

聖嬰中學

HOLY INNOCENTS' HIGH SCHOOL

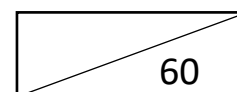


Candidate Name

Class

Index Number

END OF YEAR EXAMINATION 2023
SECONDARY 2
MATHEMATICS PAPER 2



4052/02

Date: 4 Oct 2023

Duration: 1 h 30 min

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number 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 paper clips, glue or correction tape/fluid.

Answer **ALL** questions.

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

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 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. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

For Examiner's use

You need to improve on your:

• **PRESENTATION**

• **ACCURACY**

Marks (max 5%)

Set by: Mrs Chang Poh Joo

Vetted by: Mr Ian Sim

Mathematical Formulae***Mensuration***

Curved surface area of a cone = πrl

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

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

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

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Answer **all** the questions.

- 1 (a) Find the prime factors of 936, giving your answer in index form.

Answer..... [1]

- (b) Two integers, A and B , can be written as products of prime factors, where p , q and r are constants and $r < p < q$.

$$A = p \times q^{r+1} \times 13 \qquad B = p^3 \times q^r \times 13$$

The lowest common multiple (LCM) of A and B is 936.

- (i) Write down the values of p , q and r .

Answer $p =$

$q =$

$r =$ [2]

- (ii) Find the highest common factor (HCF) of A and B .

Answer..... [1]

- (iii) Find the smallest positive integer k such that $\frac{936}{k}$ is a square number.

Answer $k =$ [1]

- 2 (a)** The speed of a toy car, v m/s is inversely proportional to the square root of its mass, m g. When the mass is 49 g, its speed is 6.4 m/s.

Find the speed of the toy car when its mass is 36 g.

Answer..... m/s [2]

- (b)** A 220 m long train enters a tunnel and passes through it completely in 1 minute 20 seconds at an average speed of 270 km/h.

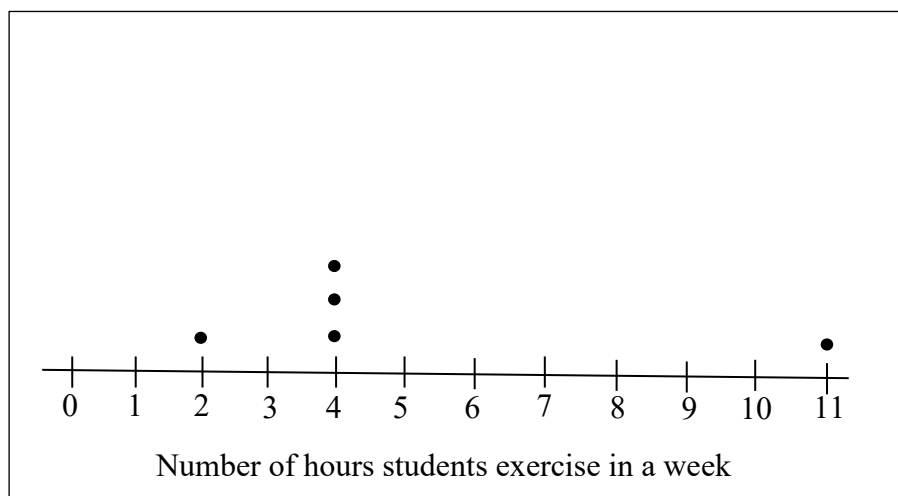
(i) Change 270 km/h into m/s.

Answer..... m/s [1]

(ii) Find the length of the tunnel, representing your answer in metres.

Answer..... m [2]

- 3 An observation was carried out on a group of 15 students to find out the number of hours they exercise in a week. The results for 5 students have been represented on the dot diagram below.



- (a) The number of hours spent exercising for 10 other students are recorded below.

5	7	1	2	5
2	3	4	6	7

Represent this data on the dot diagram.

[2]

- (b) Write down the number of hours that occurs most frequently.

Answer..... h [1]

- (c) Write down the number of hours that is an outlier.

Answer..... h [1]

- (d) Find the percentage of students who exercise at least 5 hours a week.

Answer..... % [1]

- (e) Is it appropriate to represent the data using a line graph? Explain your reasoning clearly.

Answer

.....

..... [1]

- 4 On a certain day, a bank had the following exchange rates.
 $1 \text{ SGD} = 0.8163 \text{ USD}$ and $1 \text{ USD} = 0.6977 \text{ EUR}$

- (a) Find the exchange rate between Singapore dollars (SGD) and Euros (EUR) in SGD/EUR correct to 4 significant figures.

Answer SGD / EUR [2]

- (b) A watch was sold for 430 EUR on an European website and 600 USD on an American website. If shipping is free for both websites, which one offers a better deal? Show your working clearly.

Answer The website offers a better deal because

..... [2]

- (c) Ming bought a camera in Europe costing 500 EUR.
 She pays GST at 8% on the cost of the camera when she returns to Singapore.
 Calculate the amount, in dollars, Ming spent on the camera including GST.

Answer SGD [2]

- 5 (a) Factorise completely $2mx^2 + 12mx + 18m$.

Answer [1]

- (b) Given the formulae $p = \frac{a-4c^2}{(a+4c)^2}$, find the value of p when $a = 5$ and $c = -3$.

Answer $p =$ [2]

- (c) Solve $\frac{5x-2}{3} = \frac{x+1}{2}$.

Answer $x =$ [2]

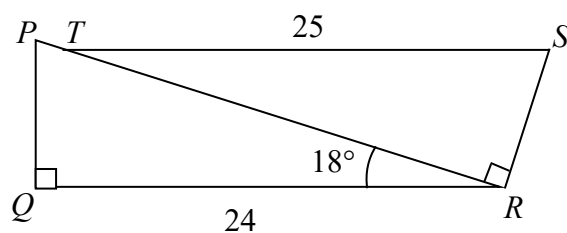
(d) (i) Factorise $x^2 + 5x - 6$.

Answer [1]

(ii) Hence factorise $(p-4)^2 + 5(p-4) - 6$.

Answer [1]

- 6 (a) In the figure, triangle PQR is congruent to triangle SRT .
 $QR = 24$ cm, $TS = 25$ cm and angle $QRP = 18^\circ$.



- (i) Identify the side of triangle SRT that is equal to PR .

Answer $PR = \dots\dots\dots$ [1]

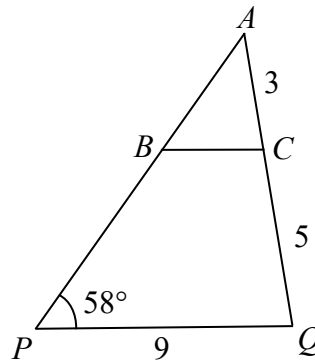
- (ii) Find the length of PT .

Answer $PT = \dots\dots\dots$ cm [1]

- (iii) Show that TS is parallel to QR . [2]

Answer

- (b) Given that triangle ABC is similar to triangle APQ , where $AC = 3$ cm, $CQ = 5$ cm, $PQ = 9$ cm and angle $APQ = 58^\circ$.



Find

- (i) angle PBC ,

Answer $^\circ$ [1]

- (ii) the ratio $BP : AP$,

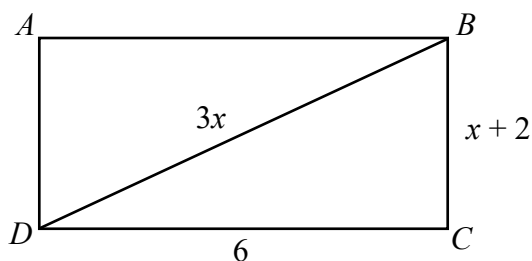
Answer : [1]

- (iii) the length of BC .

Answer $BC =$ cm [2]

7

A rectangle $ABCD$ has sides of length 6 cm and $(x + 2)$ cm.
The length of the diagonal is $3x$ cm.



- (a) Form an equation in terms of x and show that it can be reduced to $10 + x - 2x^2 = 0$.

[3]

- (b) Hence find the value of x .

Answer $x = \dots\dots\dots$ [2]

- (c) Write down as a fraction, in terms of x , the value of $\sin \angle CDB$.

Answer [1]

- (d) Find the shortest distance from A to DB .

Answer cm [2]

8 The graph $y = ax^2 + 9x + 5$ passes through the point (1.5, 14).

(a) Find the value of a .

Answer $a = \dots\dots\dots$ [1]

(b) The variables x and y are connected by the equation $y = ax^2 + 9x + 5$.
Some corresponding values of x and y are given in the table below.

x	-1	-0.5	1	2	2.5	4	5	5.5
y	-6	0	12	15	15	9	0	-6

On the grid in the next page, plot the points given in the above table and join them with a smooth curve. [3]

(c) Use your graph to find

(i) the equation of the line of symmetry,

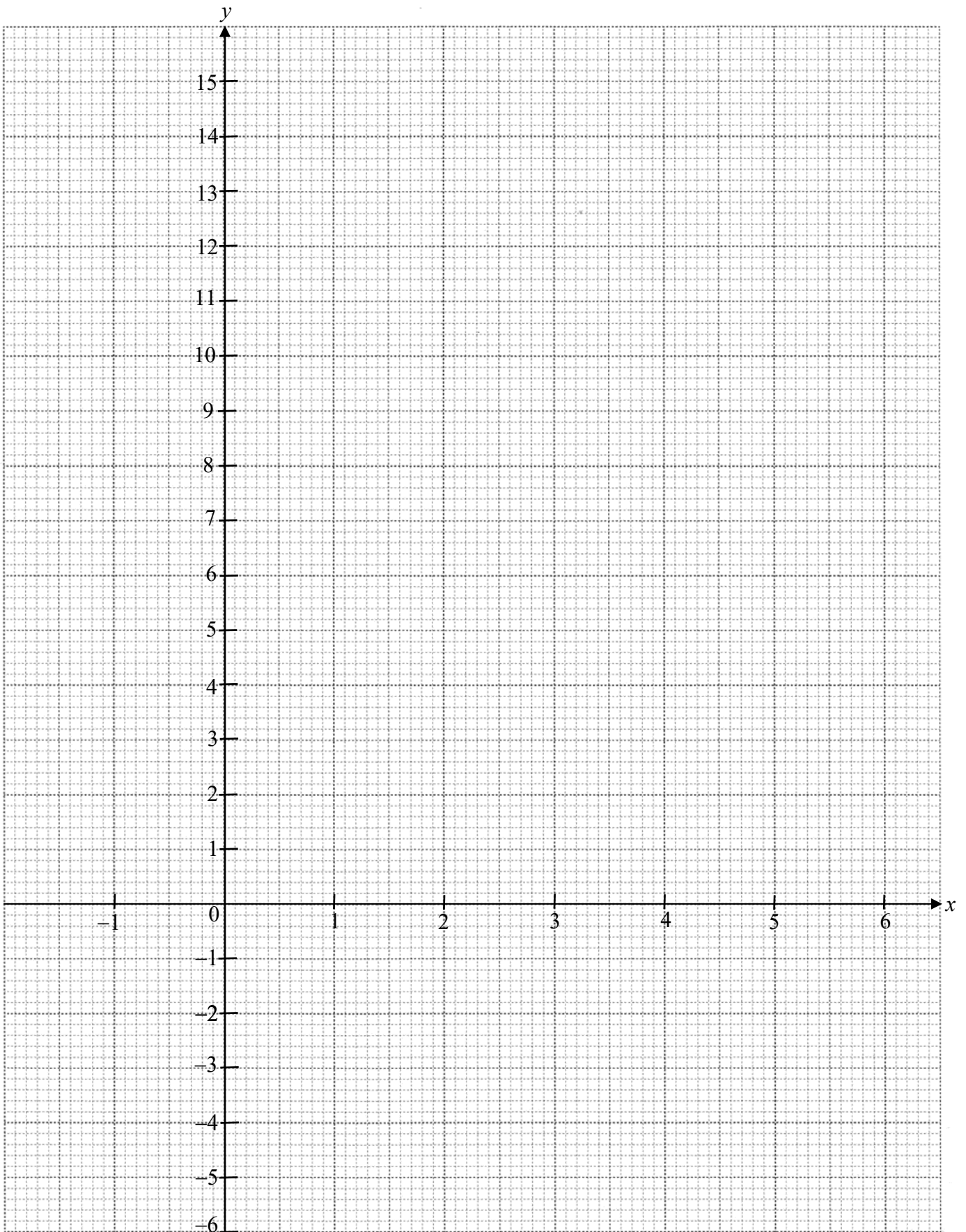
Answer $\dots\dots\dots$ [1]

(ii) the maximum value of y .

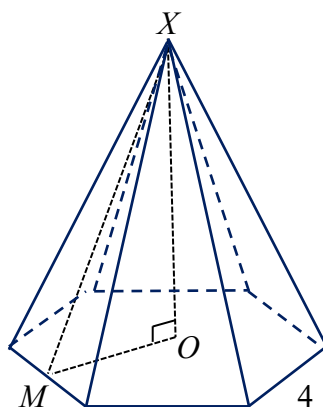
Answer $\dots\dots\dots$ [1]

(d) By drawing the line $y = \frac{1}{2}x$ on the grid, find the positive value of x for which the line intersects the graph $y = ax^2 + 9x + 5$.

Answer $x = \dots\dots\dots$ [2]



- 9 The diagram shows an object in the form of a regular hexagonal pyramid with side 4 cm. The vertex, X is directly above O . The slant height, MX , of the pyramid is 10 cm. The area of the hexagonal base is 42 cm^2 .



- (a) Calculate the total surface area of the pyramid.

Answer cm^2 [2]

- (b) Show that the height OX of the pyramid is 9.38 cm. [2]

Answer

- (c) Calculate the volume of the pyramid.

Answer cm^3 [1]

- (d) The mass of the pyramid is 100 grams.

The density of water is 1 g/cm^3 . Objects having density lower than 1 will float in water and objects having density greater than 1 will sink.

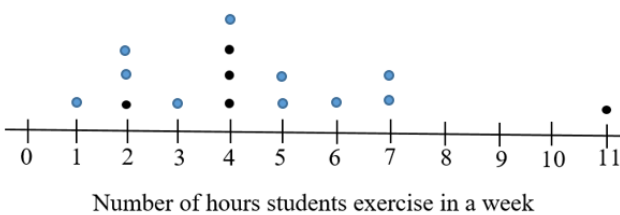
Justify whether the object will float or sink in water.
Show your working clearly.

Answer
..... [2]

End of Paper

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2023 Secondary 2 Express End of Year Examinations P2 (1-page Answer Sheet)

Qn	Solution	Qn	Solution
1a	$936 = 2^3 \times 3^2 \times 13$	6ai	ST
1bi	$p = 2, q = 3, r = 1$	6aii	1 cm
1bii	78	6aiii	$\angle STR = \angle PRQ = 18^\circ$ or $\angle RTS = \angle QRP = 18^\circ$ By <u>alternate angles</u> property, TS is parallel to QR .
1biii	26		
2a	$7\frac{7}{15}$ m/s or 7.47 m/s (correct to 3 s.f.) Answer correct to 3 s.f. is allowed as this is a contextual question (involving speed).		
2bi	75 m/s	6bi	122°
2bii	5780 m	6bii	5 : 8
3a	 Number of hours students exercise in a week	6biii	$3\frac{3}{8}$ or 3.375 (Leave as exact value) [3.38 is not accepted as this is not a contextual question]
3b	4 h	7a	By Pythagoras' Theorem, $(x+2)^2 + 6^2 = (3x)^2$ $x^2 + 4x + 4 + 36 = 9x^2$ $-8x^2 + 4x + 40 = 0$ $40 + 4x - 8x^2 = 0$ Divide by 4 : $10 + x - 2x^2 = 0$ (Shown)
3c	11 h		
3d	40%		
3e	Not appropriate. The line graph can show the <u>trend</u> of the data or The line graph is used for <u>prediction</u> of data.		
4a	1.756 SGD / EUR	7b	$x = 2.5$
4b	Working varies according to the website used. The <u>American</u> website offers a better deal because the watch <u>costs lesser</u> / <u>is cheaper</u> on the American website than that on the European website.	7c	$\sin \angle CDB = \frac{x+2}{3x}$
		7d	3.6 cm
		8a	$a = -2$
4c	Accept answers with 948.XX SGD	8b	Refer to graph on next page
5a	$2m(x+3)^2$	8ci	$x = 2.25$
5b	$-\frac{31}{49}$ [- 0.633 is not accepted as this is not a contextual question]	8cii	Max value of $y = 15.1$ (Accept ± 0.1)
		8d	$x = 4.8$ (Accept ± 0.1)
5c	$x = 1$	9a	162 cm^2
5di	$(x+6)(x-1)$	9c	131 cm^3
5dii	Let x be $(p-4)$ Factors are $(p-4+6)(p-4-1)$ $= (p+2)(p-5)$ No other method allowed as this is a 'hence' question	9d	$D = \frac{M}{V} = \frac{100 \text{ g}}{131.33 \text{ cm}^3} = 0.761 \text{ g/cm}^3$ As the density of the object is <u>less than</u> 1 g/cm^3 , it will <u>float</u> in water.

Label as
 $y = ax^2 + 9x + 5$
or $y = -2x^2 + 9x + 5$

