Name and Index Number:			Class:
	(	)	



## SENG KANG SECONDARY SCHOOL **PRELIMINARY EXAMINATIONS 2020**

MATHEMATICS	4045/02	
4 NORMAL ACADEMIC	13 August 2020	
Paper 2	2 hours	
READ THESE INSTRUCTIONS FIRST		
Candidates answer on the Question Paper. Write your class, index number and name 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 A Answer all questions.		
Section B Answer one question.		
If working is needed for any question it must be shown with the answer. Omission of essential working will result in the 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 n three significant figures. Give answers in degrees to one decimal place. For $\pi$ , use either the calculator value or 3.142, unless the question requires the	not exact, give the answer to e answer in terms of $\pi$ .	
At the end of the examination, fasten all your work securely together. The number of marks is given in brackets [ ] at the end of each question or par The total of the marks for this paper is 60.	rt question.	
	60	

Parent's / Guardian's Signature: .....

This document consists of 17 printed pages and 1 blank page.

Mathematical Formulae

**Compound** interest

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

Curved surface area of a cone =  $\pi r l$ 

Geometry and Measurement

Surface area of a sphere =  $4\pi r^2$ Volume of a cone =  $\frac{1}{3}\pi r^2 h$ Volume of a sphere =  $\frac{4}{3}\pi^{-3}$ Area of triangle  $ABC = \frac{1}{2}ab\sin C$ Arc length =  $r\theta$ , where  $\theta$  is in radians Sector area =  $\frac{1}{2}r^2\theta$ , where  $\theta$  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

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

#### Section A (52 marks)

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

1 (a) Simplify 
$$\frac{(a^3)(a^2)}{\sqrt{a^5}}$$
.

(b) Solve the equation  $2^x = \frac{1}{4}$ .

2 (a) Express  $1.3 \times 10^{-2}$  as a decimal.

leaving your answer in standard form.

(b) The area of a piece of wrapping paper is 5.88 ×10<sup>4</sup> mm<sup>2</sup>. Calculate the total area, in square millimetres, of 1.5 ×10<sup>2</sup> pieces of wrapping paper,

[2]

[1]

[1]

[2]

3 (a) Factorise 7ac - 3c + 18b - 42ab completely.

4

**(b)** Solve (y + 2)(2y - 5) = 0.

(c) Solve the equation  $\frac{-8}{x-2} = x + 4$ .

[3]

[2]

6

A coach bus travels 270 km from Singapore to Malacca. It reaches Johor in 1 hour 30 minutes after travelling at 100 km/h, and makes the rest of the journey at 120 km/h. Calculate its average speed in km/h for the entire journey.

5

6 The diagram below shows a rectangular paper box without cover. The length, breadth and height of the box are 23 cm, 18 cm and 15 cm respectively.



(a) Find the area of paper needed to construct the box.

[2]

5 (a) (i) Express 120 as a product of its prime factors.

4

[1]

[4]

(ii) State the smallest integer value of k for which 120k is a perfect square.

[1]

[2]

(b) Albert goes hiking every 12 days and swimming every 6 days. He did both kind of exercises today. How many days from now will he go hiking and swimming again on the same day?

Calculate the volume of the tennis ball.

(b) The diagram below shows a tennis ball with diameter 4 cm.

7

(c) The tennis balls are arranged neatly into the box in rows and columns.



Find the maximum number of tennis balls that can be placed in the box.

[2]

8

7 The diagram shows a trapezium PQRS with coordinates P (10, 0), Q (0, 8) and S (3, 0).



(b) The line RS has the same gradient as the line PQ. Find the equation of the line RS. [1]

(c) Hence, state the coordinates of R.

[1]

(d) Calculate the area of the trapezium PQRS.

9 A projectile is being fired from a cliff. Its height, h meters, above the ground during its flight is represented by the equation  $h = 28 + 48t - 12t^2$ , where t is the time in seconds when the projectile is being fired.

The table below shows some corresponding h and t values for the equation  $h = 28 + 48t - 12t^2$ .

1	0	1	1.5	2.5	3	4	5
h	28	64	73	73	64	р	-32

(a) State the height of the vertical cliff.

[1]

(b) Calculate the value of p.

[1]

(c) On the grid opposite, draw the graph of h = 28 + 48t - 12t<sup>2</sup> for 0 ≤ t ≤ 5. [3]
(d) Use your graph to find

(i) the greatest height reached by the projectile from the ground,

(II) the time taken for the projectile to hit the ground.

[1]

[1]



9

120 m

[2]

(a) Find the horizontal distance, d.

There is a car moving towards the building.

(b) Find the angle of depression of the point M to the car when the car is 50 m away from the building.
[2]

[Turn Over



10 Mr Kim receives an income of \$100 000 for the year 2019. The amount of tax he needs to pay is calculated after deducting the relief.

12

# He is eligible for the following relief:

Personal relief	\$1500	
Child relief	\$4000	
Parent relief	\$9000	
CPF	\$20 000	

(a) Calculate the total amount of relief.

[1]

(b) Calculate the amount of income which is taxable.

## His taxable income after deducting the relief will be taxed as follows:

Chargeable Income	Income Tax Rate (%)	Gross Tax Payable (\$)
First \$20,000	0	0
Next \$10,000	2	200
First \$30,000	-	200
Next \$10,000	3.50	350
First \$40,000	•	550
Next \$40,000	7	2,800

#### (c) How much tax does he need to pay?

[2]

### 14

### Section B (8 marks)

# Answer one question from this section. Each question carries 8 marks.

11 (a) The diagram shows a triangular field XYZ, where XY = 18 m, YZ = 11 m and  $\angle XYZ = 80^{\circ}$ .



[3]

(d) In order to save up for his retirement, Mr Kim decided to deposit \$15 000 into his Supplementary Retirement Scheme account, which is not taxable.

How much lesser tax does he pay?

[3]

#### (ii) Calculate the area of triangular field XYZ.

15

#### (b) The diagram shows a semi-circle with centre O and radius 16 cm.



Given that angle  $\angle COE = 0.5$  radians, find

(i) the angle COA in radians,

(ii) the area of the segment CDE.

[2]

[1]



.

(b) If the company decides to increase the wages of each worker by 10%, describe how the cumulative frequency curve differs from the given curve. [1]

(c) If two workers are selected at random, calculate the probability that

(i) they both earn less than \$40 each per week, [1]

(ii) one earns less than \$40 per week and the other earns between \$60 to \$80 per week. [2]

END OF PAPER

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## 2020 4NA Preliminary Examinations Paper 2 ANSWERS

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1	(a) $a^{\frac{5}{2}}$ (b) $x = -2$	2	(a) 0.013 (b) $8.82 \times 10^6 \text{ mm}^2$
3	(a) $(7a-3)(c-6b)$ (b) $y = -2$ or $y = 2\frac{1}{2}$ (c) $x = 0$ or $x = -2$	4	108 km/h
5	$120 = 2^3 \times 3 \times 5$ 30; 12 days	6	1644 cm <sup>2</sup> ; 33.5 cm <sup>3</sup> ; 60 balls
7	$-\frac{4}{5}; y = -\frac{4}{5}x + 2\frac{2}{5};$ R (0, 2 $\frac{2}{5}$ ); 36 $\frac{2}{5}$ units <sup>2</sup>	8	30.0 m; 42.0°
9	28 m; p = 28; greatest height = 76 m; time taken = 4.5 secs	10	\$ 34 500; \$65 500; \$2335; \$1050 lesser tax
11	19.4 m: 97.5 m <sup>2</sup> : 2.64 rad: 2.63 cm <sup>2</sup>	12	(a) Median wage = \$40: Interquartile range
			= \$32; 30 <sup>th</sup> percentile wage = \$26; (b) The cumulative frequency curve will be less steep. (c) $\frac{399}{1599}$ ; $\frac{80}{799}$

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