} : \vec{EB} = 4 : 5$ .

(a) Express, as simply as possible, in terms of  $\mathbf{a}$  and  $\mathbf{b}$ ,

(i)  $\vec{BA}$ ,

$$\begin{aligned} \vec{BA} &= \vec{OA} - \vec{OB} \\ &= \mathbf{a} - 6\mathbf{b} \end{aligned}$$

(ii)  $\vec{OD}$ ,

$$\begin{aligned} \vec{OD} &= \vec{OA} + \vec{AD} \\ &= \vec{OA} - \frac{2}{5}\vec{BA} \\ &= \mathbf{a} - \frac{2}{5}(\mathbf{a} - 6\mathbf{b}) \\ &= \frac{3}{5}(\mathbf{a} + 4\mathbf{b}) \end{aligned}$$

(iii)  $\overline{CB}$ ,

[1]

$$\begin{aligned}\overline{CB} &= \overline{OB} - \overline{OC} \\ &= 6b - 3a \\ &= 3(2b - a)\end{aligned}$$

BI

(iv)  $\overline{AE}$ ,

[2]

$$\begin{aligned}\overline{AE} &= \overline{AC} + \overline{CE} \\ &= 2a + \frac{4}{9}\overline{CB} \\ &= 2a + \frac{4}{9}(6b - 3a) \\ &= \frac{2}{3}(a + 4b)\end{aligned}$$

BI

(b) Write down the relationship between  $OD$  and  $AE$ . Explain your answer. [2]

$$\overline{OD} = \frac{3}{5}(a + 4b)$$

$$\overline{AE} = \frac{2}{3}(a + 4b)$$

Since

$$|\overline{OD}| = \frac{9}{10}|\overline{AE}|,$$

$OD$  and  $AE$  are parallel lines.

M1 - Relationship between  $OD$  and  $AE$

A1 - Parallel lines

(c) Find the ratio of

(i) area of triangle  $CAE$  : area of triangle  $AOD$  ,

[2]

$$\frac{\text{area of triangle } CAE}{\text{area of triangle } AOD} = \frac{\frac{1}{2}(CA)(AE) \sin \theta}{\frac{1}{2}(OA)(OD) \sin \theta}$$

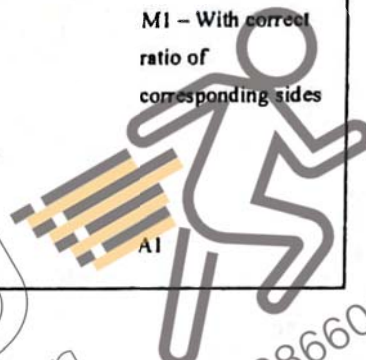
$$= \frac{AE}{OD} \times \frac{CA}{OA}$$

$$= \frac{10}{9} \times \frac{2}{1}$$

$$= \frac{20}{9}$$

20:9

M1 - With correct ratio of corresponding sides



(ii) area of triangle  $CAE$  : area of triangle  $AOB$ .

[2]

$$\frac{\text{area of triangle } CAE}{\text{area of triangle } AOB} = \frac{\text{area of triangle } CAE}{\text{area of triangle } AOD} \times \frac{\text{area of triangle } AOD}{\text{area of triangle } AOB}$$

$$= \frac{20}{9} \times \frac{\frac{1}{2}(h)(AD)}{\frac{1}{2}(h)(AB)}$$

$$= \frac{20}{9} \times \frac{2}{5}$$

$$= \frac{8}{9}$$

8:9

M1 - Common height relationship

A1

7. (a) There are two boxes of sweets containing toffees and chocolates.  
 Box A contains 8 toffees and 4 chocolates, whereas box B contains 7 toffees and 3 chocolates.

Jolin loves chocolates.

One of the boxes is chosen at random and a sweet is taken out.

If she gets a chocolate, she will consume it.

If she did not get a chocolate from the first selection, she will place the sweet into the other box and she will select again from the other box.

Jolin limits herself to two selections.

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

- (i) Jolin will have her favourite chocolate from the first selection, [3]

$$\begin{aligned}
 P(\text{first selection}) &= P(\text{Box A}) + P(\text{Box B}) \\
 &= \left(\frac{1}{2}\right)\left(\frac{4}{12}\right) + \left(\frac{1}{2}\right)\left(\frac{3}{10}\right) \\
 &= \frac{19}{60}
 \end{aligned}$$

M1 - with  $\frac{1}{2}$   
 M1 -  $4/12 + 3/10$   
 (without  $\frac{1}{2}$ )  
 A1

- (ii) Jolin will have her favourite chocolate. [3]

$$\begin{aligned}
 P(\text{favourite}) &= P(\text{at first}) + P(\text{at second}) \\
 &= \frac{19}{60} + P(\text{no A, yes B}) + P(\text{yes A, no B}) \\
 &= \frac{19}{60} + \left(\frac{1}{2}\right)\left(\frac{8}{12}\right)\left(\frac{3}{11}\right) + \left(\frac{1}{2}\right)\left(\frac{7}{10}\right)\left(\frac{4}{13}\right) \\
 &= \frac{4421}{8580}
 \end{aligned}$$

M1 - from (i)  
 M1 - with  $\frac{1}{2}$  and 2 cases for P(at second) correct  
 A1

- (b) Your friend, Kenton gives you a chance to win \$1000 by playing a game of "Guess the number". There are two options of the game that he allows you to choose.

Option A

He uses a random number generator to choose a number from 1 to 8.  
If you guess it correctly, you win.

Option B

You flip a fair coin.

If the coin lands on head, Kenton will roll a fair 6-sided die. If you manage to guess what it rolled, you win.

If the coin lands on tail, Kenton will use a random number generator to choose a random number from 1 to 8. If you guess the number correctly, you win.

Which option will you choose? Explain your answer. [3]

Option A

$$P(\text{win}) = \frac{1}{8}$$

Option B

$$P(\text{win}) = P(\text{H, die}) + P(\text{T, No. Gen.})$$

$$= \left(\frac{1}{2}\right)\left(\frac{1}{6}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{8}\right)$$

$$= \frac{7}{48} \left(> \frac{1}{8}\right)$$

Since Option B has a higher probability,  
Option B should be chosen.

M1  
M1 - with both options' probability correctly calculated.

- A regular hexagon forms within the inner circle  $ABCDEF$  with  $OB = 5$  cm. This information is illustrated in Figure 3.

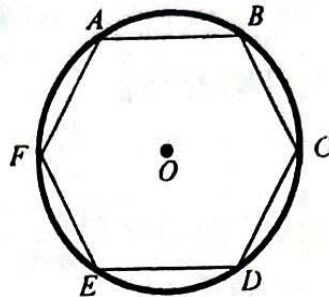


Figure 3

- (a) Show that the radius of the outer circle is 13.31 cm, correct to 2 decimal places. [6]

Let  $M$  be the midpoint of  $AB$ .

Consider  $\triangle AGX$ ,

Using Cosine Rule,

$$AG^2 = 18^2 + 18^2 - 2(18)(18)\cos\frac{\pi}{6}$$

$$AG = 9.31749 \text{ cm}$$

Consider  $\triangle AMO$ ,

$$\angle AOM = 360^\circ \div 12$$

$$= 30^\circ$$

$$AM = 5 \sin 30^\circ$$

$$MO = 5 \cos 30^\circ$$

Consider  $\triangle AGM$ ,

By Pythagoras theorem,

$$GM = \sqrt{AG^2 - AM^2}$$

$$= \sqrt{9.31749^2 - (5 \sin 30^\circ)^2}$$

$$= 8.9758 \text{ cm}$$

Radius =  $GM + MO$

$$= 8.9758 + 5 \cos 30^\circ$$

M1 - finding line segment  $AG$

M1 - finding angle  $AOX$  or  $AOB = 60^\circ$

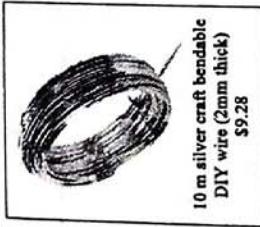
M1 -  $AX$

M1 -  $XO$

M1 -  $GX + XO$

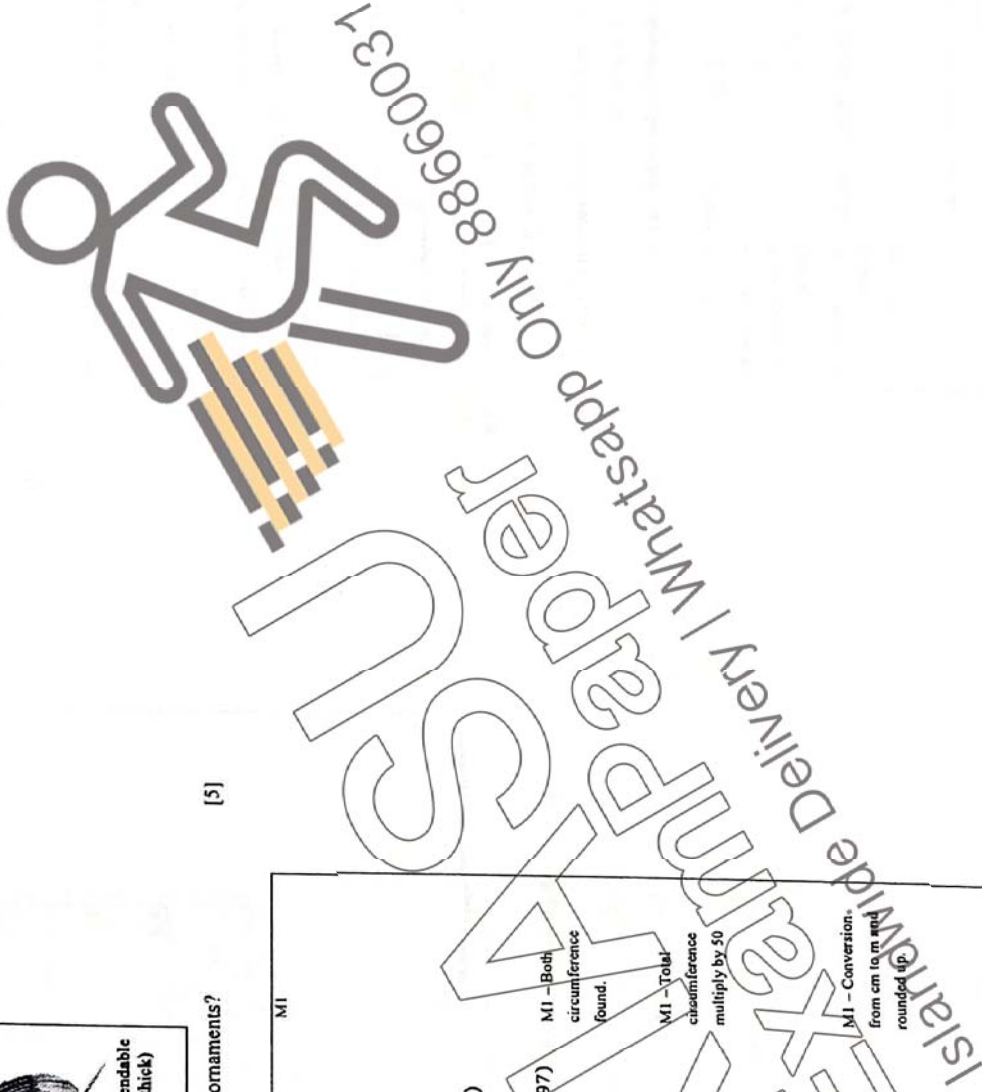
$$= \$111.36 \text{ (to 2dp)}$$

- (b) Team Hō'ola decided to make 50 dreamcatcher-inspired ornaments and Janice chanced upon the following promotion.



What is the estimated cost to make these ornaments? [5]

arc AG = $(18) \left(\frac{\pi}{6}\right)$	MI
= $3\pi$ cm	
Petals = $12 \times 3\pi$	
= $36\pi$ cm	
Circumference of small circle = $2\pi(5)$	
= $10\pi$	
Circumference of big circle = $2\pi(13.30597)$	MI - Both
= $26.6119\pi$	circumference
	found.
	MI - Total
	circumference
	multiply by 50
Amount of wire for 50 dreamcatchers	
= $(26.6119\pi + 10\pi + 36\pi) \times 50$	
= $3630.59\pi$ cm	
= $36.3059\pi$ m	
Rolls of wire needed	
= $\frac{36.3059\pi}{10}$	MI - Conversion
= $11.4058$	from cm to m and
= 12 (rounded up)	rounded up.
Cost = $12 \times \$9.28$	



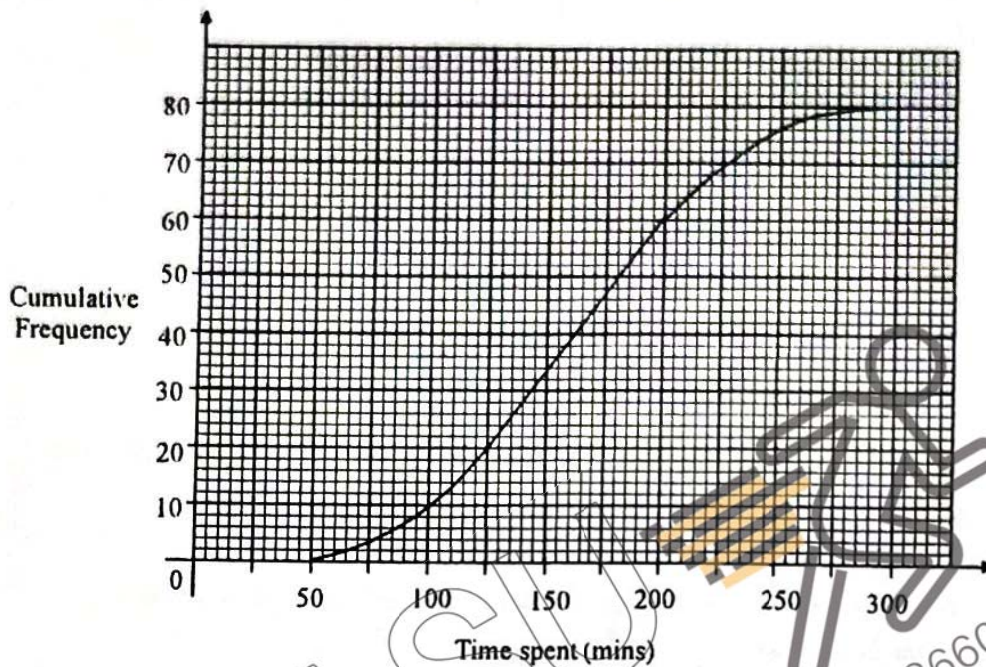
(c) Find the area of the shaded region as shown in Figure 1.

[5]

area of $AG$ segment	
$= \frac{1}{2}(18)^2 \left(\frac{\pi}{6}\right) - \frac{1}{2}(18)(18) \sin \frac{\pi}{6}$	M1
$= 3.823 \text{ cm}^2$	
area of $\triangle AGX = \frac{1}{2}(8.9758)(5 \sin 30^\circ)$	M1 – area of right
$= 11.21975 \text{ cm}^2$	angle triangle AGX.
area of $\triangle OXA = \frac{1}{2}(5 \cos 30^\circ)(5 \sin 30^\circ)$	M1 – area of right
$= 5.41266 \text{ cm}^2$	angle triangle OXA.
area of shaded region	
$= \pi(13.30597)^2 - 5.41266 \times 12$	M1 – big circle area
$- (3.823 + 11.21975) \times 12$	
$= 310.7504 \text{ cm}^2$	
$= 311 \text{ cm}^2$	A1

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9. (a) The cumulative frequency curve below shows the time spent in minutes by a group of 80 teenagers on Instagram (a social media platform) on a particular day.



Use the curve to estimate

- (i) the median,

[1]

$$\frac{N}{2} = 40$$

median = 162.5 min

B1

- (ii) the interquartile range.

[2]

$$\frac{N}{4} = 20$$

$$\frac{3N}{4} = 60$$

Q1 = 125 min

Q3 = 200 min

B1 – both Q1 and Q3 correct

Interquartile Range = Q3 – Q1

$$= 200 - 125$$

$$= 75 \text{ min}$$

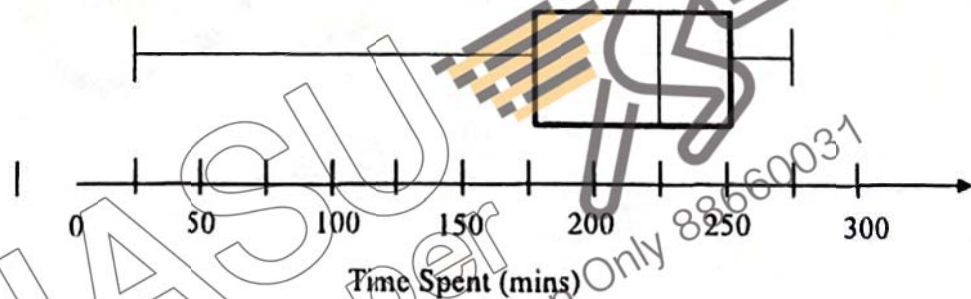
A1

- (b) Through a market research, it was found out that the time spent on Facebook (another social media platform) is less popular and less consistent among the same group of 80 teenagers. A second cumulative frequency curve for the same group of 80 teenagers spending their time on Facebook is drawn.

Describe how the second cumulative frequency curve may differ from the curve for Instagram. [2]

The curve will <u>shift to the left</u>	B1 – shift to left
and has a <u>gentler slope</u>	B1 – Gentler slope
as compared to the given curve.	

- (c) The box-and-whisker plot represents the distribution of the time spent for the same group of 80 teenagers on SnapChat (another social media platform).

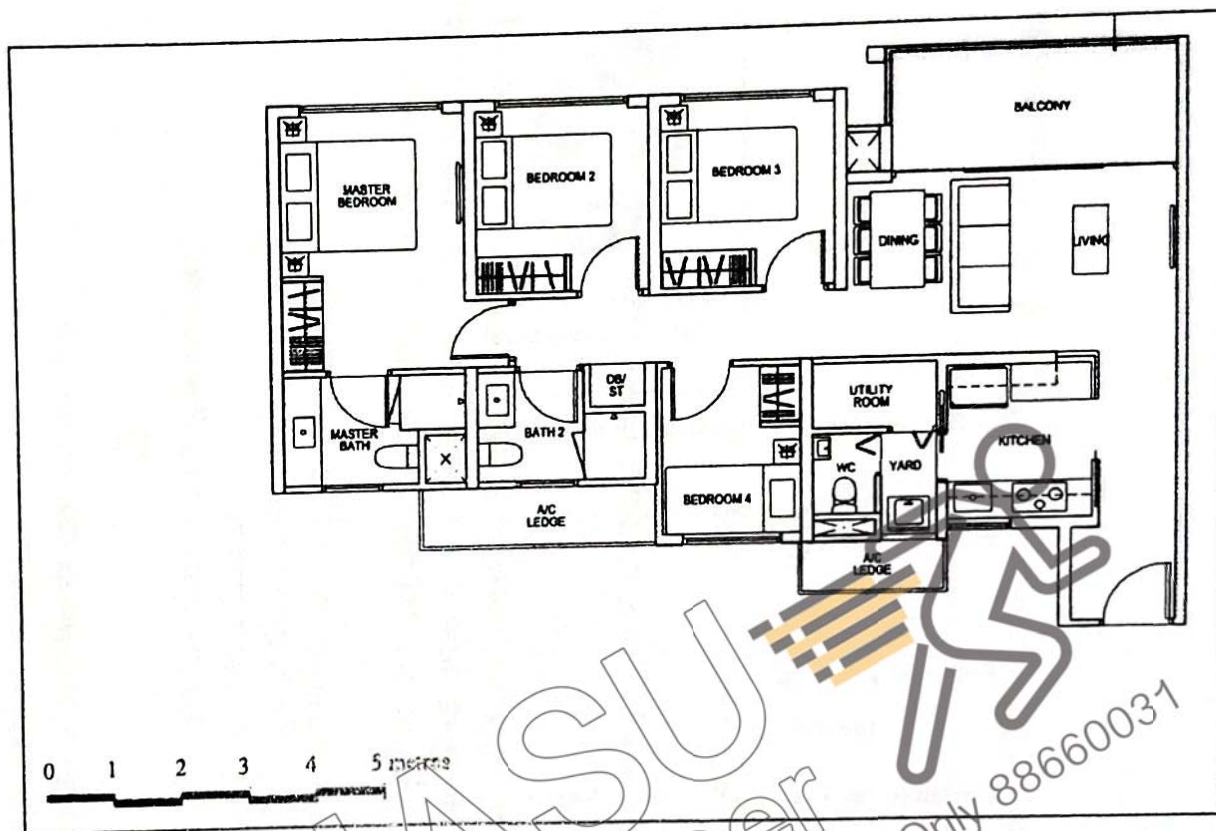


For this group of 80 teenagers, which of the social media platforms - Instagram, Facebook or Snapchat, is the most popular?

Support your answer with an appropriate statistical measure. [2]

Median (Instagram) = 162.5 min	M1 – Evidence for median especially for SnapChat
Median (Facebook) < 162.5 min	
Median (SnapChat) = 225 min	
Since <u>Snapchat has the highest median</u> , it is the most popular.	A1 – Median as statistical comparison
*If students show no data evidence but mentioned about highest median, award 1 mark.	

10. Ms Tan got her new home recently and the layout of her house is shown in the diagram below. The layout is drawn to scale.



- (a) Express the scale of the map in the form of 1:n [1]

$$1\text{cm} = 1\text{m}$$

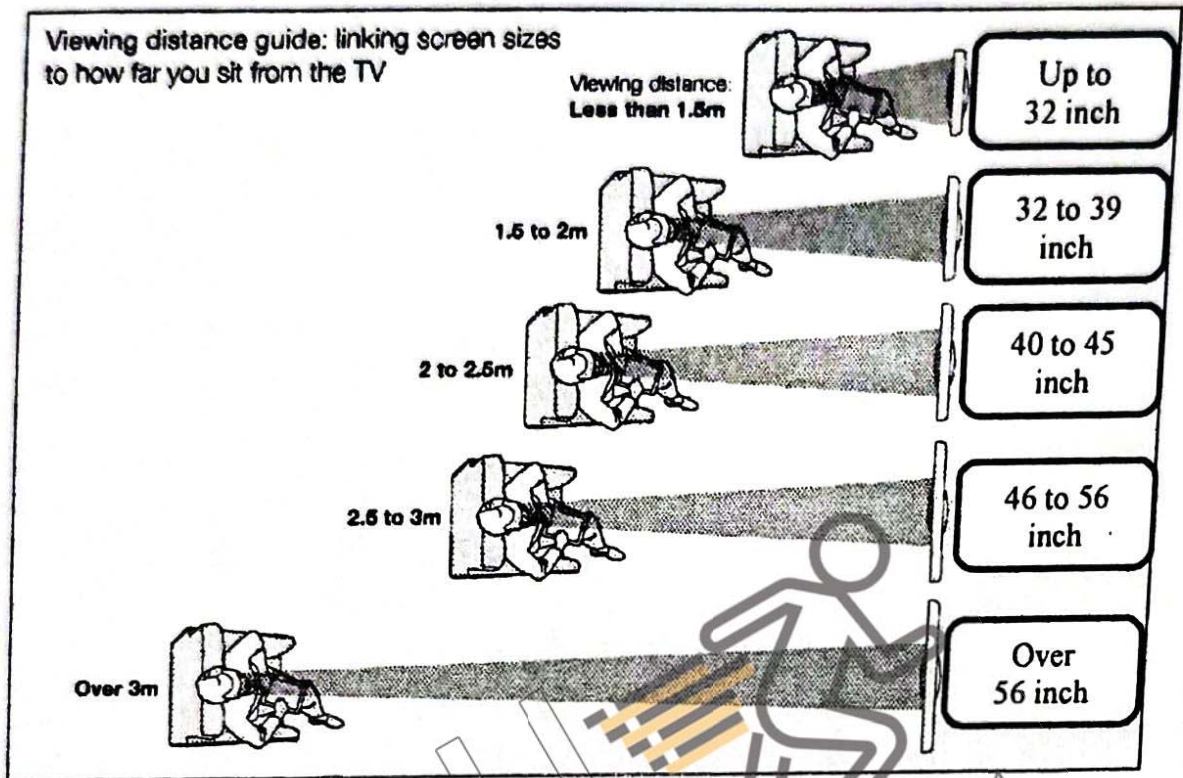
$$1\text{cm} = 100\text{cm}$$

$$1:100$$

BI

(b) Ms Tan decides to get a television set for her living room.

She found the following infographic online.



What is the range of television size which Ms Tan should get for her living room?

[2]

$\text{Distance of Sofa from TV} = 3.1 \text{ m} \times 100 \text{ cm}$ $= 310 \text{ cm}$	M1 - Measured distance can range from 2.3 m to 3.1 m
Range - 46 to 56 inch	A1

- (c) Ms Tan decided to shop for her television set online and she saw the following options:

The image shows two product listings for LG OLED 4K Smart TVs. The first listing is for a 55-inch model (LG OLED5588STB) priced at SGD2,988.00. The second listing is for a 65-inch model (LG OLED6588STB) priced at SGD4,988.00. Both listings include the LG logo, product name, price, and a quantity selector set to 1. There is a watermark of a person pushing a cart and a phone number 88660031 overlaid on the image.

Ms Tan pays a downpayment of \$2 000 for her television set as suggested in (b). She pays the remaining amount over 3 months, with a simple interest rate of 7% per annum.

Calculate her monthly instalment.

[3]

Ms Tan to purchase 55 inch TV.

$$\begin{aligned} \text{Remaining amount} &= \$2988 - \$2000 && \text{M1} \\ &= \$988 \end{aligned}$$

$$\begin{aligned} \text{Interest} &= \frac{988 \times 7 \times \frac{3}{12}}{100} && \text{M1 - with correct} \\ &= \$17.29 && \$988 \text{ and } 3/12 \end{aligned}$$

$$\begin{aligned} \text{Monthly instalment} &= \frac{\$988 + \$17.29}{3} && \text{A1} \\ &= \$335.10 \text{ (to 2dp)} \end{aligned}$$

