Name:	Class:	Index Number:

ST. HILDA'S SECONDARY SCHOOL

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END-OF-YEAR EXAMINATION 2020

Mathematics **4048**

Date of Exam: 6 Oct 2020
Duration: 2 hours

Level: Secondary 1 Express

Candidates answer on the Question Paper.

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

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

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

Section A and B
Write all your answers on the Question Paper.

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 total number of marks for this paper is **80**.

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.

At the end of the examination, fasten all your work securely together.

Set by: Ms Cindy Tan

Checked by: Mr Lee Junyi

For Examiner's Use	
Section A	40
Section B	40
Total	80

Section A
Answer **all** the questions.

1 x grams of beansprouts cost 60 cents.

Find an expression, in terms of x and y, for the number of grams of beansprouts that can be bought for y dollars.

Answer ..... grams [1]

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2 Given that $p = -2$ and $q = 7$, evaluate each of the following expressions.

(a) p^2q

Answer ..... [1]

(b) $\dfrac{8q - p}{p + q}$

Answer ..... [1]

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3 The lowest temperature recorded in desert A is $-7°$ C.

The difference between the highest and lowest temperature is $45.9°$ C.

(a) What is the highest temperature recorded in desert A?

Answer .....°C [1]

(b) The lowest temperature recorded in desert B is $6°$C less than that in desert A. What is the lowest temperature recorded in desert B?

Answer .....°C [1]

4 All SHSS students went through a health screening exercise. It was found out that the myopia rate among the students was 40%.

Myopia rate is calculated by dividing the number of students who are short-sighted by the entire SHSS student population, and then expressed as a percentage.

(a) Explain what a myopia rate of 40% means.

Answer .....

..... [1]

(b) The myopia rate of 40% is correct to k significant figure.

Explain why k can be 1.

Answer .....

..... [1]

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5 State the number of significant figures in

(a) 8.7010

Answer ..... [1]

(b) 0.02005

Answer ..... [1]

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6 Factorise completely

(a) $6xyz + 2xz$

Answer ..... [1]

(b) $-9h^2 - 15h$

Answer ..... [1]

7 Write down an algebraic expression for each of the following statements.

(a) Subtract $3y$ from the product of x and $4z$.

Answer ..... [1]

(b) Divide 5 by the sum of $7a$ and 2.

Answer ..... [1]

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8 Written as a product of its prime factors $5880 = 2^3 \times 3 \times 5 \times 7^2$

(a) Express 300 as a product of its prime factors.

Answer ..... [1]

(b) Hence, write down the greatest integer that will divide both 300 and 5880 exactly.

Answer ..... [1]

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9 $p = 2^4 \times 3^2 \times 7^2 \times 11^6$

$q = 2 \times 3^5 \times 7^2$

(a) Find the smallest integer k such that kq is perfect square.

Answer $k =$..... [1]

(b) Find the square root of p, leaving your answer as a product of its prime factors.

Answer ..... [1]

10 Ashwin, Bennett and Cloe share the cost of a cake.

Ashwin pays 40% of the cost, Bennett pays $\frac{1}{3}$ and Cloe pays the rest.

(a) What fraction of the cost does Cloe pay?

Answer ..... [1]

(b) Given that Ashwin pays \$5.20 more than Bennett, find the total cost of the cake.

Answer \$..... [2]

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11 **(a)** Arrange the following numbers in ascending order.

$$13 \quad 3 \quad 0.\dot{3} \quad \frac{3}{10} \quad 30$$

Answer ....., ..., ..., ..., ... [1]

(b) Using the numbers given in **(a)**, write down the

(i) prime number(s)

Answer ..... [1]

(ii) rational number(s)

Answer ..... [1]

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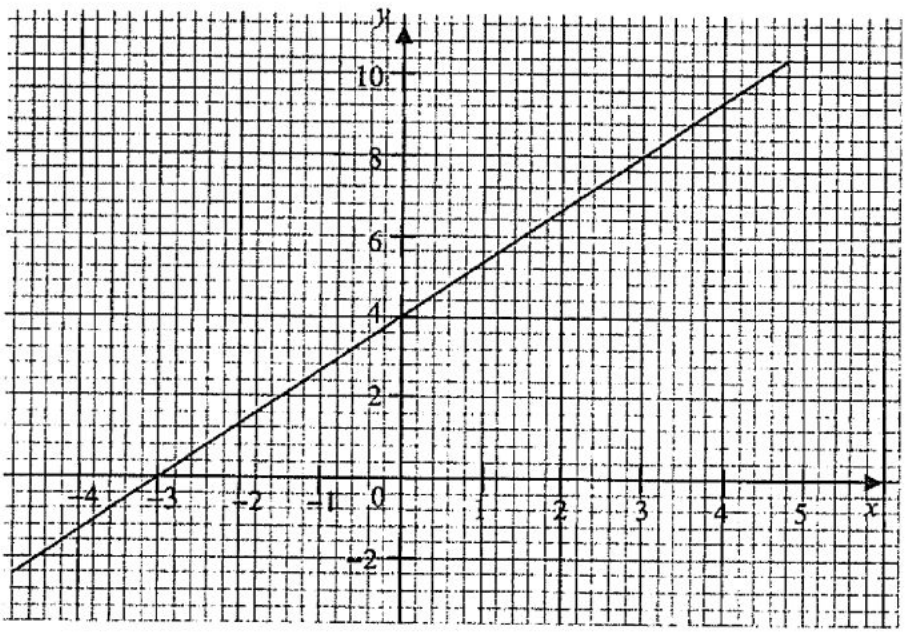
12 A linear graph is shown below.



(a) Complete the table of values for the graph.

x	-3	0	3
y			

[1]

(b) Find the equation of the line.

Answer ..... [2]

(c) Does the line pass through the point $(-6,-5)$?

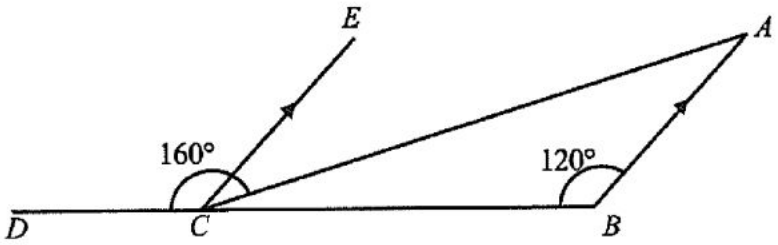
Explain using your answer in **(b)**.

Answer .....

..... [1]

13 In the diagram below, not drawn to scale, $\angle ABC = 120°$ and $\angle ACD = 160°$.

AB is parallel to EC. BCD is a straight line.



Stating your reasons clearly, calculate

(a) $\angle ECD$

Answer ..... ° [1]

(b) $\angle BAC$

Answer ..... ° [1]

(c) $\angle ACB$

Answer ..... ° [1]

(d) Reflex $\angle ABC$

Answer ..... ° [1]

14 **(a)** In the sequence $9, k, 23, 30, 37, 44, \ldots$ find

(i) the value of k,

Answer $k =$ ..... [1]

(ii) the expression for nth term of the sequence,

Answer ..... [1]

(iii) the 40th term in the sequence.

Answer ..... [1]

(b) Is 220 a term of the sequence shown in **(a)**? Explain your answer.

Answer .....

..... [1]

15 **(a)** Expand and simplify $1+3(1-3p)$.

Answer ..... [2]

(b) Express $\frac{5x}{8}-\frac{3y+x}{2}$ as a single fraction in its simplest form.

Answer ..... [3]

Section B
Answer **all** the questions.

16 Three trains arrive at platform A, B and C every 180, 150 and 120 seconds respectively.
On a weekday, the three trains first arrive together at the platforms at 05 55.
The platforms close at 23 59 at night.
Calculate the number of times the three trains arrive at the platforms together on a weekday.

Answer ..... [3]

17 The length of each side of a square is increased by 20%.

Let the original length of the square be x cm.

(a) Write an expression, in terms of x, for the length of the square after the increase.

Answer ..... cm [1]

(b) Determine if the area of the square increases by 40% after the increase in the length. Show your workings clearly.

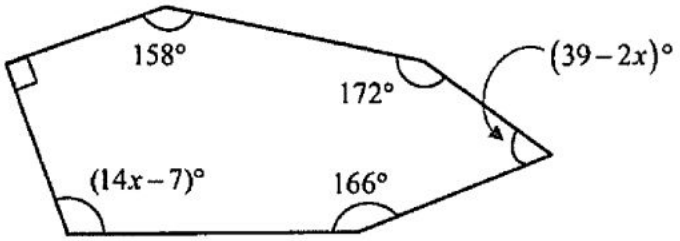
Answer .....

..... [3]

18 **(a)** Find the sum of all the interior angles of a hexagon.

Answer ..... ° [1]

(b) The diagram shows a closed hexagon.



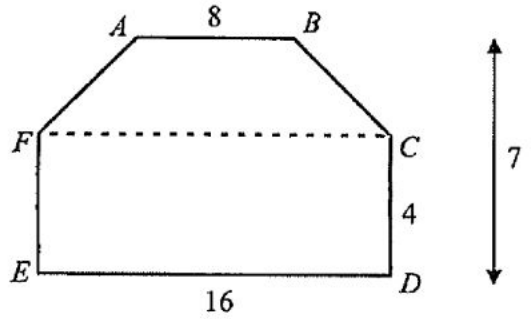
(i) Form an equation in x and solve it.

Answer x = ... [2]

(ii) Hence, find the value of the acute interior angle.

Answer ..... ° [1]

19 The figure below shows a field consisting of a trapezium $ABCF$ and a rectangle $CDEF$.
$AB = 8$ km, $CD = FE = 4$ km, $ED = 16$ km and $AF = BC$.



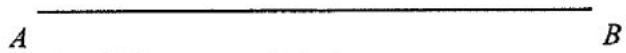
(a) Find the area of the field.

Answer ..... km^2 [2]

(b) At 7 am, Jared started his training for marathon by running along the perimeter of the field at a constant speed of 7 km/h. He finished running one round around the field at 1 pm.
Calculate the length AF.

Answer ..... km [3]

20 $ABCD$ is a trapezium with $BC = 7$ cm, $\angle BAD = 100°$ and $\angle ABC$ is a right angle. AB has already been drawn.



(a) Using a pair of compasses and ruler, construct trapezium $ABCD$. [3]

(b) Calculate the area of trapezium $ABCD$.

Answer .....cm^2 [2]

21 A trader bought m apples for \$12.

(a) Write down an expression, in terms of m, for the cost, in dollars, of each apple.

Answer \$..... [1]

(b) It was found that 3 of the apples were bad and could not be sold.
The trader sold each remaining apple at \$1.50.
Write down an expression, in terms of m, for the amount of money, in dollars, received from the sales of the remaining apples.

Answer \$..... [1]

(c) The trader made a 25% profit from the sales of the apples.
Write down an equation to represent this information and show that it reduces to

$$1.5m = 19.5$$

Answer [2]

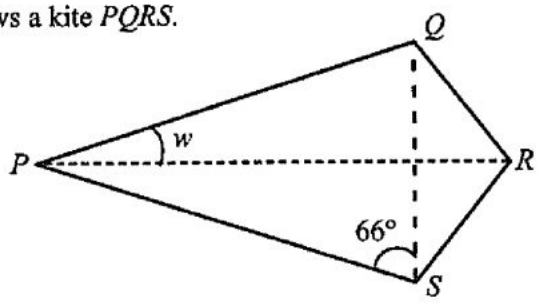
(d) Solve the equation $1.5m = 19.5$.

Answer m =..... [1]

(e) Find the number of remaining apples sold.

Answer ..... apples [1]

22 The diagram shows a kite $PQRS$.



Giving your reasons clearly, explain why w is $24°$.

Answer

[2]

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23 Solve

(a) $5(q+3)=17$

Answer q =..... [2]

(b) $\dfrac{2m-15}{7m+1}=\dfrac{1}{3}$

Answer m =..... [3]

24 A rectangular piece of thin metal sheet $ABCD$ is shown in Figure 1.

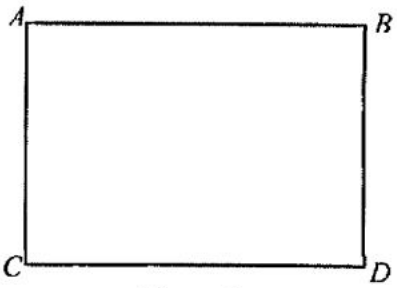


Figure 1

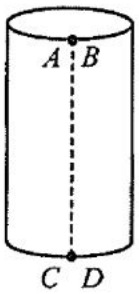


Figure 2

The same piece of metal sheet is rolled up to form a cylinder shown in Figure 2.

Points A and C are joined to B and D respectively, with no overlap.

The ratio of the base radius of the cylinder to its height is 1: 4.

(a) Given that the height of the cylinder is 21cm,

(i) calculate the base radius of the cylinder,

Answer ..... cm [1]

(ii) find the area of the metal sheet shown in Figure 1, leaving your answer in terms of π.

Answer ..... cm^2 [2]

[Question 24 continues on the next page.]

[Question 24 continues from the previous page.]

(b) The bottom of the cylinder is sealed with metal of negligible thickness.

Water is poured into the hollow cylinder at a rate of 80 cm^3/s.

Alex claims that the cylinder would be completely filled within 20 seconds.

Justify if this is true.

Answer .....

..... [3]

End of Paper

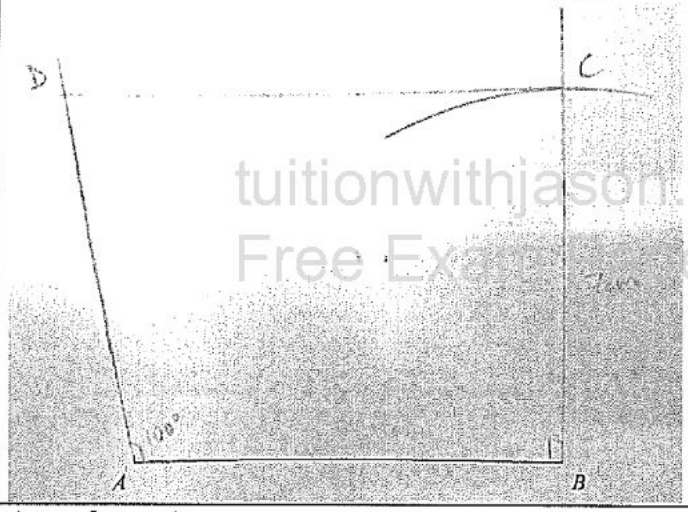
	Section A	
1	60 cents ---------- x grams $100y$ cents ---------- $\frac{x}{60}\times 100y=\frac{5xy}{3}$ grams	
2a	p^2q $=(-2)^2(7)$ $=28$	Note that brackets are required for -2 is required. $(-2)^2=4$ but $-2^2=-4$
2b	$\frac{8q-p}{p+q}$ $=\frac{8(7)-(-2)}{(-2)+(7)}$ $=11.6$	Similar to question 2a, students need to note that brackets are required for -2 is required.
3a	$-7+45.9=38.9°C$	Note that if we want to get the highest temperature, we will add the difference in temperature ($45.9°C$) to the lowest temperature ($-7°C$)
3b	$-7-6=-13°C$	Since the temperature is $6°C$ lesser than that in desert A, we need to minus $6°C$ from $-7°C$.
4a	It means that for every 100 students in SHSS, there are 40 students who are myopic. OR It means that there are 40 students per 100 students in SHSS, who are myopic.	
4b	The first digit 4 is a non-zero digit and it is significant. Therefore it can be 1 sf or 2 sf.	
5a	5 sf	The 0 in the hundredth and ten thousandth places is be counted as significant. e.g. 8.701 has 4 s.f. 8.7010 has 5 s.f.
5b	4 sf	The 0 in the tenth place is not significant. The 0 in the thousandth and ten thousandth places are counted as significant. e.g. 0.02 has 1 s.f. 0.020 has 2 s.f. 0.0200 has 3 s.f. 0.02005 has 4 s.f.
6a	$6xyz+2xz=2xz(3y+1)$	

6b	$-9h^2-15h=-3h(3h+5)$	Accept $3h(-3h-5)$
7a	$4xz-3y$	
7b	$\frac{5}{7a+2}$	
8a	$300=2^2\times3\times5^2$	
8b	HCF = $2^2\times3\times5=60$	The greatest integer that will divide both numbers will be the HCF of both numbers.
9a	$k=2\times3$ $k=6$	
9b	$\sqrt{p}=2^2\times3\times7\times11^3$	In order to find the square root of p, we need divide the powers of all the prime factors by 2.

10a	$1-\frac{40}{100}-\frac{1}{3}=\frac{4}{15}$	
10b	$\frac{40}{100}-\frac{1}{3}=\frac{1}{15}$ 1 unit ---------- \$5.20 15 units ---------- 5.20×15 $=\$78$	
11a	$\frac{3}{10}, 0.\dot{3}, 3, 13, 30$	
11bi	3, 13	
11bii	$3, 13, \frac{3}{10}, 0.\dot{3}, 30$	
12a	0, 4, 8	
12b	Equation is $y=\frac{4}{3}x+4$ OR $y=1\frac{1}{3}x+4$	Note that gradient = rise / run. An upwards sloping line (/) has positive gradient and a downward sloping line (\ ) has a negative gradient
12c	$y=\frac{4}{3}(-6)+4$ $y=-4\neq-5$ The line does not pass through the point.	Note: we need to substitute the x coordinate of the point into the equation of the line. If the answer for y-coordinate is the same as the point, then it means that the line passes through the point. However, in this case, the y-coordinate is -4, so we conclude that the line does not pass through the point.
13a	$\angle ECD=120°$ (corr. angles, EC // AB)	For Q13, minus 1 mark for each part for no / wrong reason.
13b	$\angle ECA=160°-120°$ $=40°$ $\angle BAC=40°$ (alt angles, EC // AB)	
13c	$\angle ACB=180°-160°\ (adj\angle s\ on\ str\ line)$ $=20°$	
13d	Reflex $\angle ABC=360°-120°\ (\angle s\ at\ a\ pt)$ $=240°$	
14ai	16	

14aii	$T_n = 7n+2$	Must expand and simplify when using the formula $T_n = a+(n-1)d$
14aiii	$T_{20} = 7(40)+2$ $= 282$	
14b	$T_n = 7n+2 = 220$ $7n = 220-2$ $n = 218 \div 7$ $n = 31\frac{1}{7}$ No. 220 is not a term in the sequence because n is **not a whole number**.	Students must show workings for getting $n = 31\frac{1}{7}$ **AND** explain further that n is not a whole number.
15a	$1+3(1-3p)$ $=1+3-9p$ $=4-9p$	Students **should multiply 3 into the brackets**, not add up 1 + 3 first.
15b	$\frac{5x}{8}-\frac{3y+x}{2}$ $=\frac{5x-4(3y+x)}{8}$ $=\frac{5x-12y-4x}{8}$ $=\frac{x-12y}{8}$	

	Section B	
16	$180 = 2^2 \times 3^2 \times 5$ $150 = 2 \times 3 \times 5^2$ $120 = 2^3 \times 3 \times 5$ LCM $= 2^3 \times 3^2 \times 5^2$ $= 1800s$ $= 30\,\text{min}$ 0555 to 2359 has ≈ 18 hours (round down to whole number) 18 hours = $18 \times 2 = 36$ times $36 + 1 = 37$ times	
17a	$1.2x$ cm	
17b	Original area $= x^2$ New area after the increase $= 1.2x \times 1.2x$ $= 1.44x^2$ Percentage increase $= \frac{1.44x^2 - x^2}{x^2} \times 100\%$ $= \frac{0.44x^2}{x^2} \times 100\%$ $= 44\%$ The area of the square increases by 44%, not 40%.	DO NOT use their own values. Question stated "let the original length be x". Students who let x = their own values will be awarded zero mark.
18a	$(6-4) \times 180° = 720°$	
18bi	$720 = 90 + 158 + 172 + 39 - 2x + 166 + 14x - 7$ $720 = 618 + 12x$ $720 - 618 = 12x$ $102 = 12x$ $102 \div 12 = x$ $x = 8.5$	
18bii	$39 - 2(8.5)$ $= 22$	

		Solutions for students
19a	Height of trapezium $7-4=3$ Total area = area of trapezium + rectangle $=\frac{1}{2}\times(8+16)\times 3 \quad + \quad 4\times 16$ $=36+64$ $=100\ km^2$	Many students did not remember the formula for trapezium area.
19b	7 am to 1 pm = 6h Total distance $=7\times 6$ $=42km$ $AF=(42-16-8-4-4)\div 2$ $=5km$	
20a	 	Students must draw an arc for BC. The question gave BC = 7cm. AB must be // to CD because ABCD is a trapezium.
20b	Area of trapezium $=\frac{1}{2}(8+9.3)7$ $=60.55cm^2$	AB is measured to be 8 cm. BC is given as 7 cm. Students should not round off 60.55 because it is an exact answer.
21a	$\$\ \frac{12}{m}$	
21b	$\$\ 1.5(m-3)$	Accept $1.50(m-3)$

21c	$1.5(m-3)=\frac{125}{100}(12)$ $1.5m-4.5=15$ $1.5m=15+4.5$ $1.5m=19.5$ *(shown)*	
21d	$1.5m=19.5$ $m=19.5\div1.5$ $m=13$	
21e	$m=13-3$ $=10$	
22	$\angle QPS=180-66-66$ ($\angle$ *sum of* Δ) $=48°$ $\angle QPR=48\div2$ (property of kite) $=24°$	Must mention that the angle is bisected due to property of kite
23a	$5(q+3)=17$ $5q+15=17$ $5q=17-15$ $q=\frac{2}{5}$	Accept 0.4
23b	$\frac{2m-15}{7m+1}=\frac{1}{3}$ $3(2m-15)=7m+1$ $6m-45=7m+1$ $-45-1=7m-6m$ $m=-46$	
24a	$r=21\div4$ $r=5.25\ cm$	
24b	Area of paper $=2\pi rh$ $=2\pi(5.25)(21)$ $=220.5\pi\ cm^2$	Many students made the mistake of keying in the value of π in the calculator.
24c	Volume $=\pi r^2h$ $=\pi(5.25)^2(21)$ $=1818.393098$ $=1820\ cm^3\ (3sf)$ After 20s, $80\times20=1600\ cm^3$	Many students do not remember the formula for volume of cylinder.

	$1600 < 1820$ The claim is not true. The cylinder is not completely filled after 20 s. **OR** Volume $= \pi r^2 h$ $= \pi (5.25)^2 (21)$ $= 1818.393098 cm^3$ Time taken $= 1818.393098 \div 80$ $= 22.72991373$ $= 22.7s\,(3sf)$ $22.7s > 20s$ The claim is not true. The cylinder takes 22.7s to be completely filled up, not 20 seconds.	Must show comparison Must show comparison