



YUSOF ISHAK SECONDARY SCHOOL PRELIMINARY EXAMINATION 2020

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CANDIDATE
NAME

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CLASS

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INDEX
NUMBER

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MATHEMATICS 4 NORMAL ACADEMIC

4045/2

Paper 2

14 August 2020

Additional Materials: Nil

2 hours

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces provided on all the work you hand in.
Write in dark blue or black ink 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.

Section A

Answer **all** questions

Section B

Answer **one** question

The number of marks is given in brackets [] at the head of each section.
If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is **60**.

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.
Answers in degrees should be given to one decimal place.
For π , use either your calculator value or 3.142.

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

Mathematical Formulae*Compound interest*

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

Mensuration

$$\text{Curved surface area of cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2} ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

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

[3]

Section A (52 marks)

Answer **all** questions in this section.

1 The diameter of a virus is 0.0000001036 metres.

(a) Write this diameter correct to 3 significant figures. [1]

(b) Write your answer to **part (a)** in standard form. [1]

2 Simplify

(a) $(a^8)^{\frac{3}{4}}$, [2]

(b) $(3b)^0$. [1]

3 (a) Find the highest common factor (HCF) of 16, 30 and 72. [1]

[4]

- (b) Bus Aero, Bus Best and Bus Causeway leave a bus station every 16, 30 and 72 minutes respectively.

The first time that the three buses set off together is 0800 hours.
At what time will the three buses set off together again?

[2]

-
- 4 June cycles 6 km to school from home at an average speed of 20 km/h.
After school, she cycles back home in 16 minutes.

Find the average speed, in km/h, for June's cycling trip to and from school.

[4]

[5]

- 5 (a) The perimeter of an equilateral triangle is equal to the circumference of a circle of radius 8 cm.

Find the length of the side of the equilateral triangle, leaving the answer in terms of π .

[2]

- (b) Another equilateral triangle has the same area as a circle with radius 3 cm.

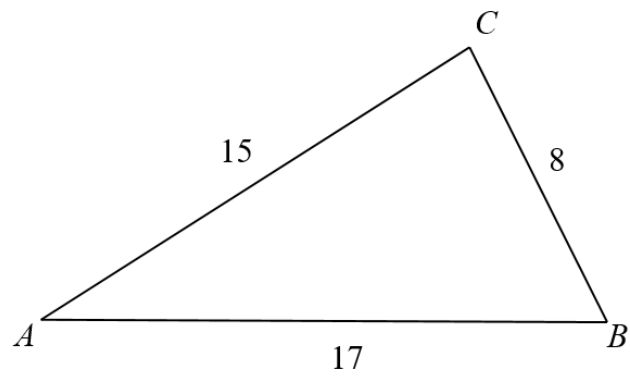
The length of the side of this triangle is l cm.

Find l .

[2]

6 (a)

[6]



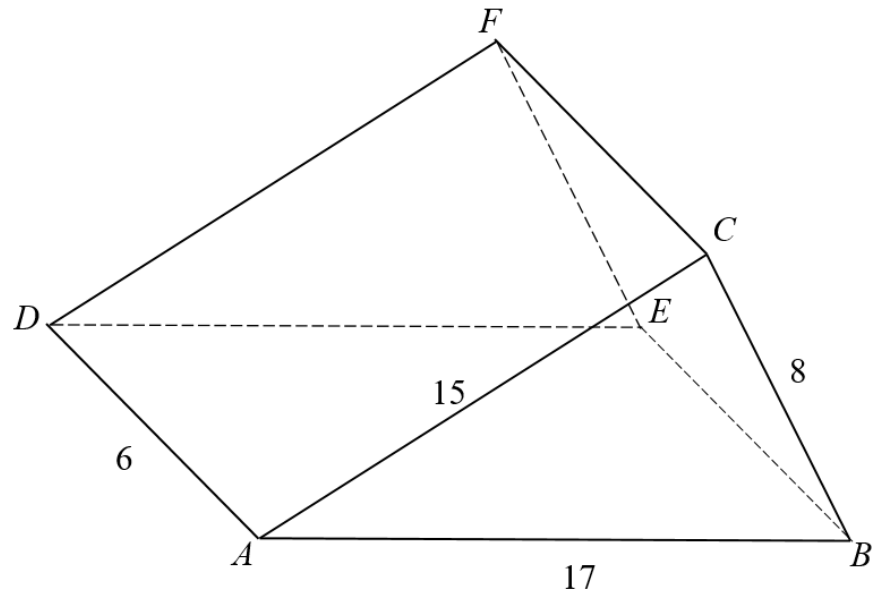
$AB = 17$ cm, $BC = 8$ cm and $AC = 15$ cm.

Prove that triangle ABC is a right-angled triangle.
(Triangle ABC is not drawn to scale.)

[2]

[7]

(b)



The triangle ABC in **part (a)**, forms the uniform cross-section of a triangular prism.

The length of AD is 6 cm.

Triangle DEF forms the other end of the uniform cross-section of the prism.

Calculate

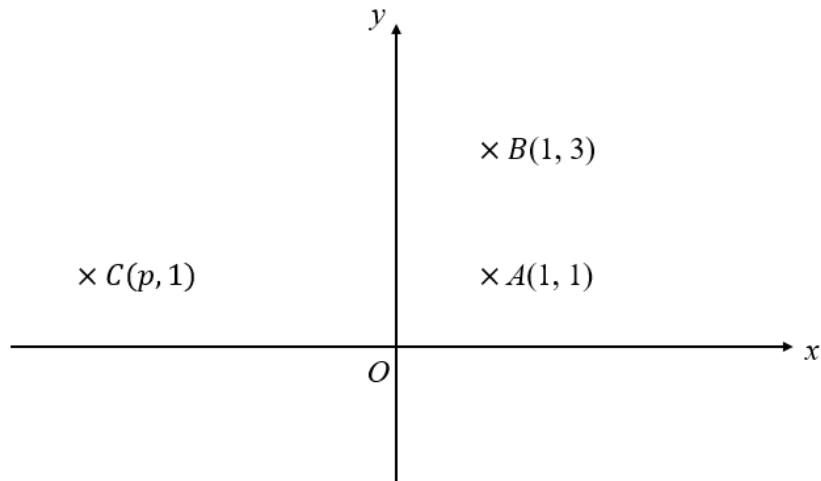
(i) the length of the diagonal CD , [2]

(ii) the total surface area of the prism, [2]

(iii) the volume of the prism. [2]

[8]

7



ABC are the vertices of a right-angled triangle.
 A is the point $(1,1)$, B is the point $(1,3)$ and C is the point $(p,1)$.

- (a) The right-angled triangle ABC has an area of 5 units^2 .

Show that the value of p is -4 .

[2]

- (b) Find the equation of

(i) AB ,

[1]

(ii) BC .

[3]

8 (a) Expand and simplify $6-3(x-3)$. [2]

(b) Factorise completely $5ax-15bx-a+3b$. [2]

(c) Solve $x-3=\frac{12}{x-2}$. [4]

9 A projectile is fired from the top of a hill. Its vertical height h , in metres, above the ground at time t seconds during the flight is represented by the equation $h=15+3t-t^2$.

The table shows the corresponding values of t and h for the graph $h=15+3t-t^2$.

t	0	1	2	3	3.5	4	5	5.5
h	15	17	17	15	p	11	5	1.25

(a) Find the value of p . [1]

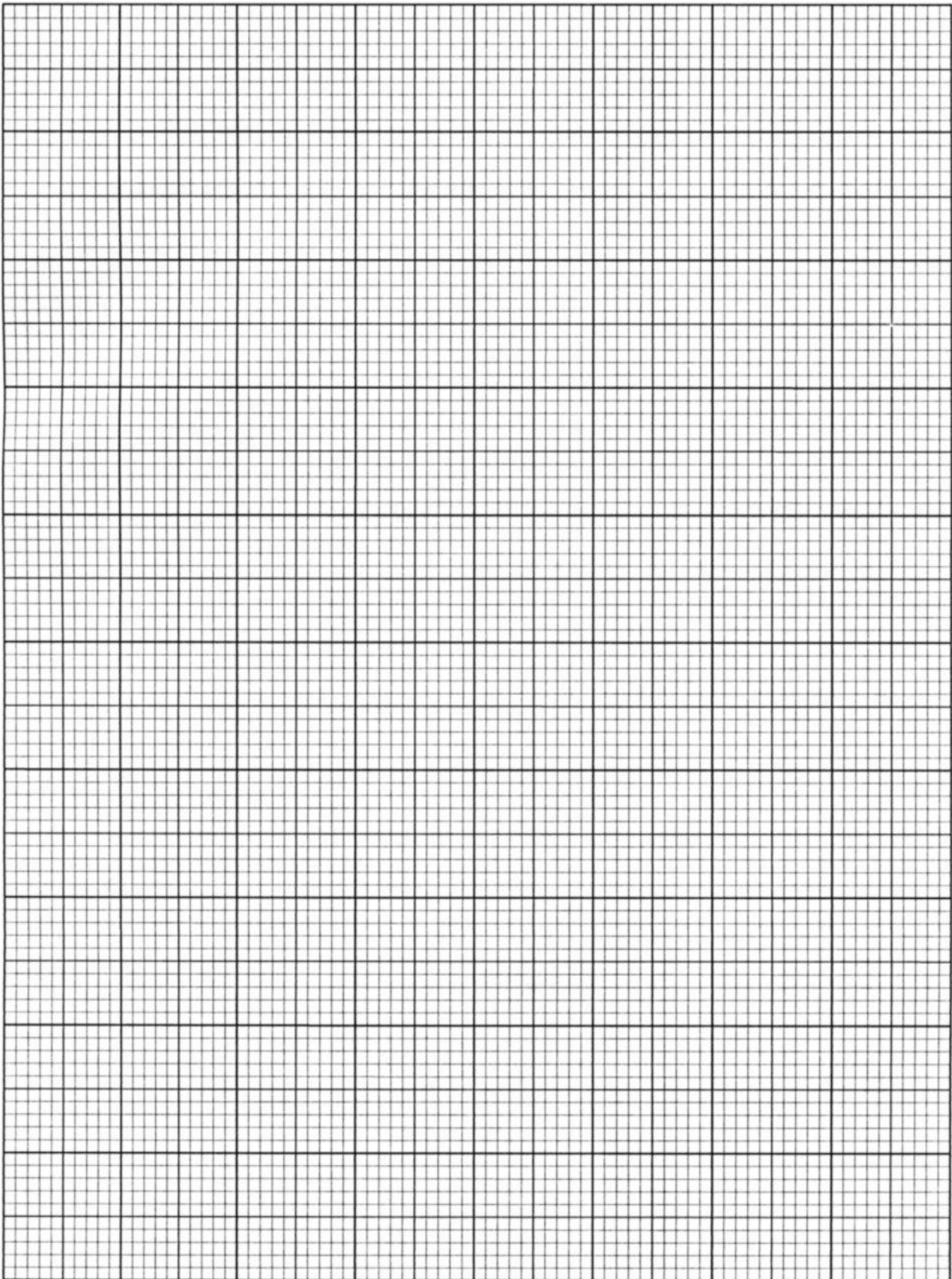
[10]

(b) Draw the graph of $h = 15 + 3t - t^2$ on the grid provided.

Use a scale of 2 cm to 1 unit on the horizontal t -axis.

Use a scale of 1 cm to 1 unit on the vertical h -axis.

[3]



- (c) Use your graph to
- (i) explain how the time in which the projectile hits the ground can be found, [1]
- (ii) estimate the time when the ball hits the ground. [1]

- 10 (a) Letchmi earns a monthly income of \$9,500 in 2020.

She contributes 20% of her income every month to her Central Provident Fund (CPF) account as required by law.

Calculate the total amount which will be contributed to her CPF account in 2020. [2]

Table A shows part of the individual income tax rates table for Singapore residents.

Table A: Income tax rates table

Chargeable Income (\$)	Tax rate (%)	Gross Tax Payable (\$)
First \$20,000 Next \$10,000	0 2	0.00 200.00
First \$30,000 Next \$10,000	- 3.50	200.00 350.00
First \$40,000 Next \$40,000	- 7	550.00 2800.00
First \$80,000 Next \$40,000	- 11.5	3350.00 4600.00

Source: Inland Revenue Authority of Singapore (IRAS)

<https://www.iras.gov.sg/irashome/Quick-Links/Tax-Rates/Individual-Income-Tax-Rates/>

Tax deductions are given to Singapore residents to encourage family formation, upgrading of skills and saving for retirement. These are implemented through reliefs which reduce the chargeable income.

Table B shows the various tax reliefs for Singapore residents.

Table B: Deductions for Individuals (Reliefs)

Tax relief	Amount
CPF salary contribution	20% of salary
CPF top-up (self)	Up to \$7,000
CPF top-up (spouse)	Up to \$7,000
Course fee relief	Up to \$5,500
Parent relief (non-working parents)	
-Taxpayer stays with Parent	\$9,000 per parent
-Taxpayer does not stay with parent	\$5,500 per parent
Qualifying Child Relief	\$4,000
Supplementary Retirement Scheme (SRS) contribution	Up to \$15,300

Adapted from Inland Revenue Authority of Singapore (IRAS)

<https://www.iras.gov.sg/irashome/Individuals/Locals/Working-Out-Your-Taxes/Deductions-for-Individuals--Reliefs--Expenses--Donations-/>

Letchmi has a new-born child and stays with both her retired parents.

Besides the compulsory CPF contributions, she makes a CPF top up of \$7,000 for herself.

Letchmi has also signed up for a professional development course that costs \$5,000.

(b) Calculate her income tax payable in 2020.

[3]

[13]

Letchmi has personal savings of \$6500 in her bank.

She has two choices of using the money.

Choice 1: Reduce further her income tax payable by contributing all of it to her Supplementary Retirement Scheme account.

OR

Choice 2: Invest the money for 1 year in a financial product that guarantees a return of 8% per annum.

(c) Decide which choice should Letchmi make.

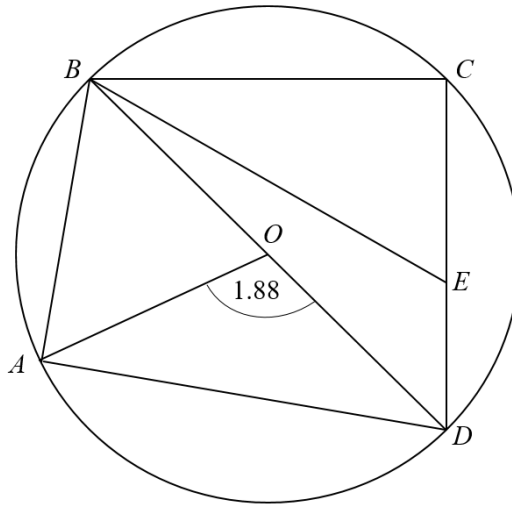
Explain your answer with suitable workings.

[3]

[14]
Section B (8 Marks)

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

11



In the diagram, A , B , C and D are points on the circle, centre O . BD is a diameter of the circle. E is a point on line CD .

Angle $AOD = 1.88$ radians.

$OD = 3.75$ cm, $BE = 6.5$ cm and $DE = 2.5$ cm.

(a) Calculate

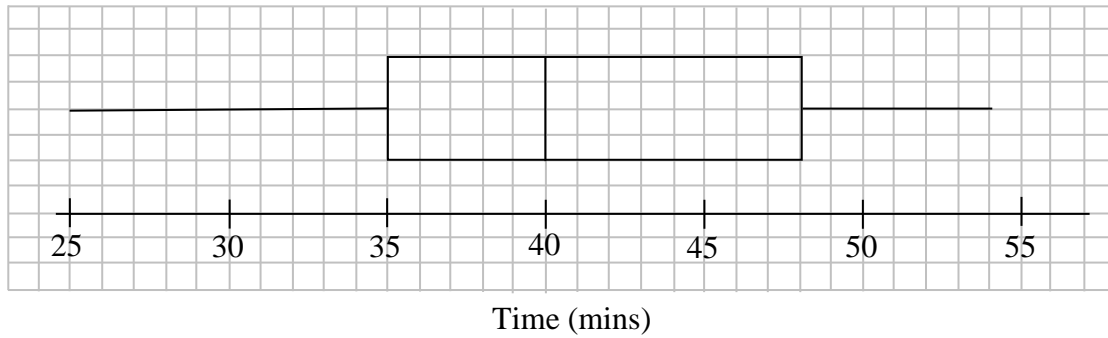
(i) angle AOB , giving your answer in radians, [1]

(ii) AB , [2]

(iii) angle BED , giving your answer in radians. [3]

(b) Calculate the length of minor arc AD . [2]

12



(a) The box-and-whisker plot summarises the time spent on homework daily for Class A.

(i) Find the median time. [1]

(ii) Find the interquartile range of the time spent on homework. [1]

(iii) In Class B, it has an upper quartile of 45 minutes.

Which class has a larger proportion of students that spends 46 minutes or more on their homework?

Explain your answer. [1]

[16]

- (b) There are 42 students in Class A.

The table below summarises the time taken by the 42 Class A students to complete a 5 km run.

Time (t minutes)	Frequency
$20 \leq t < 25$	3
$25 \leq t < 30$	7
$30 \leq t < 35$	10
$35 \leq t < 40$	17
$40 \leq t < 45$	5

- (i) Calculate an estimate of the mean time taken by the students. [2]

- (ii) Explain why the mean time is an 'estimate'. [1]

- (iii) Two of the students are picked at random.

What is the probability that the two students picked complete the run in less than 30 minutes? [2]

~~ End of Paper ~~

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