

Name: .....(      )      Class: Sec .....



# St. Gabriel's Secondary School

## 2016 Second Semestral Examination

Subject : Mathematics  
 Paper : 1  
 Level/Stream : Sec 2 Express  
 Duration : 1 hour 15 minutes  
 Date : 5 October 2016  
 Setter(s) : Ms Fina Zhu

### READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

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

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 3 significant figures. Give answers in degrees to 1 decimal place.

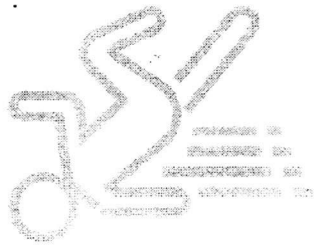
For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

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

The total number of marks for this paper is 50.

<b>50</b>	

This question paper consists of 9 printed pages including this cover page.



Answer **all** the questions.

1 State 'True' or 'False' for the following statements

(a) If  $p$  and  $q$  are two different prime numbers,  $pq$  has only 2 factors.

Answer ..... [1]

(b) The diagonals of a parallelogram are perpendicular to each other.

Answer ..... [1]

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2 (a) Round 0.099801 correct to 2 significant figures.

Answer ..... [1]

(b) The first four terms of a sequence are 2, 8, 18 and 32.  
Write down the 6th term of the sequence.

Answer ..... [1]

(c) Convert 31 m/s to km/h.

Answer ..... km/h [1]

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3 (a) An unbiased die is thrown. Find the probability that the number shown is a prime number.

Answer ..... [1]

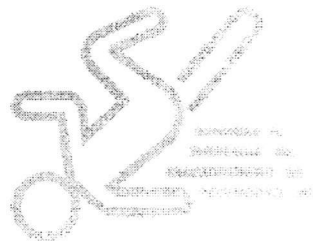
(b) Ryan picks a number from 9 to 15. Find the probability that the number he picks

(i) is odd,



Answer ..... [1]

(ii) is a perfect cube.



Answer ..... [1]

- 4 Given that  $42^2 - 8^2 = 5k$ , use algebraic rule to find the value of  $k$ .  
(Note: You are not allowed to use the calculator for this question.)

Answer  $k =$  ..... [3]

- 5 Solve  $2x^2 - 9x - 5 = 0$ .

Answer  $x =$  ..... or ..... [3]

- 6 Find the ratio of the curved surface area of the cone in **Figure 1** to the curved surface area of the hemisphere in **Figure 2**.

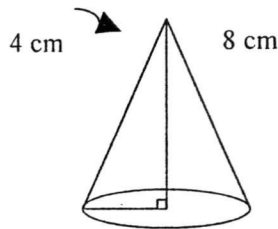
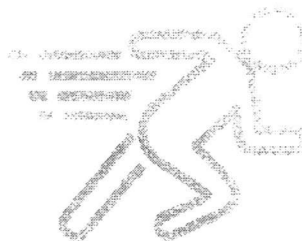


Figure 1

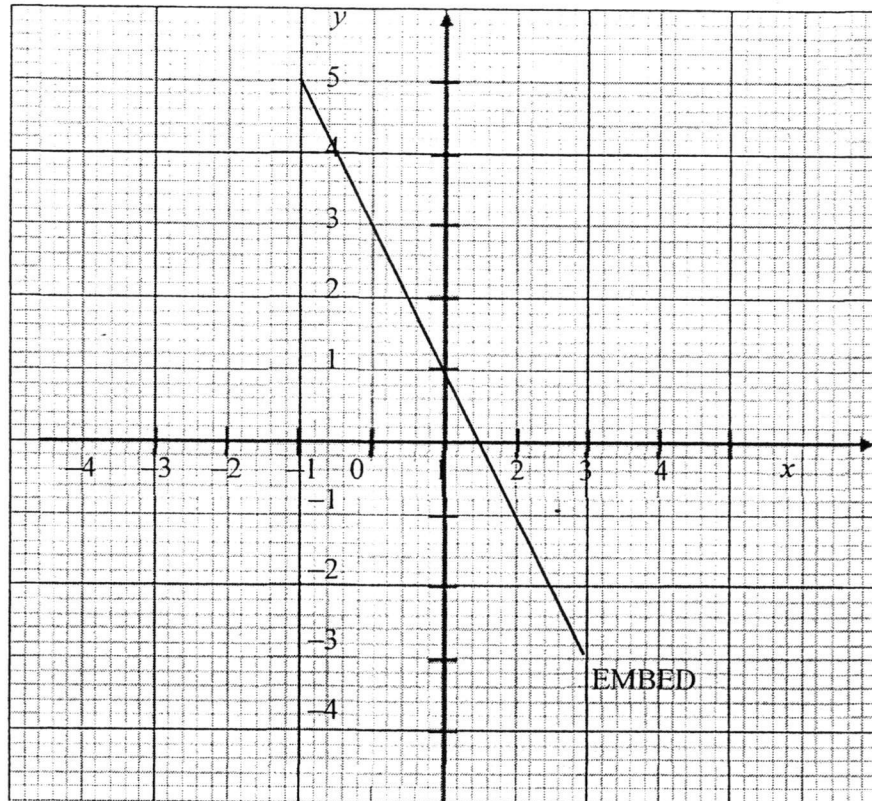


Figure 2



Answer ..... : ..... [3]

7 The graph of  $y = 3 - 2x$  is drawn on the grid below.



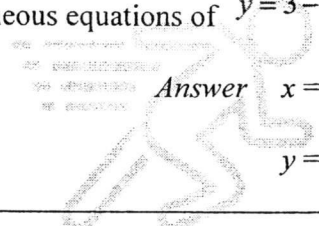
(a) State the gradient of the line  $y = 3 - 2x$ .

Answer ..... [1]

(b) Draw the line  $y = 2$  on the same grid.

[1]

(c) Hence, solve the simultaneous equations of  $y = 3 - 2x$  and  $y = 2$ .



Answer  $x =$  .....

$y =$  ..... [1]

- 
- 8 The school organises an overseas trip for a group of 40 pupils and the amount of fund available allows them to travel for 15 days. If the number of pupils increases to 50, find the difference in the number of days they could travel with the same amount of fund provided.

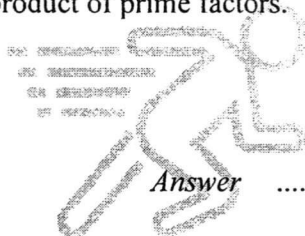
*Answer* ..... days [3]

- 
- 9 The highest common factor (HCF) and lowest common multiple (LCM) of two numbers are 12 and 360 respectively.

- (a) Express the HCF as the product of prime factors.

*Answer* ..... [1]

- (b) Express the LCM as the product of prime factors.



*Answer* ..... [1]

- (c) One possible set of the two numbers is 12 and 360.  
Write down another set of two numbers that will have the same HCF and LCM.

Answer ..... [1]

- 10 (a) Daniel has a total of 19 dollar notes of which  $x$  are \$5 notes and  $y$  are \$2 notes. The total value of the dollar notes is \$71. Form two equations in terms of  $x$  and  $y$  to represent the information.

Answer ..... [1]

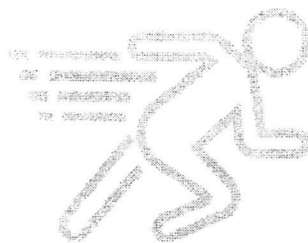
..... [1]

- (b) Given  $9m - 2n = m + \frac{1}{4}n$ , find the value of  $\frac{m}{n}$ .

Answer  $\frac{m}{n} = \dots\dots\dots$  [2]

- 11 Factorise completely

(a)  $-3pq + 2p^2 + 3q - 2p$ ,





Answer ..... [2]

(b)  $a^4 - 81$ .

Answer ..... [2]

- 
- 12 The distribution of marks obtained by students in a Mathematics class test is given in the stem and leaf diagram below. The total marks is 80.

Key	1		0 8 9 9
3   3 represents 33 marks	3		3 4 4 5 7
	3		1 3 4 5 5 5 7 8 9
	4		0 0 3 4 6 6 8
	5		2 3 4 7 9
	6		2 8
	7		2 6 9
	8		0

- (a) Find

- (i) the total number of students who sat for the test,

Answer ..... students [1]

- (ii) the modal mark for the test,

Answer ..... [1]

- (iii) the median mark for the test.

Answer ..... [1]

- (b) If remedial lesson is given to students who scored less than 25 marks, find the

percentage of students who have to attend remedial.

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

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13 If  $x + y = -3$  and  $xy = -10$ , find the value of

(a)  $(y+1)(x+1)$ ,

*Answer* ..... [2]

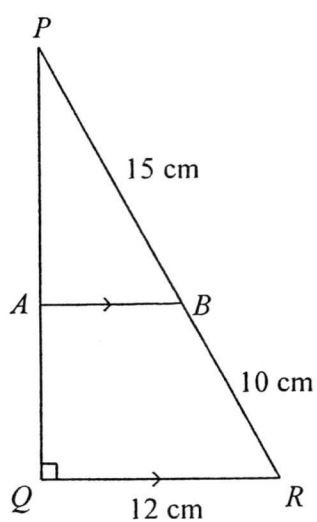
(b)  $x^2 + y^2$ .



Answer ..... [3]

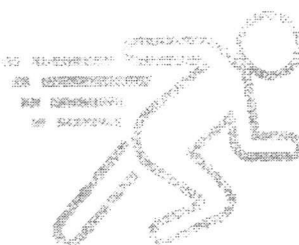
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14



$PAB$  and  $PQR$  are two similar right-angled triangles.  $A$  and  $B$  are points on  $PQ$  and  $PR$  respectively such that  $AB$  is parallel to  $QR$ .  $BR = 10$  cm,  $PB = 15$  cm and  $QR = 12$  cm. Find

(a)  $AB$ ,



Answer  $AB = \dots\dots\dots$  cm [2]

(b)  $PQ$ ,

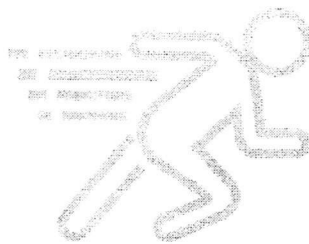
Answer  $PQ = \dots\dots\dots$  cm [2]

(c) angle  $QPR$ .

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

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**End of Paper**



Qn	Solution		Remarks
1a	False	B1	Generally ok.
1b	False	B1	• 0 mark for those who wrote T or F.
2a	0.10	B1	Generally ok.
2b	72	B1	• Common mistake: 0.010 or 0.100
2c	111.6 km/h	B1	
3a	0.5 or $\frac{1}{2}$	B1	Generally ok.
3b	(i) $\frac{4}{7}$ (ii) 0	B1 B1	• Common Mistake: not reducing to lowest term or leaving answer as $\frac{0}{7}$
4	$42^2 - 8^2 = 5k$ $(42+8)(42-8) = 5k$ $(50)(34) = 5k$ $\therefore k = 340$	M1 M1 A1	Generally ok.
5	$2x^2 - 9x - 5 = 0$ $(2x+1)(x-5) = 0$ $x = -0.5$ or $x = 5$	M1 A2	Generally ok. 0 mark for those who attain solution from expression $(2x+1)(x-5)$ , not equation.
6	$\pi(4)(8) \cdot 2\pi(6)^2$ 4 : 9	M2 A1	<b>Common Mistakes:</b> • Applied wrong formulas OR used rounded off figure when comparing ratio.

			<ul style="list-style-type: none"> <li>[-1m] wrong side of ratio</li> <li>[-1m] no brackets → <math>26^2</math> or <math>2\pi 36</math></li> </ul>
7a	-2	B1	<ul style="list-style-type: none"> <li>Badly done. Some forgot about -ve sign.</li> </ul>
7b	See drawing	B1	<ul style="list-style-type: none"> <li>Ok but many did not label the graph.</li> </ul>
7c	$x = 0.5, y = 2$	B1	<ul style="list-style-type: none"> <li>Generally ok.</li> </ul>
8	$50d = 40 \times 15$ $d = 12$ days Difference = $15 - 12 = 3$ days	M1 M1 A1	<ul style="list-style-type: none"> <li>[-1m] 40 pupils = 15 days</li> <li>Most students did not find the difference.</li> </ul>
9a	$HCF = 2^2 \times 3$	B1	<ul style="list-style-type: none"> <li>Some did not give product form</li> </ul>
9b	$LCM = 2^3 \times 3^2 \times 5$	B1	<ul style="list-style-type: none"> <li>e.g. 2, 2, 3</li> </ul>
9c	[60, 72] & [24, 180] & [36, 120]	B1	<ul style="list-style-type: none"> <li>Part c is quite badly done.</li> </ul>
10a	$x + y = 19$ $5x + 2y = 71$	B1 B1	<ul style="list-style-type: none"> <li>50-50</li> </ul>
10b	$9m - 2n = m + \frac{1}{4}n$ $8m = \frac{9}{4}n$ $\frac{m}{n} = \frac{9}{4} \div 8$ $= \frac{9}{32}$	M1 A1	<ul style="list-style-type: none"> <li>Quite badly done. Many only get M1.</li> <li>Many has answer <math>\frac{32}{9}</math></li> <li>A few with the same weird mistake:  <math>32 \times \frac{m}{n} = 9</math>  <math>\frac{32}{9} \times \frac{m}{n} = 0</math></li> </ul>
11a	$-3pq + 2p^2 + 3q - 2p$ $= p(2p - 3q) - (2p - 3q)$ $= (p - 1)(2p - 3q)$	M1 A1	<ul style="list-style-type: none"> <li>Majority can do.</li> </ul>
11b	$a^4 - 81$ $= (a^2)^2 - (9)^2$ $= (a^2 + 9)(a^2 - 9)$ $= (a^2 + 9)(a + 3)(a - 3)$	M1 A1	<ul style="list-style-type: none"> <li>Badly done.</li> <li>Some left answer in index form as <math>(a^2 + 3^2)(a^2 - 3^2) \rightarrow</math> No M1</li> <li>Many missed out A1</li> </ul>
12a	(i) 36 (ii) 35 (iii) 39.5	B1 B1 B1	<ul style="list-style-type: none"> <li>Well done for part (i) and (ii)</li> <li>50-50 for part (iii)</li> </ul>
12b	$\frac{7}{36} \times 100\%$ $= 19\frac{4}{9}\%$	M1 A1	<ul style="list-style-type: none"> <li>[-1m] for not writing % after 100</li> </ul>

13a	$(y+1)(x+1) = xy + y + x + 1$ $= -10 - 3 + 1$ $= -12$	M1 A1	Generally ok. <b>Common mistake:</b> <ul style="list-style-type: none"> <li>• <math>(y+1)(x+1) = xy + y + x + 2</math></li> </ul>
13b	$x^2 + y^2 = (x+y)^2 - 2xy$ $= (-3)^2 - 2(-10)$ $= 29$	M1 M1 A1	Badly done. <b>Common mistake:</b> <ul style="list-style-type: none"> <li>• <math>x^2 + y^2 = (x+y)(x-y)</math></li> <li>• <math>x^2 + y^2 = (x+y)(x+y)</math></li> <li>• <math>-3^2 = 9</math></li> </ul>
14a  14b	$\frac{AB}{12} = \frac{15}{15+10}$ $AB = 7.2\text{cm}$ $PQ = \sqrt{25^2 - 12^2}$ $= \sqrt{481}$ $= 21.9\text{cm}$	M1 A1 M1 A1	Generally ok. <b>Common mistake:</b> <ul style="list-style-type: none"> <li>• [-1m] no unit for all 3 parts</li> <li>• [-1m] for wrong unit</li> <li>• Several did not write <math>\angle</math></li> </ul> $PQ^2 = 25^2 - 12^2$ <ul style="list-style-type: none"> <li>• <math>= 21.9\text{cm}</math></li> </ul>
14c	$\sin \angle QPR = \frac{12}{25}$ $\angle QPR = 28.685\dots$ $= 28.7^\circ$	M1 A1	<ul style="list-style-type: none"> <li>• <math>\sin^{-1} = \frac{12}{25}</math> or <math>\sin^{-1} QPR = \frac{12}{25}</math></li> </ul>

St Gabriel's Sec Sch  
Mathematics Department  
2016 Sec 2E SA2 Paper 2  
Answer Key & Marking Scheme

Qn No.	Solutions	Marks	Remarks
1	$8a^2 - 18b^2 = 2(4a^2 - 9b^2)$ $= 2[(2a)^2 - (3b)^2]$ $= 2(2a + 3b)(2a - 3b)$	M1  A1	Generally well done.
2	$(x+1)^2 - 14(x+1) + 49$ $= (x+1)^2 - 2(7)(x+1) + 7^2$ $= (x+1-7)^2$ $= (x-6)^2$ <p>Since length of one side of square is 6 cm,  <math>x - 6 = 6</math>  <math>x = 12</math></p>	M1  M1  A1	$(x+1)^2 - 14(x+1) + 49$ $= x^2 + 2x + 1 - 14x$ $- 14 + 49$ $= x^2 - 12x + 36$ $= (x-6)^2$
3	<p>Surface Area of shaded portion</p> $= 2\left(\frac{1}{2}\pi r^2\right)$ $= \pi r^2$ $= 3.142 \times 26.6 \times 26.6$ $= 2223.15352 \text{ cm}^2$ <p>[or 707.56 <math>\pi \text{ cm}^2</math>]  [or 2222.865298 <math>\text{cm}^2</math> (using calculator <math>\pi</math>)]</p> <p>Surface area of white portion/curved surface</p> $= \frac{7}{8}(4\pi r^2)$ $= \frac{7}{8} \times 4 \times 3.142 \times 26.6 \times 26.6$ $= 7781.03732 \text{ cm}^2$ <p>[or 2476.46 <math>\pi \text{ cm}^2</math>]  [or 7780.028543 <math>\text{cm}^2</math> (using calculator <math>\pi</math>)]</p> <p>Total surface area of remaining solid</p> $= 2223.15352 + 7781.03732$ $= 10004.2 \text{ cm}^2 \text{ (to 1 d.p.)}$ <p>[or 10002.89384 <math>\text{cm}^2</math> (using calculator <math>\pi</math>)]</p>	M1  M1  A1	<p>Many used calculator's <math>\pi</math> instead of 3.142 (as stated on cover pg). Marks awarded accordingly.</p> <p>Many had longwinded methods – finding total surface area of sphere first, and minus 1/8 of it to find the 7/8<sup>th</sup> of surface area of sphere.</p> <p>Many used rounded off answers to find final answer, resulting in inaccuracy.</p>







		$= \frac{11}{12}$		
	(b)	$\sin \angle BAQ = \frac{4}{5}$ $\angle BAQ \approx 53.13^\circ$ $\sin \angle ABP = \frac{11}{12}$ $\angle ABP \approx 66.44^\circ$ $\therefore \angle PCQ = 180^\circ - \angle BAQ - \angle ABP \text{ (} \angle \text{ sum of } \Delta \text{)}$ $= 180^\circ - 53.13^\circ - 66.44^\circ$ $= 60.43^\circ$ $= 60.4^\circ \text{ (correct to 1 d.p.)}$	M1 A1	<p>No reasoning (-1m) (<math>\angle</math> sum of <math>\Delta</math>)</p> <p>Many used rounded off answers to calculate, resulting in inaccuracy (incorrect final answer)</p>
	(c)	<p>In <math>\Delta ACP</math>, <math>\angle PCQ = \angle PCA = 60.43^\circ</math></p> $\sin \angle PCA = \frac{55}{AC}$ $AC = \frac{55}{\sin 60.43^\circ}$ $\approx 63.2 \text{ cm (to 3 s.f.)}$	M1 A1	Many longwinded ways of doing – finding AQ and QC separately and adding them up to get AC. (more time taken) (inaccuracy occurs when rounded off answers were used to calculate)
8	(a)	<p>Scale of map A = 2 cm : 5 km</p> $= 2 \text{ cm} : 5 \times 1000 \times 100 \text{ cm}$ $= 2 \text{ cm} : 500\,000 \text{ cm}$ $= 1 \text{ cm} : 250\,000$ $= 1 : 250\,000$	M1 A1	Well done.
	(b)	<p>Scale of map A = 2 cm : 5 km</p> $= 1 \text{ cm} : 2.5 \text{ km}$ <p>Area on map A : actual area</p> $= 1 \text{ cm}^2 : 2.5 \times 2.5 \text{ km}^2$ $= 1 \text{ cm}^2 : 6.25 \text{ km}^2$ <p><math>\therefore</math> actual area of the park = 6.25 <math>\times</math> 2.5</p> $= 15.625 \text{ km}^2$	M1 A1	Some forgot to convert to new scale for area.
	(c)	<p>Scale of map B = 1 : 50 000</p> $= 1 \text{ cm} : 0.5 \text{ km}$ <p>Area on map B : actual area</p> $= 1 \text{ cm}^2 : 0.5 \times 0.5 \text{ km}^2$ $= 1 \text{ cm}^2 : 0.25 \text{ km}^2$	M1	Some used the wrong scale to calculate.

		$\therefore \text{area of park on map } B = \frac{15.625}{0.25}$ $= 62.5 \text{ cm}^2$		
		-		
9	(a)	$\frac{2p+q+p+3q}{2} = 14.5$ $3p+4q = 29$	M1 A1	Many didn't reduce or simplify
	(b)	$\frac{p-q+3p-2q+2p+q+p+3q+2p+3q+5p+2q}{6} = 12$ $\frac{14p+6q}{6} = 12$ $2(7p+3q) = 72$ $7p+3q = 36$	M1     A1	Many didn't reduce or simplify

	(c)	$3p+4q = 29 \quad \text{----- (1)}$ $7p+3q = 36 \quad \text{----- (2)}$ $(1) \times 3: 9p+12q = 87 \quad \text{----- (3)}$ $(2) \times 4: 28p+12q = 144 \quad \text{----- (4)}$ $(4) - (3):$ $28p+12q - (9p+12q) = 144 - 87$ $19p = 57$ $p = 3$  $\text{Substituting } p = 3 \text{ into (1),}$ $3p+4q = 29$ $3(3)+4q = 29$ $4q = 20$ $q = 5$	M1  M1  A1      A1	Many did not label equations or show what was done to labelled equations, resulting in confusing presentation.
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10	(a)	When $t = 3$ , $p = 28 + 32(3) - 8(3)^2$ $p = 52$		
	(b)	28 m		
	(c)	Correct Scales used for both Axes (must label) Correct Points Plotted Points joined up with a Smooth Curve	B1 B1 B1	Some got the wrong axis (swapped)
	(d)(i)	Greatest height = 60 m		
	(d)(ii)	Length of time = $3.15 - 0.85$ $= 2.3 \text{ s}$	M1 A1	Accept 2.1s to 2.5s
	(e)	$t = 4.75 \text{ s}$		Accept 4.65s to 4.85s

[End of Marking Scheme]