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Name	Class	Index Number
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**BROADRICK SECONDARY SCHOOL  
SECONDARY 2 EXPRESS  
END-OF-YEAR EXAMINATION 2022**

**MATHEMATICS**

**4052**

**Section 1**

**October 2022**

Candidates answer on the Question Paper.

**2 hours 15 minutes**

**READ THESE INSTRUCTIONS FIRST**

Write your name, class and index number on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

**Section 1**

Answer **all** the questions.

**Section 2**

Answer **all** the questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for Section 1 is 45.

The total of the marks for this paper is 90.

**You are to hand in Section 1 and Section 2 separately.**

For Examiner's Use		
Reason	Question Number	Marks Deducted
Rounding-off		
Premature Rounding		
Others		

For Examiner's Use	
Section 1	/ 45
Section 2	/ 45
Total	90

This document consists of **11** printed pages.

Setter(s): Mrs Jasmine Chua

**Mathematical Formulae***Compound interest*

$$\text{Total amount} = P \left( 1 + \frac{r}{100} \right)^n$$

*Mensuration*

$$\text{Curved Surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2} ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

*Trigonometry*

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

*Statistics*

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left( \frac{\sum fx}{\sum f} \right)^2}$$

Answer **all** the questions in this section.

- 1 Given that  $y$  is directly proportional to the cube of  $(x + 1)$  and that  $y = 15$  when  $x = 2$ ,

(a) express  $y$  in terms of  $x$ ,

(b) find the value of  $x$  when  $y = 120$ , *Answer* ..... [2]

(c) find the value of  $y$  when  $x = 11$ . *Answer*  $x =$  ..... [2]

*Answer*  $y =$  ..... [1]

2 (a) Factorise completely

(i)  $15y^2 - y - 6$ ,

*Answer* ..... [2]

(ii)  $2ac - 6ad + 10bc - 30bd$ .

*Answer* ..... [2]

(b) Expand and simplify  $(2x - 1)(2x + 1) - 3(2x + 3)^2$ .

*Answer* ..... [3]

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

*Answer* ..... [3]

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- 4 Solve the following pair of simultaneous equations.

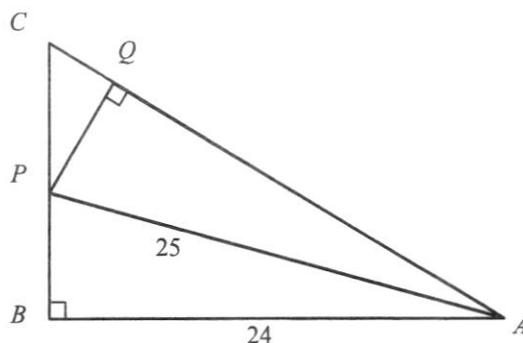
$$3x - 2y = 8$$

$$4x + 3y = 5$$

*Answer*  $x =$  .....

$y =$  ..... [3]

- 5 In the diagram, triangle  $ABP$  is congruent to triangle  $AQP$ .  
 $BP$  and  $AQ$  are extended to meet at  $C$ .  
 $AB = 24$  cm,  $AP = 25$  cm and  $\text{angle } ABP = \text{angle } AQP = 90^\circ$ .



- (a) State the length of  $AQ$ .

Answer  $AQ = \dots\dots\dots$  cm [1]

- (b) Hence, find  
 (i) angle  $PAB$ ,

Answer angle  $PAB = \dots\dots\dots^\circ$  [2]

- (ii) angle  $ACB$ .

Answer angle  $ACB = \dots\dots\dots^\circ$  [2]

- 6 The total number of hours spent using the computer in a week by 12 students are shown in the stem-and-leaf diagram below.

Stem	Leaf
0	8
1	2 4 4 $k$ 8
2	5 5
3	0 8
4	1 9

Key: 1 | 2 means 12 hours

- (a) Given that the mode is 14 hours, find the value of  $k$ .

Answer  $k = \dots\dots\dots$  [1]

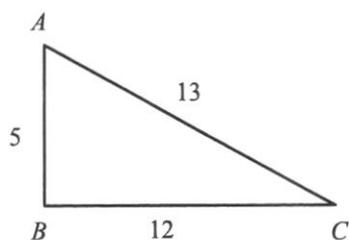
- (b) Find  
 (i) the mean number of hours,

Answer  $\dots\dots\dots$  hours [2]

- (ii) the median number of hours.

Answer  $\dots\dots\dots$  hours [1]

- 7 A triangle  $ABC$  has sides  $AB = 5$  cm,  $BC = 12$  cm and  $AC = 13$  cm.



- (a) Prove that triangle  $ABC$  is a right-angled triangle.

Answer  $\dots\dots\dots$   
 $\dots\dots\dots$   
 $\dots\dots\dots$   
 $\dots\dots\dots$  [2]

- 7 (b) Hence, find  
 (i)  $\sin \hat{BAC}$ ,

*Answer* ..... [1]

- (ii)  $\hat{ACB}$ .

*Answer*  $\hat{ACB} =$  ..... [1]

- 8 It is given that  $y = \frac{B+2x}{x}$ .

- (a) Find  $y$  when  $x = -3$  and  $B = 6$ .

*Answer*  $y =$  ..... [2]

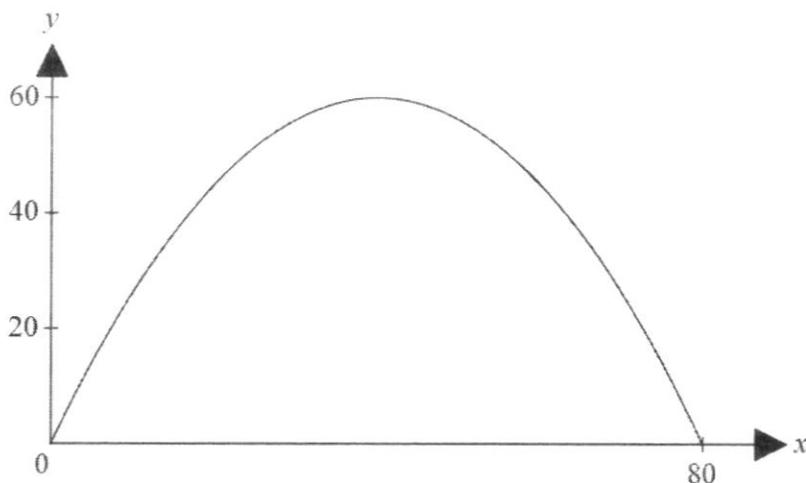
- (b) Express  $x$  in terms of  $y$  and  $B$ .

*Answer* ..... [2]

9 Amos threw a javelin.

Ignoring the height of Amos, the trajectory of the arc is shown below.

The highest point the javelin reaches is 60 m and the distance from the throw is 80 m away.



The vertical height,  $y$  metres, of the javelin, and the horizontal distance,  $x$  metres, can be modelled by the equation  $y = ax(x - 80)$ .

The value  $a$ , is a constant to be determined.

(a) Write down the equation of the line of symmetry of the graph.

*Answer* ..... [1]

(b) Write down the coordinates of the highest point of the javelin.

*Answer* (....., .....) [1]

(c) Hence or otherwise, find the value of  $a$ .

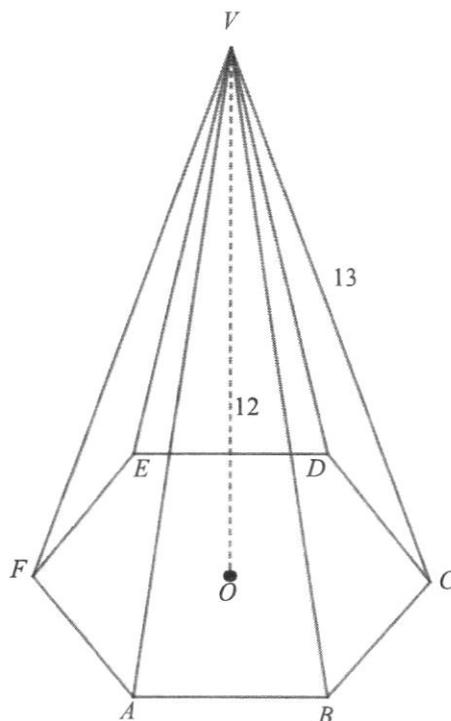
*Answer*  $a =$  ..... [2]

10 **Diagram I** shows a regular right hexagonal pyramid  $VABCDEF$ .

The vertical height of the pyramid is given by  $VO = 12$  m, where  $O$  is the centre of the hexagonal base.

The slant edges of the pyramid are given by

$$VA = VB = VC = VD = VE = VF = 13 \text{ m.}$$

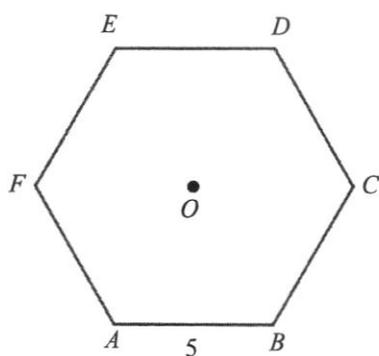


**Diagram I**

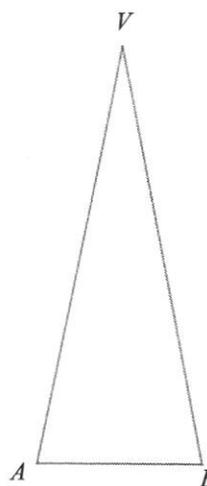
**Diagram II** shows the hexagonal base  $ABCDEF$ .

The sides of the hexagon are given by  $AB = BC = CD = DE = EF = FA = 5$  m.

**Diagram III** shows the lateral face of hexagonal pyramid  $VAB$ .



**Diagram II**



**Diagram III**

- 10 (a) Find the slant height of the lateral face of the hexagonal pyramid  $VAB$  in **Diagram III**.

*Answer* ..... m [2]

- (b) Given that base area of the hexagon  $ABCDEF$  is  $65 \text{ m}^2$  shown in **Diagram II**, find

- (i) the volume of the pyramid,

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

- (ii) the total surface area of the hexagonal pyramid shown in **Diagram I**.

*Answer* .....  $\text{m}^2$  [2]

***End of Section 1***

Name	Class	Index Number
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**BROADRICK SECONDARY SCHOOL  
SECONDARY 2 EXPRESS  
END-OF-YEAR EXAMINATION 2022**

**MATHEMATICS****4052****Section 2****October 2022**

Candidates answer on the Question Paper.

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For Examiner's Use (To combine with Section 1)		
Reason	Question Number	Marks Deducted
Rounding-off		
Premature Rounding		
Others		

For Examiner's Use
<b>45</b>

This document consists of **11** printed pages.

Setter(s): Mrs Jasmine Chua

Answer **all** the questions in this section.

- 1 (a) A group of men took 10 days to build a structure.  
Assuming the men work at the same rate, find the number of days to build the structure if the number of men is doubled.

*Answer* ..... [1]

- (b) A builder is to build a rectangular playground with dimensions  $x$  m by  $y$  m.  
Given that  $x$  and  $y$  are inversely proportional, and  $y = 34$  when  $x = 20$ .
- (i) Find the equation connecting  $x$  and  $y$ .

*Answer* ..... [2]

- (ii) Find the value of  $y$  when  $x = 15$ .

*Answer*  $y =$  ..... [1]

- 2 Andi, Ben and Calvin shared the cost of a gift, \$ $x$ , equally.  
Calvin did not have any money, so his friends paid for his share first.

- (a) Ben paid \$ $y$  and Andi paid 0.6 of what Ben paid.  
Form an equation, in terms of  $x$  and  $y$ , to represent the above information.

*Answer* ..... [1]

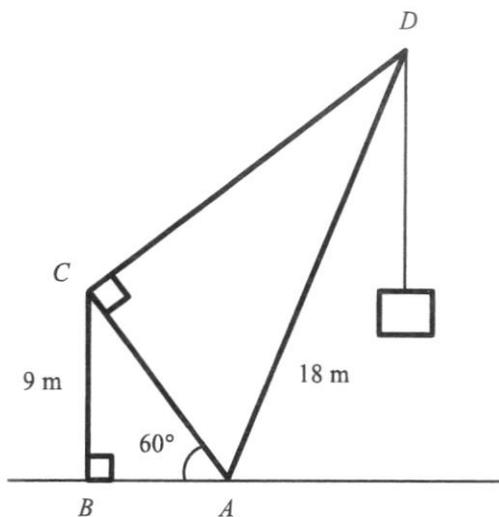
- (b) Andi paid \$24 for Calvin's share.  
Form an equation, in terms of  $x$  and  $y$ , to represent the above information.

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

- (c) Solve the simultaneous equations in parts (a) and (b) to find the cost of the gift.

*Answer* \$ ..... [3]

- 3 The diagram shows part of the framework of a crane that is used for lifting loads. The base  $AB$  is fixed at ground level and  $ABCD$  is in a vertical plane. The loads are suspended from the point  $D$ .  
 $BC = 9$  m,  $AD = 18$  m, angle  $BAC = 60^\circ$  and angle  $ACD = \text{angle } ABC = 90^\circ$ .



Calculate

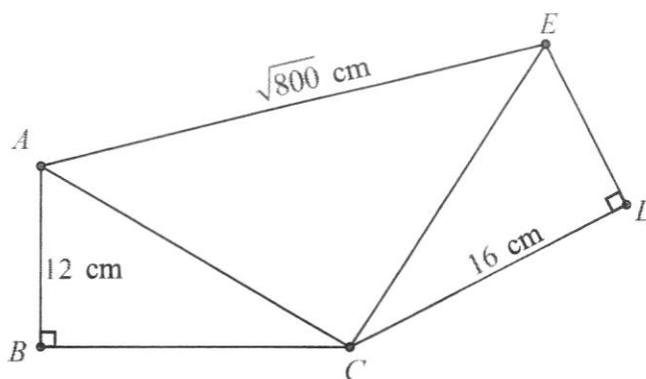
- (a) the length of  $AC$ ,

Answer ..... m [2]

- (b) angle  $CAD$ .

Answer angle  $CAD = \dots\dots\dots^\circ$  [2]

- 4 A pentagon,  $ABCDE$ , is made up of three triangles.  
 Triangle  $ABC$  is congruent to triangle  $EDC$ .  
 $AB = 12$  cm,  $CD = 16$  cm and angle  $ABC$  and angle  $EDC = 90^\circ$ .



- (a) Show that  $AC = 20$  cm.

*Answer*

[2]

- (b) (i) Show that triangle  $ACE$  is a right-angled triangle.

*Answer*

[2]

- (ii) Hence, find the shortest distance from  $C$  to  $AE$ .

*Answer* ..... cm [2]

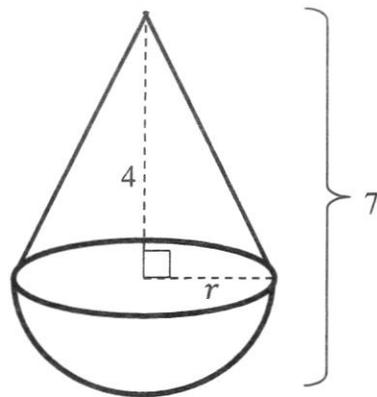
5 (a) Express  $\frac{9}{x^2 + 2x - 15} + \frac{3x - 1}{x^2 - 3x}$  as a single fraction.

*Answer* ..... [3]

(b) Factorise  $4x^2y + 4xy - 3y$  completely.

*Answer* ..... [2]

- 6 The diagram below shows a sinker used by fishermen to keep the bait in place. It is made up of a right circular cone and a hemisphere. The height of the sinker is 7 cm, and the height of the right circular cone is 4 cm.



- (a) Find the radius,  $r$  of the hemisphere.

*Answer* .....cm [1]

- (b) Calculate the total surface area of the sinker.

*Answer* .....cm<sup>2</sup> [3]

- 6 (c) Calculate the total volume of the sinker.

*Answer* ..... cm<sup>3</sup> [3]

- 7 The variables  $x$  and  $y$  are connected by the equation  $y = x^2 - 2x - 7$ .  
Some corresponding values of  $x$  and  $y$  are given in the following table.

$x$	-3	-2	-1	0	1	2	3	4
$y$	8	1	-4	-7	-8	$n$	-4	1

- (a) Calculate the value of  $n$ .

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

- (b) Using a scale of 2 cm to represent 1 unit on the horizontal  $x$ -axis and 1 cm to represent 1 unit on the vertical  $y$ -axis, draw the graph of  $y = x^2 - 2x - 7$  for  $-3 \leq x \leq 4$ . [3]

- (c) Using your graph drawn, find

- (i) value of  $y$  when  $x = 1.5$ ,

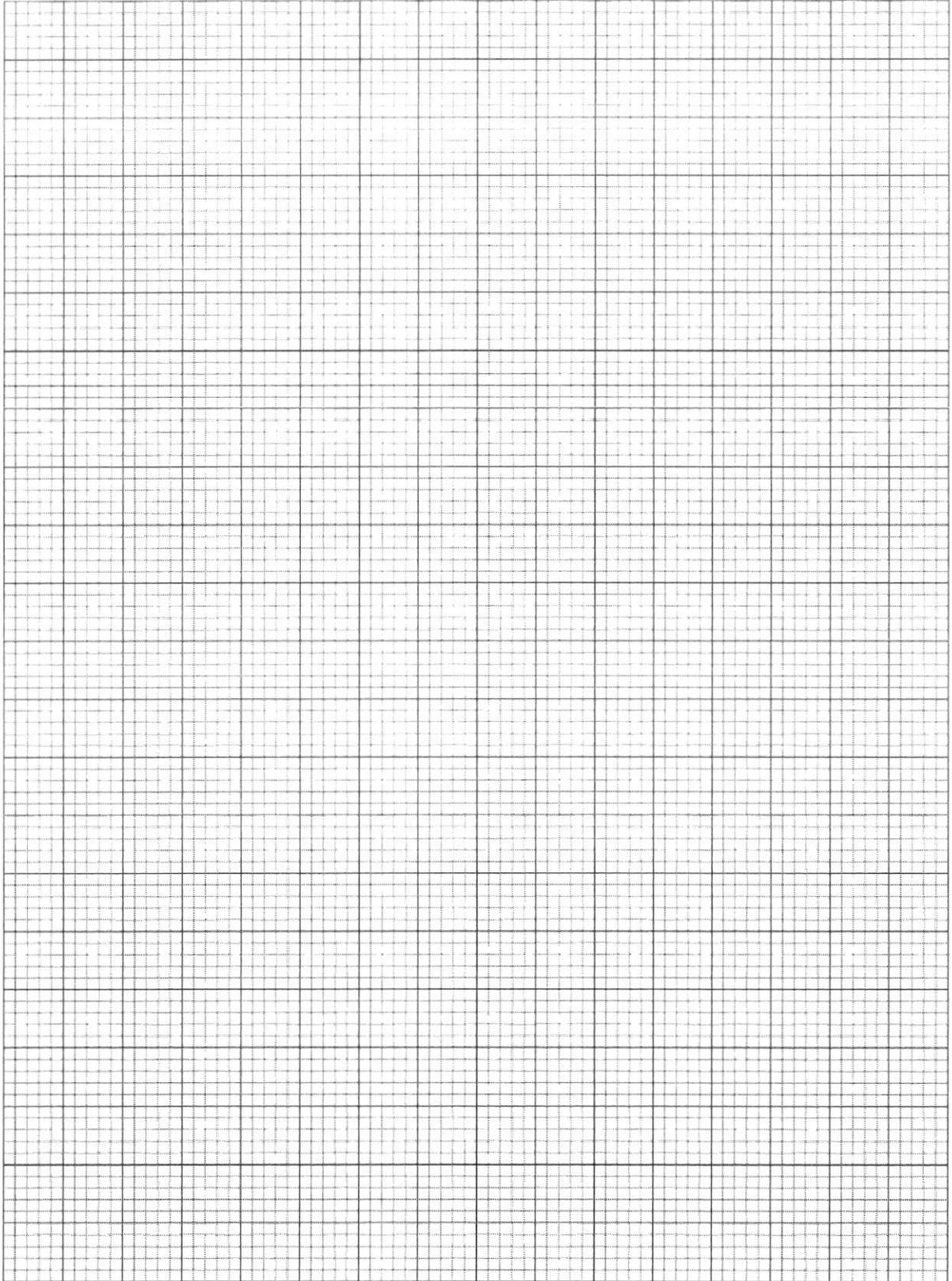
*Answer*  $y =$ ..... [1]

- (ii) the coordinates of the minimum point,

*Answer* (....., .....) [1]

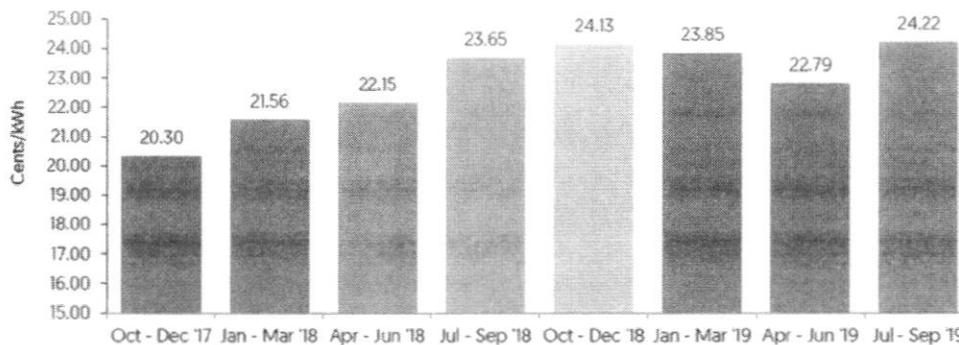
- (iii) the equation of the line of symmetry.

*Answer* ..... [1]



- 8 Traditionally, all households have their electricity provided by **S-Power**, which prices their electricity at rates recommended by the government. These rates can vary from month to month.

The rates per quarter recommended by the government are shown in the chart below, from October 2017 to September 2019. The rates are inclusive of 7% GST.



- (a) Calculate the cost of electricity in November 2018, if a household uses 183 kWh of electricity in that month.

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

- (b) Find the average rate recommended by the government per quarter, from the period of October 2017 to September 2019.

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

- 8 (c) All households can now choose among different electricity companies to provide their electricity.  
The packages that another company, **Telectricity** provides, are shown in the table below.

<b>Package A</b>	Fixed rate: \$0.1798 / kWh (Exclude 7% GST)
<b>Package B</b>	22% off average rate recommended by government (from October 2017 to September 2019)
<b>Package C</b>	\$0 for the first 6 months, after which 20% off average rate for the remaining months.

Justify which package would be a better option if Dionne had changed her household electricity company to **Telectricity**, from October 2017 to September 2019.  
Show your working clearly.

*Answer*

[4]

***End of Section 2 & End of Paper***

Question	Working/ Steps
<b>1a</b>	$y = k(x+1)^3$ $15 = k(2+1)^3$ $15 = k(27)$ $k = \frac{15}{27} = \frac{5}{9}$ $y = \frac{5}{9}(x+1)^3$
<b>1b</b>	$y = 120$ $120 = \frac{5}{9}(x+1)^3$ $216 = (x+1)^3$ $6 = x+1$ $x = 5$
<b>1c</b>	$x = 11$ $y = \frac{5}{9}(11+1)^3$ $y = \frac{5}{9}(12)^3$ $y = 960$
<b>2ai</b>	$15y^2 - y - 6$ $= (5y+3)(3y-2)$
<b>2aii</b>	$2ac - 6ad + 10bc - 30bd$ $= 2(ac - 3ad + 5bc - 15bd)$ $= 2[a(c - 3d) + 5b(c - 3d)]$ $= 2(a + 5b)(c - 3d)$ <p>Mtd 2:</p> $2ac - 6ad + 10bc - 30bd$ $= 2a(c - 3d) + 10b(c - 3d)$ $= (2a + 10b)(c - 3d)$ $= 2(a + 5b)(c - 3d)$
<b>2b</b>	$(2x-1)(2x+1) - 3(2x+3)^2$ $= (4x^2 + 2x - 2x - 1) - 3(4x^2 + 6x + 6x + 9)$ $= 4x^2 - 1 - 3(4x^2 + 12x + 9)$ $= 4x^2 - 1 - 12x^2 - 36x - 27$ $= -8x^2 - 36x - 28$

3	$\frac{x}{2x-1} + \frac{2}{x+1}$ $= \frac{x(x+1)+2(2x-1)}{(2x-1)(x+1)}$ $= \frac{x^2+x+4x-2}{(2x-1)(x+1)}$ $= \frac{x^2+5x-2}{(2x-1)(x+1)}$
4	$3x - 2y = 8 \text{ ----- (1)}$ $4x + 3y = 5 \text{ ----- (2)}$ $(1) \times 3, 9x - 6y = 24 \text{ ----- (3)}$ $(2) \times 2, 8x + 6y = 10 \text{ ----- (4)}$ <p style="text-align: right;">elimination/substitution</p> $(3)+(4), 17x = 34$ $x = 2$ <p>Sub <math>x = 2</math> into (2),</p> $4(2) + 3y = 5$ $8 + 3y = 5$ $3y = -3$ $y = -1$
5a	$AQ = AB = 24$ (congruent $\Delta$ s)
5bi	$\cos \hat{PAB} = \frac{24}{25} \text{ or } \hat{PAB} = \cos^{-1} \frac{24}{25}$ $\angle PAB = 16.26 = 16.3^\circ \text{ (1dp)}$
5bii	$\angle ACB = 180^\circ - 90^\circ - (16.26^\circ \times 2)$ $= 57.48 = 57.5^\circ \text{ (1 dp)}$
6a	4
6bi	$\frac{8+12+14+14+14+18+25+25+30+38+41+49}{12}$ $= 24$

<b>6b ii</b>	$\frac{18+25}{2}$ $=21.5$
<b>7a</b>	$\left. \begin{array}{l} AC^2 = 13^2 = 169 \\ AB^2 + BC^2 = 5^2 + 12^2 = 169 \end{array} \right\}$ <p>Since <math>AB^2 + BC^2 = AC^2</math>, by converse of Pythagoras theorem, triangle <math>ABC</math> is a right-angled triangle, <math>\angle ABC = 90^\circ</math>.</p>
<b>7bi</b>	$\sin \angle BAC = \frac{12}{13}$
<b>7b ii</b>	$\angle ACB = 22.6^\circ$
<b>8a</b>	$y = \frac{6+2(-3)}{(-3)} = 0$
<b>8b</b>	$xy = B+2x$ $x = \frac{B}{y-2}$
<b>9a</b>	$\frac{0+80}{2} = 40$ $x = 40$
<b>9b</b>	$(40, 60)$
<b>9c</b>	<p>Sub <math>x = 40, y = 60,</math></p> $y = ax(x-80)$ $60 = a(40)(40-80)$ $60 = -1600a$ $a = \frac{60}{-1600}$ $= -\frac{3}{80}$
<b>10a</b>	$5 \div 2 = 2.5$ <p>By Pythagoras' Theorem,</p>

	$13^2 = l^2 + 2.5^2$ $l^2 = 162.75$ $l = \sqrt{162.75}$ $l = 12.757$ $l = 12.8 \text{ m}$
<b>10b i</b>	<p>Volume of pyramid</p> $= \frac{1}{3} \times \text{base area} \times \text{height}$ $= \frac{1}{3} \times 65 \times 12$ $= 260 \text{ m}^3$
<b>10b ii</b>	<p>Surface Area of pyramid</p> <p>= base area + 6 lateral faces</p> $= 65 + 6 \times \frac{1}{2} \times 5 \times \sqrt{162.75}$ $= 256.36$ $= 256 \text{ m}^2 \text{ (3sf)}$

Question	Working/ Steps
<b>1a</b>	Number of days = 5
<b>1bi</b>	$k = 34 \times 20$ $k = 680$ $x = \frac{680}{y}$ or $y = \frac{680}{x}$
<b>1bii</b>	$y = \frac{680}{15}$ $= 45\frac{1}{3}$
<b>2a</b>	$0.6y + y = x$ $1.6y = x$
<b>2b</b>	$0.6y - 24 = \frac{x}{3}$
<b>2c</b>	$1.6y = x$ ----- (1) $0.6y - 24 = \frac{x}{3}$ ----- (2) Sub (1) into (2), $0.6y - 24 = \frac{1.6y}{3}$ $1.8y - 72 = 1.6y$ $0.2y = 72$ $y = 360$ Sub $y = 360$ into (1), $x = 1.6(360)$ $= 576$ Cost of gift = \$576
<b>3a</b>	$\sin 60^\circ = \frac{9}{AC}$ $AC = \frac{9}{\sin 60^\circ}$ $= 10.3923$ $= 10.4 \text{ m (3 s.f.)}$

<b>3b</b>	$\cos \angle CAD = \frac{AC}{18}$ $\angle CAD = \cos^{-1} \frac{9}{18}$ $= 54.7^\circ \text{ (1 d. p.)}$
<b>4a</b>	$AC^2 = 12^2 + 16^2$ $AC = \sqrt{400}$ $AC = 20 \text{ cm (shown)}$
<b>4bi</b>	$AE^2 = (\sqrt{800})^2 = 800$ $AC^2 + EC^2 = 20^2 + 20^2 = 800$ <p>Since <math>AE^2 = AC^2 + EC^2</math>, by the converse of Pythagoras' Theorem, triangle <math>ACE</math> is a right-angled triangle and angle <math>ACE = 90^\circ</math>.</p>
<b>4bii</b>	$\frac{1}{2} \times \sqrt{800} \times d = \frac{1}{2} \times 20 \times 20$ $d = 14.142$ $= 14.1 \text{ cm (3 s.f.)}$
<b>5a</b>	$\frac{9}{x^2+2x-15} + \frac{3x-1}{x^2-3x}$ $= \frac{9}{(x-3)(x+5)} + \frac{3x-1}{x(x-3)}$ $= \frac{9x+(3x-1)(x+5)}{x(x-3)(x+5)}$ $= \frac{9x+3x^2+15x-x-5}{x(x-3)(x+5)}$ $= \frac{3x^2+23x-5}{x(x-3)(x+5)}$
<b>5b</b>	$4x^2y + 4xy - 3y$ $= y(4x^2 + 4x - 3)$ $= y(2x + 3)(2x - 1)$
<b>6a</b>	$r = 7 - 4$ $= 3$
<b>6b</b>	curved surface of cone = $\pi(3)(5)$

	$= 15\pi$ <i>curved surface of hemisphere</i> $= 2\pi(3)^2$ $= 18\pi$ <i>total surface area</i> $= 15\pi + 18\pi$ $\approx 104\text{cm}^2$
6c	<i>volume of cone</i> $= \frac{1}{3} \times \pi(3)^2 \times 4$ $= 12\pi$  <i>volume of hemisphere</i> $= \frac{2}{3}\pi(3)^3$ $= 18\pi$  <i>total volume</i> $= 12\pi + 18\pi$ $\approx 94.2\text{cm}^3$
8a	$0.2413 \times 183 = 44.1579$ $= \$44.16$ (2d.p.)
8b	Average rate $= \frac{20.30 + 21.56 + 22.15 + 23.65 + 24.13 + 23.85 + 22.79 + 24.22}{8}$ $= 22.83125$ cents / kWh $= \$0.23$ / kWh (2d.p.)
8c	Package A: $1.07 \times 0.1798$ $= \$0.192386$  Package B: $= \frac{0.2283125}{1} \times 78\%$ $= \$0.17808$ Package C: $\$0 + \left( \frac{22.15 + 23.65 + 24.13 + 23.85 + 22.79 + 24.22}{6} \times 0.8 \right)$ $= \frac{18.772}{100}$ $= \$0.18772$  Since <u><math>\\$0.17808</math> is cheapest</u> for every 1kWh, package <u>B</u> would be a better package.
7a	$n = -7$
7b	Refer to the graph
7ci	$y = -7.75$ (accept $7.9 \leq y \leq -7.6$ )
7cii	$(1, -8)$
7ciii	$x = 1$

**Broadrick Secondary School**  
**End-of-Year Exams 2022**  
**Secondary 2 Express Mathematics**  
**Section 1 Marking Scheme**

Question	Working/ Steps	Remarks
<b>1a</b>	$y = k(x+1)^3$ $15 = k(2+1)^3$ $15 = k(27)$ $k = \frac{15}{27} = \frac{5}{9}$ $y = \frac{5}{9}(x+1)^3$	<p style="text-align: center;">M1</p> <p style="text-align: center;">A1</p>
<b>1b</b>	$y = 120$ $120 = \frac{5}{9}(x+1)^3$ $216 = (x+1)^3$ $6 = x+1$ $x = 5$	<p style="text-align: center;">M1</p> <p style="text-align: center;">A1</p>
<b>1c</b>	$x = 11$ $y = \frac{5}{9}(11+1)^3$ $y = \frac{5}{9}(12)^3$ $y = 960$	<p style="text-align: center;">B1</p>
<b>2ai</b>	$15y^2 - y - 6$ $= (5y+3)(3y-2)$	<p style="text-align: center;">B2</p>
<b>2aii</b>	$2ac - 6ad + 10bc - 30bd$ $= 2(ac - 3ad + 5bc - 15bd)$ $= 2[a(c - 3d) + 5b(c - 3d)]$ $= 2(a + 5b)(c - 3d)$ <p>Mtd 2:</p> $2ac - 6ad + 10bc - 30bd$ $= 2a(c - 3d) + 10b(c - 3d)$ $= (2a + 10b)(c - 3d)$ $= 2(a + 5b)(c - 3d)$	<p style="text-align: center;">M1</p> <p style="text-align: center;">A1</p>

<b>2b</b>	$(2x-1)(2x+1) - 3(2x+3)^2$ $= (4x^2 + 2x - 2x - 1) - 3(4x^2 + 6x + 6x + 9)$ $= 4x^2 - 1 - 3(4x^2 + 12x + 9)$ $= 4x^2 - 1 - 12x^2 - 36x - 27$ $= -8x^2 - 36x - 28$	M1 M1 A1
<b>3</b>	$\frac{x}{2x-1} + \frac{2}{x+1}$ $= \frac{x(x+1) + 2(2x-1)}{(2x-1)(x+1)}$ $= \frac{x^2 + x + 4x - 2}{(2x-1)(x+1)}$ $= \frac{x^2 + 5x - 2}{(2x-1)(x+1)}$	M1  M1  A1
<b>4</b>	$3x - 2y = 8 \text{ -----(1)}$ $4x + 3y = 5 \text{ -----(2)}$ $(1) \times 3, 9x - 6y = 24 \text{ ----- (3)}$ $(2) \times 2, 8x + 6y = 10 \text{ ----- (4)}$ <p style="text-align: center;">elimination/substitution</p> $(3)+(4), 17x = 34$ $x = 2$ <p>Sub <math>x = 2</math> into (2),</p> $4(2) + 3y = 5$ $8 + 3y = 5$ $3y = -3$ $y = -1$	M1  A1  A1
<b>5a</b>	$AQ = AB = 24$ (congruent $\Delta$ s)	B1
<b>5bi</b>	$\cos \hat{PAB} = \frac{24}{25}$ or $\hat{PAB} = \cos^{-1} \frac{24}{25}$  $\angle PAB = 16.26 = 16.3^\circ$ (1dp)	M1  A1
<b>5bii</b>	$\angle ACB = 180^\circ - 90^\circ - (16.26^\circ \times 2)$ $= 57.48 = 57.5^\circ$ (1 dp)	M1 A1
<b>6a</b>	4	B1

<b>6bi</b>	$\frac{8+12+14+14+14+18+25+25+30+38+41+49}{12}$ $=24$	M1 A1
<b>6bii</b>	$\frac{18+25}{2}$ $=21.5$	B1
<b>7a</b>	$\left. \begin{array}{l} AC^2 = 13^2 = 169 \\ AB^2 + BC^2 = 5^2 + 12^2 = 169 \end{array} \right\}$ <p>Since <math>AB^2 + BC^2 = AC^2</math>, by converse of Pythagoras theorem, triangle <math>ABC</math> is a right-angled triangle, <math>\angle ABC = 90^\circ</math>.</p>	M1 A1
<b>7bi</b>	$\sin \angle BAC = \frac{12}{13}$	B1
<b>7bii</b>	$\angle ACB = 22.6^\circ$	B1
<b>8a</b>	$y = \frac{6+2(-3)}{(-3)} = 0$	M1A1
<b>8b</b>	$xy = B + 2x$ $x = \frac{B}{y-2}$	M1A1
<b>9a</b>	$\frac{0+80}{2} = 40$ $x = 40$	B1
<b>9b</b>	$(40, 60)$	B1
<b>9c</b>	<p>Sub <math>x = 40, y = 60</math>,</p> $y = ax(x-80)$ $60 = a(40)(40-80)$ $60 = -1600a$ $a = \frac{60}{-1600}$ $= -\frac{3}{80}$	M1 A1

<b>10a</b>	$5 \div 2 = 2.5$ By Pythagoras' Theorem, $13^2 = l^2 + 2.5^2$ $l^2 = 162.75$ $l = \sqrt{162.75}$ $l = 12.757$ $l = 12.8 \text{ m}$	M1  A1
<b>10b i</b>	Volume of pyramid $= \frac{1}{3} \times \text{base area} \times \text{height}$ $= \frac{1}{3} \times 65 \times 12$ $= 260 \text{ m}^3$	M1 A1
<b>10b ii</b>	Surface Area of pyramid $= \text{base area} + 6 \text{ lateral faces}$ $= 65 + 6 \times \frac{1}{2} \times 5 \times \sqrt{162.75}$ $= 256.36$ $= 256 \text{ m}^2 \text{ (3sf)}$	M1  A1

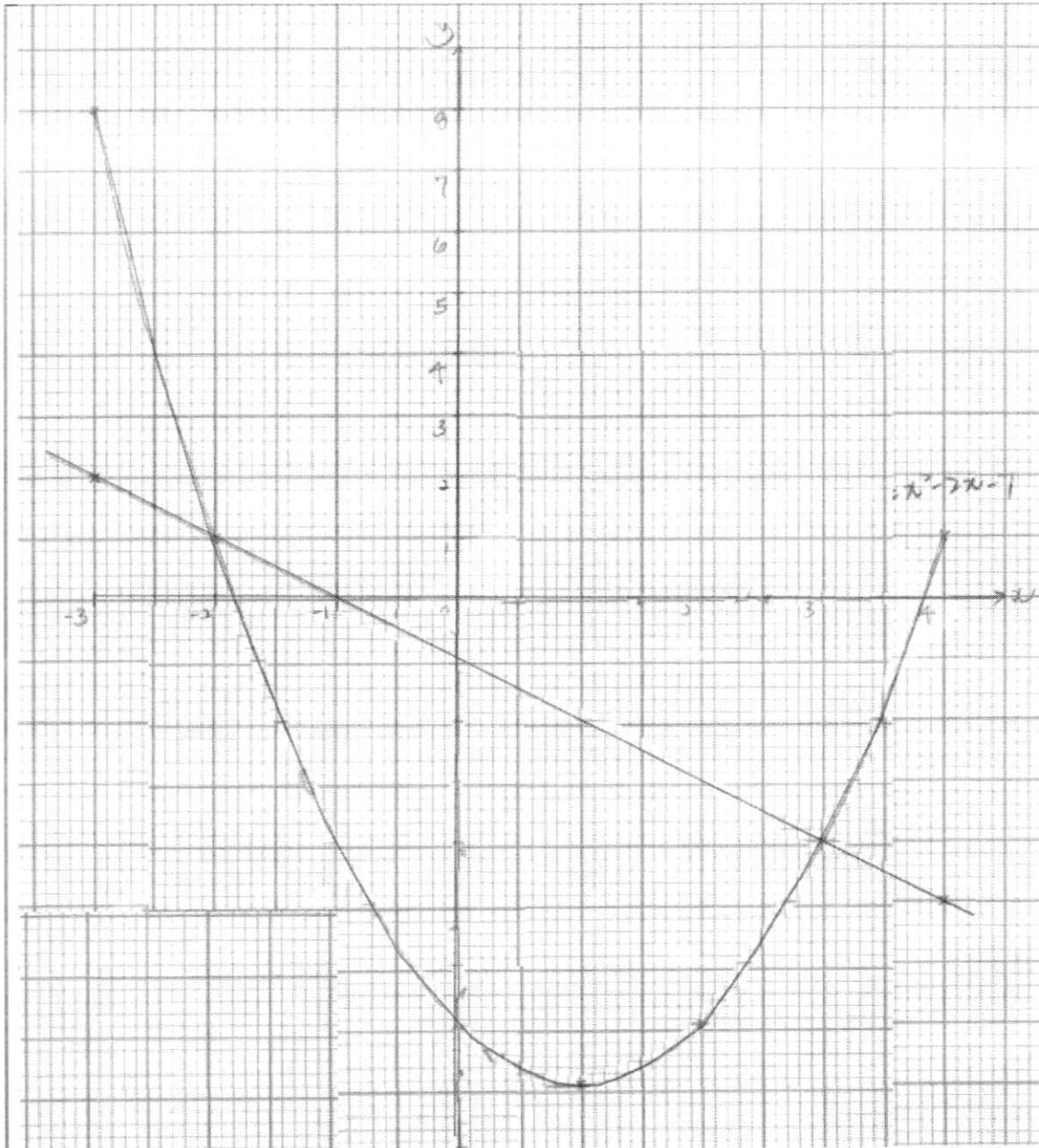
## Section 2 Marking Scheme

Question	Working/ Steps	Remarks
<b>1a</b>	Number of days = 5	B1
<b>1b i</b>	$k = 34 \times 20$ $k = 680$ $x = \frac{680}{y}$ or $y = \frac{680}{x}$	M1 A1
<b>1b ii</b>	$y = \frac{680}{15}$ $= 45\frac{1}{3}$	A1
<b>2a</b>	$0.6y + y = x$ $1.6y = x$	B1
<b>2b</b>	$0.6y - 24 = \frac{x}{3}$	B1
<b>2c</b>	$1.6y = x$ ----- (1) $0.6y - 24 = \frac{x}{3}$ ----- (2) Sub (1) into (2), $0.6y - 24 = \frac{1.6y}{3}$ $1.8y - 72 = 1.6y$ $0.2y = 72$ $y = 360$ Sub $y = 360$ into (1), $x = 1.6(360)$ $= 576$ Cost of gift = \$576	M1 A1 A1



	$= \frac{9x+3x^2+15x-x-5}{x(x-3)(x+5)}$ $= \frac{3x^2+23x-5}{x(x-3)(x+5)}$	A1
<b>5b</b>	$4x^2y + 4xy - 3y$ $= y(4x^2 + 4x - 3)$ $= y(2x + 3)(2x - 1)$	M1 A1
<b>6a</b>	$r = 7 - 4$ $= 3$	B1
<b>6b</b>	<p>curved surface of cone = <math>\pi(3)(5)</math> = <math>15\pi</math></p> <p>curved surface of hemisphere = <math>2\pi(3)^2</math> = <math>18\pi</math></p> <p>total surface area = <math>15\pi + 18\pi</math> <math>\approx 104\text{cm}^2</math></p>	M1 M1 A1
<b>6c</b>	<p>volume of cone = <math>\frac{1}{3} \times \pi(3)^2 \times 4</math> = <math>12\pi</math></p> <p>volume of hemisphere = <math>\frac{2}{3}\pi(3)^3</math> = <math>18\pi</math></p> <p>total volume = <math>12\pi + 18\pi</math> <math>\approx 94.2\text{cm}^3</math></p>	M1 M1 A1
<b>8a</b>	$0.2413 \times 183 = 44.1579$ $= \$44.16 \text{ (2d.p.)}$	B1
<b>8b</b>	<p>Average rate <math>\therefore</math></p> $= \frac{20.30 + 21.56 + 22.15 + 23.65 + 24.13 + 23.85 + 22.79 + 24.22}{8}$ $= 22.83125 \text{ cents / kWh}$ $= \$0.23 \text{ / kWh (2d.p.)}$	M1 A1
<b>8c</b>	<p>Package A: <math>1.07 \times 0.1798</math> = <math>\\$0.192386</math></p> <p>Package B: <math>= \frac{0.2283125}{1} \times 78\%</math> = <math>\\$0.17808</math></p>	B1

	Package C: $\$0 + \left( \frac{22.15 + 23.65 + 24.13 + 23.85 + 22.79 + 24.22}{6} \times 0.8 \right)$ $= \frac{18.772}{100}$ $= \$0.18772$ <p>Since <u>\$0.17808 is cheapest</u> for every 1 kWh, package <u>B</u> would be a better package.</p>	B1   B1  A1
7a	$n = -7$	B1
7b	Refer to the graph	



*P1 at least 6 correct points.*

*P2 all plots*

*C1 smooth graph through plotted points*

7ci	$y = -7.75$ (accept $7.9 \leq y \leq -7.6$ )	B1
7cii	(1, -8)	B1
7ciii	$x = 1$	B1