ST. MARGARET'S SECONDARY SCHOOL

Mid-Year Examinations 2017

Founded 1842

CANDIDATE NAME

CLASS

REGISTER NUMBER

MATHEMATICS

Section B

Secondary 1 Express

8 May 2017

2 hours

(For Sections A and B)

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

Write your name, registration number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section B contains **9** questions.
Answer **all** the questions in the spaces provided.
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 π, use either your calculator value or 3.142, unless the question requires the answer in terms of π or otherwise.

You are advised to spend not more than 1 hour on this section.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this section is 40.

For Examiner's Use

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Section B (40 marks)

Answer **all** the questions

1 **(a)** Express 936, 252 and 132 as a product of its prime factors, leaving your answers in index notation. [3]

(b) A rectangular block of marble has a base 936 cm by 252 cm, with height 132 cm. A stonemason needs to cut the marble up into cubes of the largest possible size.

(i) Find the dimension of the marble cube he can cut. [1]

(ii) Find the total number of cubes he can cut from the block of marble. [1]

2 Planets in our Solar System take a certain number of years to complete one orbit around the Sun. Below are the orbital duration of the planets.

Planet	Orbital Duration (years)
Earth	1
Mars	2
Jupiter	12
Saturn	30
Uranus	84

Planetary alignment is when the planets line up in a straight line towards the sun. It is considered as one of the most interesting sights in astronomy.

(a) Express 12, 30 and 84 as the product of their prime factors, leaving your answers in index notation. [3]

(b) If the last time Jupiter, Saturn and Uranus align themselves in a straight line was the year 1932, determine which year will Jupiter, Saturn and Uranus next align themselves? [2]

3 Certificate of Entitlement (COEs) is a quota system to restrict the vehicle population in Singapore. To own a vehicle, the buyer must pay the prevailing COE price together with the listed price of the car. The COE price changes every two weeks depending on how many cars are being sold for that period. The selling price of a car is as follows:

$$\text{Selling Price of Car (\$)} = \text{Listed price of car(\$)} + \text{COE price(\$)}$$

Eric is a car salesman and he earns commission based on the selling price of the car, excluding the prevailing COE prices. He sold a car to Benjamin recently. Below are the information of the car.

COE price	Car Model	Final Selling Price ($)
$50,101	Monda Jazz	$98,101

If his commission is 3% of the **listed price** of the car,

(a) Calculate how much commission he earned from selling the Monda Jazz. [2]

(b) Benjamin decides to buy the car on hire purchase. He needs to pay a deposit of $25000 and the interest rate is 2.5% per annum over 5 years. Calculate his monthly instalment. Leave your answer to the nearest dollar. [3]

4 Erica is x years old. Her sister is 12 years older than her while her father is twice as old as her sister. Express

(a) her sister's age in terms of x, [1]

(b) her father's age in terms of x, [1]

(c) the sum of the ages of Erica, her sister and her father. [2]

(d) If Erica is 12 years old, determine the age of her father. [2]

5 A recipe to bake 20 muffins states that the ratio of flour and milk needs to be 5 : 3.

(a) If Nancy uses 200 ml of flour, calculate how much milk she needs. [2]

(b) If baking 20 muffins require 400 ml of flour, calculate the amount of milk required if Nancy wants to bake 50 muffins. [2]

6 Mr Sim wanted to get a new vacuum cleaner and he chanced upon two posters shown below.

Shop A

Store wide 10% discount

NOW GSS promotion!

Further 15% discount on discounted price!!!

Applicable to all products!
While stocks lasts!

Shop B

Great Singapore Sales is here!

Store wide now…

25% discount for all products!!!

Applicable to all products!
While stocks lasts!

If the marked price of the vacuum cleaner for both shops is $800,

(a) calculate the selling price of the vacuum cleaner for Shop A. [2]

(b) Comparing offers from both shops, which shop should Mr Sim buy from to get a better deal? Give a reason for your answer. [2]

7 Mr Sim changed $3600 Singapore Dollars (S$) into US Dollars (USD) for his trip to New York City. Upon returning, he had 800 USD left. Given that the currency exchange rate is S$1 to 0.71 USD.

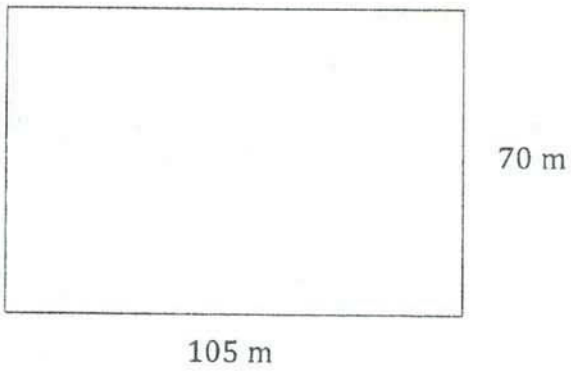
(a) Find out how much USD did Mr Sim get at first. [2]

(b) Mr Sim wants to exchange his remaining USD back to Singapore Dollars. Calculate the amount of Singapore Dollars he will get back. Give your answers to the nearest Singapore Dollars. [2]

8 **(a)** A bank charges 8.5 % simple interest per annum on any bank loan. Mr Sim recently took out a loan of $12000 from the bank. If he decides to repay the loan after 4 years, how much in total does he have to repay the bank? [2]

(b) Mr Wong invested $35000 in an account with the bank. If he earns a total interest of $16800 after 8 years, calculate the bank's investment simple interest rate per annum. [2]

9



A rectangular field is estimated to be 105 m long and 70 m wide, correct to the nearest metres.

(a) Determine the greatest possible length and breadth of the field, correct to 1 decimal place. [2]

(b) Hence, determine the greatest possible perimeter of the field. [1]

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Section A

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Write your name, registration number and class on all the work you hand in.
Write in dark blue or black pen.
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Section A contains **12** questions.
Answer **all** the questions in the spaces provided.
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 π, use either your calculator value or 3.142, unless the question requires the answer in terms of π or otherwise.

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Answer **all** the questions

1 From the set of numbers below,

$$\frac{2}{7} \quad 3 \quad 0.549 \quad \frac{\sqrt{23}}{5} \quad \frac{-14}{\sqrt{2}} \quad 5.5 \quad 0 \quad \frac{\sqrt{100}}{3}$$

(a) Write down the integers.

Answer (a) [1]

(b) Write down the irrational numbers.

Answer (b) [1]

(c) Arrange them on a number line.

Answer (c)

[2]

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2 Given that the integers $A = 2^{11} \times 3^4 \times 11^7$ and $B = 3^{10} \times 11^8$.
Write down in index notation,

(a) the HCF of A and B,

Answer (a) _____ [1]

(b) the LCM of A and B,

Answer (b) _____ [1]

(c) the value of x where Bx is a perfect cube.

Answer (c) $x =$ _____ [1]

---

3 Winry went to an electronic store to get a new refrigerator. She bought the refrigerator for \$535. If the selling price of the refrigerator is inclusive of 7% GST, calculate the price of the refrigerator before GST is added.

Answer \$ [2]

---

4 **(a)** Express 240 metres to 1.3 kilometres as a ratio, in its simplest form.

Answer (a) _____ : _____ [2]

(b) If $A:B$ is $5:6$ and $B:C$ is $8:3$, find the ratio $A:B:C$.

Answer (b) _____ : _____ : _____ [2]

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5 Ben owns a bakery, selling croissants and fruit tarts. On a certain day, he sold a total of 575 croissants and fruit tarts. If he sold 30% more croissants than fruit tarts on that day, how many croissants and tarts did he sell?

Answer Number of croissants - [1]

Number of fruit tarts - [1]

---

6 Calculate $\frac{\sqrt[3]{724}}{3.2^2(8.24-5.32)}$. Give your answer correct to 3 significant figures.

Answer [1]

---

7 During winter, a particular town experiences temperature changes throughout the day. The temperature measured at midnight is $-12°C$ and it rises steadily to $18°C$ at noon.

(a) Find the difference in temperature between midnight and noon.

(b) Find the average rate of increase of temperature.

(c) Determine the time of the day when the temperature is $13°C$, assuming the rate of increase of temperature was constant.

Answer (a) °C [1]

(b) °C/h [1]

(c) [1]

8 Simplify the following algebraic expressions.

(a) $3p + 2q - 2p + 10q$

Answer (a) [1]

(b) $a - 2b + b + c - 2(c - a)$

Answer (b) [2]

(c) $\frac{x}{7} + \frac{5x + 1}{3}$

Answer (c) [3]

9 A triathlon is a race where an athlete needs to complete 3 different segments, swimming, cycling and running. Cindy took part in a triathlon and her performance for each segment is recorded below.

Race segment	Timing	Distance	Speed
Swimming	$\frac{5}{6}$ hrs	1.5 km	a km/h
Cycling	30 mins	b km	25 km/h
Running	c hrs	8 km	10 km/h

(a) Find the values of a, b and c.

Answer (a) $a =$ [1]

$b =$ [1]

$c =$ [1]

(b) Determine Cindy's average speed for the whole race, giving your answer in km/h.

Answer (b) km/h [2]

10 Bonnie plans on making simple colourful pinwheels and sells them. The materials required are coloured papers, pins and plastic straws.
If a packet of 50 coloured papers cost \$10, a box of 100 pins cost \$5 and a packet of 50 plastic straws costs \$5,

(a) Calculate the cost of making a pinwheel.

(b) Bonnie plans on selling her pinwheels for \$0.50 each and she also wishes to make a profit of at least \$50 by the end of the day.

(i) How much profit does she make from selling one pinwheel?

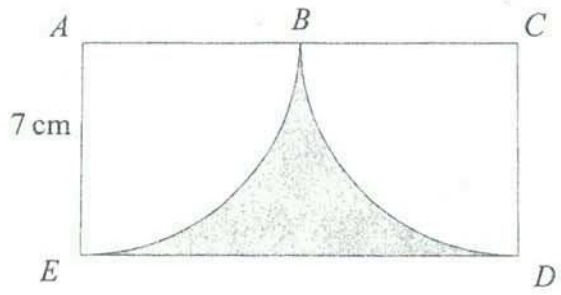
(ii) What is the minimum number of pinwheels she needs to sell in order to meet the profit target?

Answer (a) \$ [2]

(bi) \$ [1]

(bii) pinwheels [1]

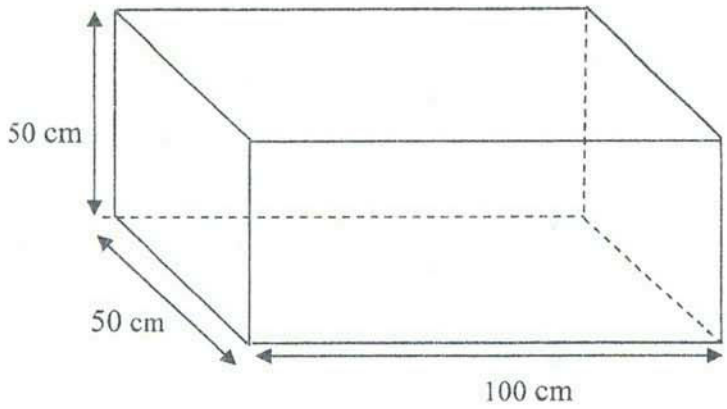
11 The figure below consists of 2 equal quadrants fitted within a rectangle.



Find the area of the shaded region. $\left(\text{Take } \pi = \frac{22}{7}\right)$

Answer _____ cm^2 [3]

12



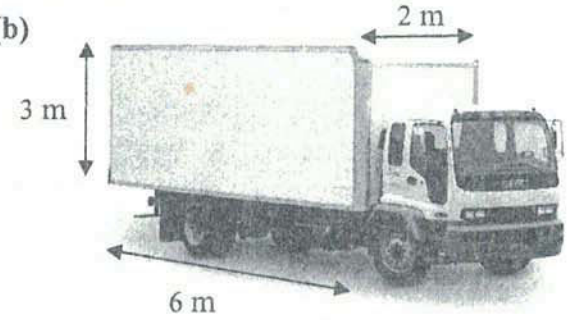
The figure shows a metallic container with a rectangular base measuring 50 cm by 100 cm with height 50 cm.

(a) Find the volume of the tank in cm^3.

Answer (a) cm^3 [1]

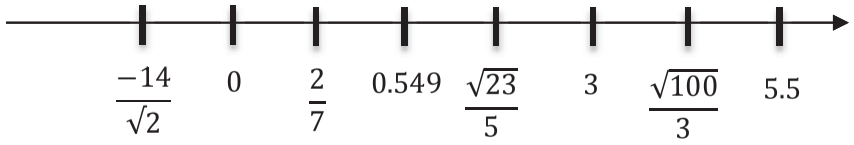
These containers, which are used to store chemicals, are to be transported by a truck to a nearby chemical plant.

(b)



If the storage space of the truck is a cuboid of base 6 m by 2 m and height of 3 m, calculate the number of containers the truck can carry in one trip.

Answer (b) containers [2]

Qn		Solution	Marks	Guidance
1.	(a)	$3, 0$	B1	
	(b)	$\frac{\sqrt{23}}{5}, \frac{-14}{\sqrt{2}}$	B1	
	(c)		B2	
2.	(a)	HCF $= 3^4 \times 11^7$	B1	
	(b)	LCM $= 2^{11} \times 3^{10} \times 11^8$	B1	
	(c)	$x = 3^2 \times 11$	B1	
3		$107\% - \$535$ $1\% - \$5$ $Price\ before\ GST - 100 \times 5 = \$500$	M1 A1	
4	(a)	$240\ m : 1.3\ km$ $240 : 1300$ $12 : 65$	 B1	
	(b)	$A : B - 5 : 6$ $8 : 3 - B : C$ $20 : 24$ $24 : 9$ $\therefore A : B : C - 20 : 24 : 9$	 M1 A1	

Qn		Solution	Marks	Guidance
5		$13\ units - Croissants$ $10\ units - Fruit\ Tarts$ $23\ units - 575$ $1\ unit = 25$ $No.of\ Croissants = 25 \times 13 = 325$ $No.of\ Fruit\ tarts = 25 \times 10 = 250$	 B1 B1	
6		$\frac{\sqrt[3]{724}}{3.2^2(8.24-5.32)} = 0.300305... \approx 0.300\,(3\text{ s.f.})$	B1	
7.	(a)	Temp Difference $= 18 - (-12) = 30°C$	B1	
	(b)	Rate of increase of Temperature $= \frac{30}{12} = 2.5°C/hr$	B1	
	(c)	Temperature difference $= 13 - (-12) = 25°C$ $Time\ taken = \frac{25}{2.5} = 10\ hrs$ $Time = 1000hrs$	 B1	
8	(a)	$3p+2q-2p+10q = p+12q$	B1	
	(b)	$a-2b+b+c-2(c-a)$ $= a - 2b + b + c - 2c + 2a$ $= 3a - b - c$	 M1 A1	
	(b)	$\frac{x}{7} + \frac{5x+1}{3}$ $= \frac{3x}{21} + \frac{7(5x+1)}{21}$ $= \frac{3x + 35x + 7}{21} = \frac{38x + 7}{21}$	 M1 M1A1	

Qn		Solution	Marks	Guidance
9	(a)	$a = 1.5 \div \frac{5}{6} = 1.8\ \text{km/h}$ $b = 0.5hrs \times 25 = 12.5\ \text{km}$ $c = 8 \div 10 = 0.8hrs$	B1 B1 B1	
	(b)	$\text{Cindy's average speed} = \frac{1.5 + 12.5 + 8}{\frac{5}{6} + 0.5 + 0.8} = \frac{22}{2\frac{2}{15}} \approx 10.3\ \text{km/h}\ (3s.f.)$	B1	
10	(a)	$Cost\ of\ one\ paper = \frac{10}{50} = \$0.20$ $Cost\ of\ one\ pin = \frac{5}{100} = \$0.05$ $Cost\ of\ one\ plastic\ straw = \frac{5}{50} = \$0.10$ $Hence, total\ cost\ of\ 1\ pinwheel = \$0.20 + \$0.05 + \$0.10 = \$0.35$	M1A1	Don't accept 35 cents – 1 mark for working
	(bi)	Profit made = $\$0.50 - \$0.35 = \$0.15$	B1	Don't accept 15 cents
	(bii)	How many pinwheels to sell = $\frac{\$50}{\$0.15} = 333\frac{1}{3}$ $Hence, she\ must\ sell\ 334\ pinwheels\ at\ least.$	B1	Students need to show rounded answer
11		Area of rectangle $= 7 \times 14 = 98\ \text{cm}^2$ $Area\ of\ quadrants = 2 \times \frac{1}{4} \times 7^2 \times \frac{22}{7} = 77\ \text{cm}^2$ $Shaded\ Area = 98 - 77 = 21\ \text{cm}^2$	M1 M1A1	
12	(a)	Volume of container $= 100 \times 50 \times 50 = 250000\ \text{cm}^3$	B1	
	(b)	No. of containers that can fit into truck $= \frac{600}{100} \times \frac{200}{50} \times \frac{300}{50} = 144\ \text{containers}$	M1A1	

Qn		Solution	Marks	Guidance
1.	(a)	$936 = 2^3 \times 3^2 \quad \times 13$ $252 = 2^2 \times 3^2 \times 7$ $132 = 2^2 \times 3 \quad \times 11$	B1 B1 B1	
	(b)	$\text{HCF} = 2^2 \times 3 = 12$ cm *Hence, the largest length of each cube is 12 cm.*	 B1	
	(c)	$Total\ number\ of\ cubes\ can\ be\ cut = \frac{936}{12} \times \frac{252}{12} \times \frac{132}{12}$ $= 18018\ cubes$	 B1	
2.	(a)	$12 = 2^2 \times 3$ $30 = 2 \times 3 \times 5$ $84 = 2^2 \times 3 \times 7$	B1 B1 B1	
	(b)	$LCM = 2^2 \times 3 \times 5 \times 7 = 420\ years$ *Hence, the next time the planets align will the year 2352*	M1 A1	
3	(a)	$Selling\ price\ of\ Jazz\ (without\ COE) = 98101 - 50101 = \$48000$ $Commission\ earned = \$48000 \times 3\% = \$1440$	M1 A1	
	(b)	$Amount\ leftover = \$98101 - \$25000 = \$73101$ $Total\ interest\ incurred = (2.5\% \times 73101) \times 5 = \$9137.625$ $Monthly\ Instalment = \frac{\$73101 + 9137.625}{60} = \$1370.64 \approx \$1371$	M1 M1 A1	
4	(a)	Sister's age $= x + 12$	B1	
	(b)	Father's age $= 2(x + 12) = 2x + 24$	B1	Accept either answer
	(c)	Sum of ages $= x + x + 12 + 2(x + 12)$ $= 4x + 36$	M1 A1	
	(d)	Erica's age = 12, let $x = 12$, $Father's\ age = 2(12) + 24$ $= 48\ years\ old$	 M1A1	

Qn		Solution	Marks	Guidance
5	(a)	$5\ units - 200$ ml $1\ unit - 40$ $Milk\ needed = 3 \times 40 = 120$ ml	M1A1	
	(b)	$20\ muffins\ need\ 400\ ml\ of\ flour$ $Hence, 50\ muffins\ need = \frac{400}{20} \times 50 = 1000\ ml\ of\ flour.$ $For\ 1000\ ml\ of\ flour, milk\ needed = \frac{1000}{5} \times 3 = 600\ ml$	M1 A1	
6	(a)	Selling price of the vacuum cleaner for Shop A $= \$800 \times \frac{90}{100} \times \frac{85}{100} = \$612$	M1A1	
	(b)	Selling price of VC for Shop B $= \$800 \times \frac{75}{100} = \$600$ Since Shop B is cheaper, Mr Sim should buy from Shop B.	M1 A1	
7	(a)	Since S$1 to 0.71 USD $S\$3600 = 3600 \times 0.71 = 2556$ USD Hence, Mr Sim got 2556 USD.	M1 A1	
	(b)	$Leftover = 800USD$ $Hence, amount\ of\ SGD\ he\ got\ back = \frac{800}{0.71} = S\$1126$	M1A1	
8	(a)	Total interest accumulated $12000 \times 8.5\% \times 4 = \$4080$ Amount he have to pay back $= \$12000 + \$4080 = \$\$16080$	M1A1	
	(b)	$Investment = \$35000$ $Interest\ earned = \$16800$ $Interest\ per\ year = \frac{16800}{8} = \$2100$ $Interest\ rate = \frac{2100}{35000} \times 100\% = 6\%$	M1 A1	

Qn		Solution	Marks	Guidance
9	(a)	$Greatest\ possible\ length\ of\ field = 105.4\ m$ $Greatest\ possible\ breadth\ of\ field = 70.4\ m$	B1 B1	
	(b)	$Greatest\ possible\ perimeter = 2(105.4) + 2(70.4) = 351.6$ m	B1	