

Answer all the questions.

1 Factorise completely $8x - x(81y + 29)$. [2]

2 Express $\frac{1}{3}(a-5) - 1 + \frac{3a}{2}$ as a single fraction in its simplest form. [3]

3 (a) Given that $2\frac{1}{2}q = 10p$, find $p : q$. [2]

(b) Simplify the ratio $1\frac{1}{5} : 2.4$. [2]

4 A motorcycle and a car were travelling towards each other at uniform speeds. They were 528 km apart at 06 30 and passed each other at 09 30.

(a) If the speed of the motorcycle is 80 km/h, find the speed of the car. [3]

(b) At 06 30, a van travelled on a different road and passed the motorcycle and car at 09 30. If the van's uniform speed is 20 m/s, find the distance it travelled before meeting the two vehicles. [2]

5 In a bottle factory, machine *A* produces 168 bottles in 3 runs and machine *B* produces 420 bottles in 5 runs. Machine *C* produces 108 bottles per run.

(a) Find the rate of bottle production by machine *A* and machine *B* respectively. [2]

(b) One day, the number of bottles each machine has made is equal for the first time since the factory started.

(i) Find the number of bottles each machine produced. [2]

(ii) Find the difference in the number of runs by machine *A* and machine *C*. [2]

6 Peter sat for two Mathematics tests. He scored 13 out of 20 for the first test and 18 out

of 35 for the second test.

- (a) Did Peter improve in his Mathematics? Show working to support your answer. [3]

At the end of the term, Peter scored x marks out of 90 for a Mathematics examination. Dave scored half of Peter's score.

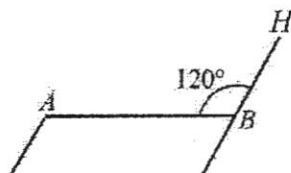
- (b) Express Dave's score in terms of x . [1]

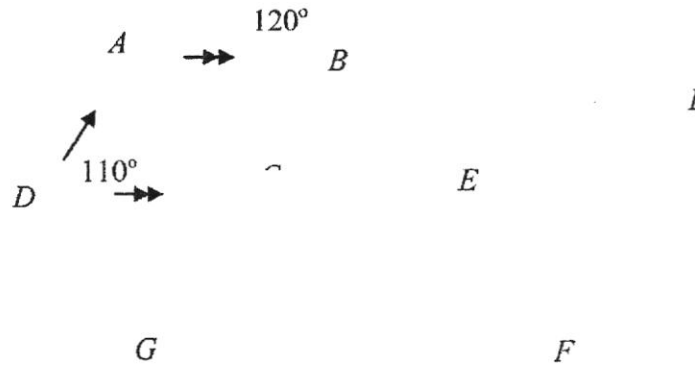
- (c) Given that Dave scored $\frac{2}{9}$ of the total score for the Mathematics examination, find Peter's marks. [2]

- 7 A sequence of rectangles was formed where in each case the length was an exact number of centimetres more than the width. The areas and perimeters of each of the first four rectangles are recorded in the following table.

Width n (in cm)	Length (in cm)	Area A (in cm^2)	Perimeter P (in cm)
1	2	2	6
2	3	6	$6 + 4$
3	4	12	$6 + 4 + 4$
4	5	20	$6 + 4 + 4 + 4$

- (a) State the width and the length of a rectangle in the sequence which has an area of 110 cm^2 . [2]
- (b) Find an expression, in terms of n , for the area, $A \text{ cm}^2$, of the rectangle. [1]
- (c) Find an expression, in terms of n , for the perimeter, $P \text{ cm}$, of the rectangle. [1]
- (d) Hence, find the width and length of a rectangle in the sequence which has a perimeter of 122 cm . [2]





$DEFG$ is a parallelogram. AB is parallel to DC , AD is parallel to BC and CBH is parallel to FI . Given that angle $ADG = 110^\circ$ and angle $ABH = 120^\circ$, find

- (a) angle ADC , [2]
- (b) angle DEF . [2]
- (c) Given that angle EFI is $58\frac{1}{3}\%$ of angle ABH , find angle EFI . [2]



The diagram shows the net of a solid metal prism with dimensions given in centimetres.

- (a) Find the area of the cross-section $ABCDEFGH$. [2]
- (b) Given that the perimeter of the cross-section is 38 cm, find the surface area of the prism. [2]
- (c) Find the volume of the prism. [2]
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10 Answer the whole of this question on a sheet of graph paper.

The table below shows some values of x and the corresponding values of y , where
 $y = 2x + 7$.

x	-4	-2	0	2
y	-1	3	7	p

- (a) Find the value of p . [1]
- (b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x -axis for $-4 \leq x \leq 2$.
Using a scale of 1 cm to represent 1 unit, draw a vertical y -axis for $-1 \leq y \leq 11$.

On your axes, plot the points given in the table and join them with a straight line. [3]
- (c) Use your graph to find the value of x when $y = 4$. [1]
- (d) State the gradient of the graph of $y = 2x + 7$. [1]
-

End of Paper

Answer Key

1 $-3x(7 + 27y)$

2 $\frac{11a + 4}{6}$

3 (a) $p : q = 1 : 4$

(b) $1 : 2$

4 (a) Speed of car = 96 km/h

(b) 216 km

5 (a) machine A = 56 bottles/run
machine B = 84 bottles/run

(bi) 1512 bottles

(bii) 13

Percentage for first test

$= 65\%$

6 (a) Percentage for second test

$= 51\frac{3}{7}\%$

Since the percentage for the second test is lower than the first, the student did not improve.

(b) $\frac{x}{2}$

(c) $x = 40$

7 (a) Width = 10 cm
Length = 11 cm

(b) $A = n(n + 1)$

(c) $P = 2 + 4n$

(d) width is 30 cm; length is 31 cm

8 (a) 60°

(b) 130°

(c) 130°

9 (a) 66 cm^2

(b) 702 cm^2

(c) 990 cm^3

10 (a) $p = 11$

(b) See graph

(c) $x = -1.5$

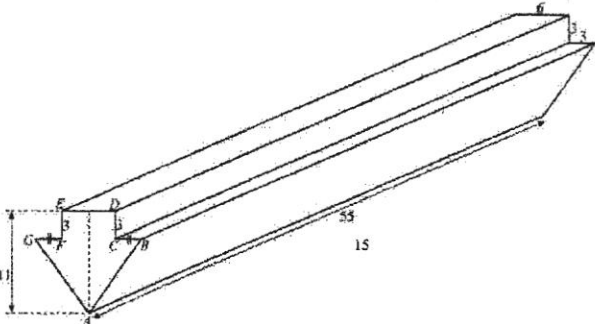
(d) Gradient = 2

St Gabriel's Sec Sch
Mathematics Department
2017 Sec 1E SA2 Paper 2
Answer Key & Marking Scheme

Qn No.	Solutions	
1	$8x - x(81y + 29)$ $= 8x - 81xy - 29x$ $= -21x - 81xy$ $= -3x(7 + 27y)$	$8x - x(81y + 29)$ $= x(8 - 81y - 29)$ $= x(-21 - 81y)$ $= -3x(7 + 27y)$
2	$\frac{1}{3}(a+5) - 1 + \frac{3a}{2}$ $= \frac{2(a+5)}{6} - \frac{6}{6} + \frac{3(3a)}{6}$ $= \frac{2a+10-6+9a}{6}$ $= \frac{11a+4}{6}$	$\frac{1}{3}(a+5) - 1 + \frac{3a}{2}$ $= \frac{1}{3}a - \frac{5}{3} - 1 + \frac{3a}{2}$ $= \frac{2a}{6} + \frac{9a}{6} - \frac{5}{3} - 1$ $= \frac{11a}{6} - \frac{8}{3}$
3	<p>(a)</p> $2\frac{1}{2}q = 10p$ $\frac{5}{2}q = 10p$ $\frac{5}{2} \div 10 = \frac{p}{q}$ $\frac{p}{q} = \frac{1}{4}$ <p>\therefore ratio $p : q = 1 : 4$</p>	$2\frac{1}{2}q = 10p$ $2.5q = 10p$ $q = 4p$ $\frac{p}{q} = \frac{1}{4}$ <p>\therefore ratio $p : q = 1 : 4$</p>
	<p>(b)</p> $1\frac{1}{5} : 2.4$ $= \frac{6}{5} : \frac{24}{10}$ $= \frac{12}{10} : \frac{24}{10}$ $= 1 : 2$	$1\frac{1}{5} : 2.4$ $= 1.2 : 2.4$ $= 12 : 24$ $= 1 : 2$
4	<p>(a)</p> <p>Time taken for vehicles to pass each other</p> $= 0930 - 0630$ $= 3 \text{ hours}$ <p>Distance travelled by motorcycle</p> $= 80 \times 3$ $= 240 \text{ km}$	

Qn No.	Solutions																																						
	Distance travelled by car $= 528 - 240$ $= 288 \text{ km}$ Speed of car $= 288 \div 3$ $= 96 \text{ km/h}$																																						
(b)	$20 \text{ m/s} = 20 \times \frac{3600}{1000}$ $= 72 \text{ km/h}$ Distance travelled by van $= 72 \times 3$ $= 216 \text{ km}$																																						
5	(a) Rate of production by machine A $= 168 \div 3$ $= 56 \text{ bottles/run}$ Rate of production by machine B $= 420 \div 5$ $= 84 \text{ bottles/run}$																																						
	(b) (i) <table border="1" data-bbox="383 1176 646 1702" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>56</td> <td>84</td> <td>108</td> </tr> <tr> <td>2</td> <td>28</td> <td>42</td> <td>54</td> </tr> <tr> <td>2</td> <td>14</td> <td>21</td> <td>27</td> </tr> <tr> <td>3</td> <td>7</td> <td>21</td> <td>27</td> </tr> <tr> <td>3</td> <td>7</td> <td>7</td> <td>9</td> </tr> <tr> <td>3</td> <td>7</td> <td>7</td> <td>3</td> </tr> <tr> <td>7</td> <td>7</td> <td>7</td> <td>1</td> </tr> <tr> <td></td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table> $\therefore \text{LCM} = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 7$ $= 1512$ Hence, number of bottles each machine produced is 1512.		A	B	C	2	56	84	108	2	28	42	54	2	14	21	27	3	7	21	27	3	7	7	9	3	7	7	3	7	7	7	1		1	1	1		
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7	7	7	1																																				
	1	1	1																																				

Qn No.	Solutions																					
(b) (ii)	No. of runs by machine <i>A</i> $= 1512 \div 56$ $= 27$ No. of runs by machine <i>C</i> $= 1512 \div 108$ $= 14$ The difference in the no. of times machine <i>A</i> and machine <i>C</i> has run $= 27 - 14$ $= 13$																					
6	(a)	Percentage for first test $= \frac{13}{20} \times 100$ $= 65\%$ Percentage for second test $= \frac{18}{35} \times 100$ $= 51\frac{3}{7}\%$ Since the percentage for the second test is lower than the first, the student did not improve.	Alternatively, students may convert to common denominator to compare. Changing to decimal is similar to converting to common denominator.																			
	(b)	$\frac{1}{2}x = \frac{x}{2}$																				
	(c)	$\frac{x}{2} = \frac{2}{9} \times 90$ $\frac{x}{2} = 20$ $x = 40$ Peter's marks is 40m																				
7	(a)	Width = 10 cm Length = 11cm																				
	(b)	$A = n(n + 1)$																				
	(c)	<table style="border: none;"> <tr> <td style="padding-right: 20px;">$\frac{n}{1}$</td> <td style="padding-right: 20px;">$\frac{P}{6}$</td> <td style="padding-left: 20px;">$= 6 + 4 \times 0$</td> </tr> <tr> <td>2</td> <td>$10 = 6 + 4$</td> <td>$= 6 + 4 \times 1$</td> </tr> <tr> <td>3</td> <td>$14 = 6 + 4 + 4$</td> <td>$= 6 + 4 \times 2$</td> </tr> <tr> <td>4</td> <td>$18 = 6 + 4 + 4 + 4$</td> <td>$= 6 + 4 \times 3$</td> </tr> <tr> <td>:</td> <td></td> <td>:</td> </tr> <tr> <td>:</td> <td></td> <td>:</td> </tr> </table>	$\frac{n}{1}$	$\frac{P}{6}$	$= 6 + 4 \times 0$	2	$10 = 6 + 4$	$= 6 + 4 \times 1$	3	$14 = 6 + 4 + 4$	$= 6 + 4 \times 2$	4	$18 = 6 + 4 + 4 + 4$	$= 6 + 4 \times 3$:		:	:		:		
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Qn No.	Solutions		
	$P_n = 6 + 4 \times (n - 1)$ $= 6 + 4n - 4$ $= 2 + 4n$ $P = 2 + 4n.$		
(d)	$2 + 4n = 122$ $4n = 120$ $n = 30$ <p>Hence, the width is 30 cm and the length is 31 cm.</p>		
8	<p>(a) $\angle BCD = \angle ABH$ (corr. \angles, $AB \parallel DC$) $= 120^\circ$</p> <p>$\angle ADC = 180^\circ - \angle BCD$ (int. \angles, $AD \parallel BC$) $= 180^\circ - 120^\circ$ $= 60^\circ$</p>		
	<p>(b) $\angle EDG = 110^\circ - \angle ADC$ $= 110^\circ - 60^\circ$ $= 50^\circ$</p> <p>$\angle DEF = 180^\circ - \angle EDG$ (int. \angles, $AD \parallel BC$) $= 180^\circ - 50^\circ$ $= 130^\circ$</p>		
	<p>(c) $\angle DEF = 58\frac{1}{3}\% \times 120$ $= 70^\circ$</p>		
9	 <p>Area of cross-section $ABCDEFG$ $=$ Area of $\triangle ABG$ + Area of rectangle $CDEF$ $= \frac{1}{2}(6 + 3 + 3) \times (11 - 3) + 6 \times 3$ $= \frac{1}{2} \times 12 \times 8 + 6 \times 3$ $= 66 \text{ cm}^2$</p>		
	<p>(b) Total surface area of prism $=$ Perimeter \times 15 + 2 \times Area of cross-section $= 38 \times 15 + 2 \times 66$ $= 702 \text{ cm}^2$</p>		

Qn No.	Solutions		
(c)	Volume of prism = Area of cross-section \times height of prism = 66×15 = 990 cm^3		
10	(a)	$p = 11$	
	(b)	Correct Scales used for both Axes (must label) Correct Points Plotted Points joined up with a straight line	
	(c)	$x = -1.5$	
	(d)	Gradient = 2	

[End of Marking Scheme]

Draft (ignore $y = -2x + 3$)

