

聖嬰中學

HOLY INNOCENTS' HIGH SCHOOL

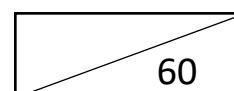


Candidate Name

Class

Index Number

END OF YEAR EXAMINATION 2024
SECONDARY 2
MATHEMATICS PAPER 2



4052/02

Date: 2 Oct 2024

Duration: 1 h 30 mins

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 = $\pi r l$

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)** Anna bought an antique vase for \$345.
One year later, she sold it for a profit of 180% of the cost price.
Calculate the selling price.

Answer \$. [2]

- (b)** Ben bought a tablet during a sale where the prices are reduced by 6%.
The sale price of the tablet is \$785.
Calculate the price of the tablet before the sale.
Give your answer correct to the nearest dollar.

Answer \$. [2]

- (c) Factorise completely $6p^2 - 2qr - 12pq + pr$.

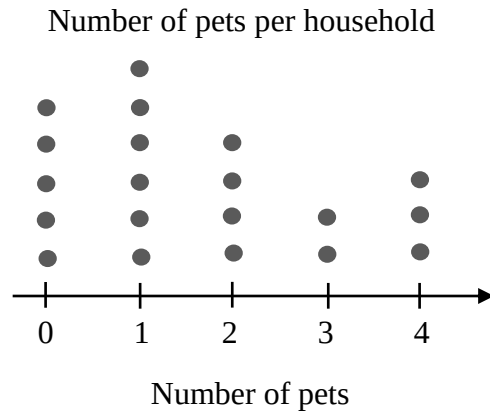
Answer [2]

- (d) It is given that y is directly proportional to $\sqrt{x}$.
Find the value of m in the following table.

x	9	16	25
y	40.5	m	67.5

Answer $m =$ [2]

- 2 A survey was conducted to find the number of pets each household has. The results are shown in the dot diagram.



- (a) Find the number of households that have less than 2 pets.

Answer [1]

- (b) Find the probability that a household, chosen at random, has 3 pets.

Answer [1]

- (c) If the results were represented by a pie chart, calculate the angle of the sector that would represent the number of households who do not have any pets.

Answer ° [1]

- (d) State the modal number of pets.

Answer [1]

- (e) Find the mean number of pets per household.

Answer [2]

- (f) David suggests using the mean as a measure of central tendency for this data set. Suggest why using the mean is appropriate.

.....

 [1]

- (g) 1 new household with 5 pets is included in the data set. Find the new mean number of pets per household.

Answer [1]

- 3 (a) In the expression $p^2 + 3pq - q + 7q^2 - 5$, write down the coefficient of q .

Answer [1]

- (b) Expand and simplify $\left(\frac{1}{2}r + s\right)(4r - s)$.

Answer [2]

(c) Simplify $\frac{20m+12n}{25m^2-9n^2} \div \frac{2}{m}$.

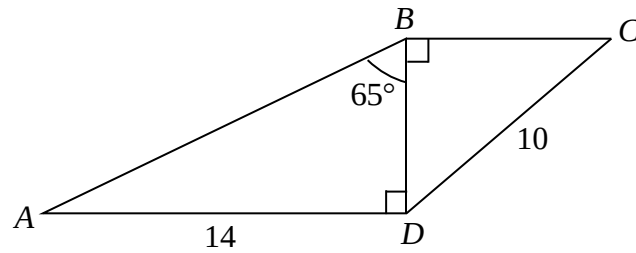
Answer [3]

(d) It is given that $s = ut + \frac{1}{2}at^2$.
Express a in terms of s , u and t .

Answer [2]

- 4 (a) The diagram shows a trapezium $ABCD$.

$AD = 14$ cm, $CD = 10$ cm and angle $ABD = 65^\circ$.



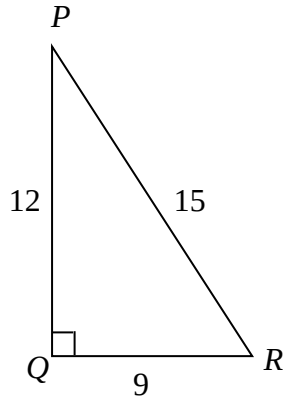
- (i) Calculate the length of BD .

Answer cm [2]

- (ii) Calculate angle BCD .

Answer $^\circ$ [2]

(b)



The diagram shows a right-angled triangle PQR .
 $PQ = 12$ cm, $QR = 9$ cm and $PR = 15$ cm.

- (i) Write down the value of $\cos \angle QPR$, leaving your answer as a fraction in its simplest form.

Answer [1]

- (ii) Write down the value of $\tan \angle PRQ$, leaving your answer as a fraction in its simplest form.

Answer [1]

5 Amos cycled 17 km at an average speed of x km/h.

(a) Write down an expression, in terms of x , for the time he cycled.

Answer h [1]

Mei Ling cycled 12 km at an average speed of 10 km/h less than Amos's speed.

(b) Write down an expression, in terms of x , for the time she cycled.

Answer h [1]

The total time that Amos and Mei Ling cycled was 60 minutes.

(c) Form an equation in terms of x and show that it reduces to $x^2 - 39x + 170 = 0$. [3]

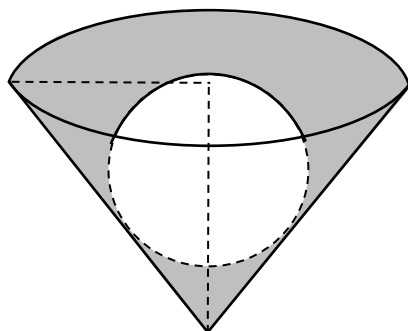
- (d) Solve the equation $x^2 - 39x + 170 = 0$ and find the time that Amos cycled.

Answer mins [2]

- (e) Briefly explain why one of the solutions for part (d) has to be rejected.

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.....
..... [1]

- 6** A conical vessel of diameter 6 cm and vertical height 4.4 cm is completely filled with water.
 A metal sphere is fully lowered into the vessel leading to an overflow of water.
 The thickness of the vessel is negligible.



- (a)** Given that the radius of the cone is twice the radius of the sphere, calculate the volume of water left in the vessel.

Answer cm^3 [3]

- (b) The conical vessel is coated with a layer of paint.
Calculate the amount of paint required.

Answer cm^2 [3]

- (c) The conical vessel is a model with a scale factor of $\frac{1}{20}$.
Find the curved surface area of the actual conical vessel in m^2 .

Answer m^2 [2]

- 7 The variables x and y are connected by the equation $y = -x^2 + 4x + 6$.

x	-2	-1	0	1	2	3	4	5	6
y	-6	1	6	9	10	9	6	1	p

- (a) Find the value of p .

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

- (b) On the grid opposite, draw the graph of $y = -x^2 + 4x + 6$ for $-2 \leq x \leq 6$. [3]

- (c) Use your graph to find the

- (i) equation of the line of symmetry of the graph $y = -x^2 + 4x + 6$,

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

- (ii) value of y when $x = 3.5$,

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

- (iii) values of x when $y = 0$.

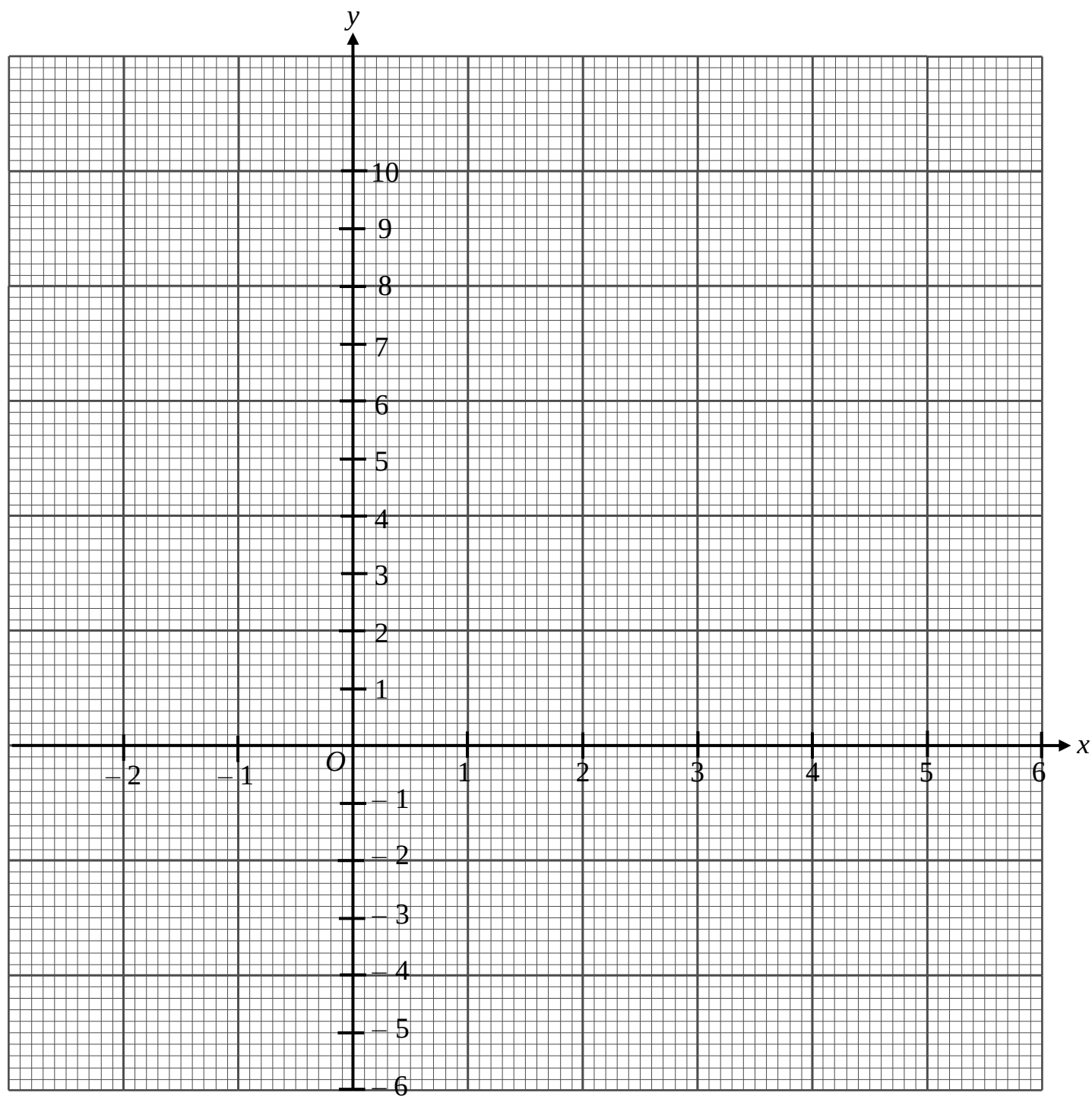
Answer $\dots\dots\dots$ or $\dots\dots\dots$ [1]

- (d) By drawing the line $y = 10.5$ on the grid opposite, explain why the equation $-x^2 + 4x + 6 = 10.5$ has no solution.

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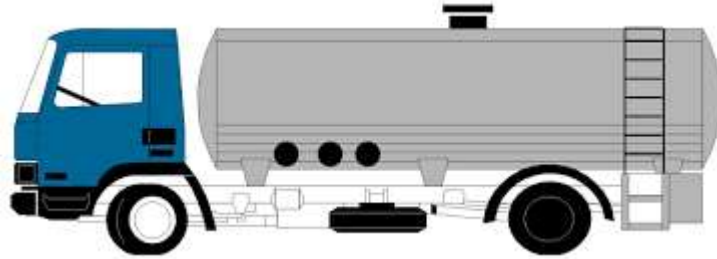
, [1]

Answer 7(b)



- 8 Liquid-carrying tanker trucks typically have tanks that can be modelled as cylinders. These cylindrical tanks contain liquids such as petroleum, chemicals and edible oils.

Tanker trucks are typically not filled up to their maximum capacity. Industry regulations allow for a maximum fill of 95% of the tank's capacity. This precaution helps to prevent spills and allows for the expansion of the carried liquid due to temperature changes.



The table below shows the 4 types of cylindrical tanker trucks and their maximum speed.

Type of cylindrical tanker truck	Diameter of cylindrical tank (m)	Length of cylindrical tank (m)	Maximum speed of truck (km/h)	Filling Time* (min)
Small	2	5.0	80	31
Medium	3	10.0	70	141
Large	4	15.0	60	377
Extra-Large	5	20.0	50	785

* Filling time refers to the duration it takes to load a tanker truck with its liquid regardless of whether it is filled to maximum regulated capacity.

- (a) Find the maximum fill of a medium-sized tanker based on industry regulations.

Answer m^3 [2]

- (b) A petroleum company in Tuas needs to deliver petrol using a large-sized tanker truck to a petrol station 40 km away in Tampines, which requires 80,000 litres of petrol.

The time required for each trip includes filling time, travelling time and the unloading time.

Assuming the filling time and unloading time is the same, determine the number of trips required and the minimum amount of time taken for this delivery.

Give your answer in hours and minutes, correct to the nearest minute.

[1 cubic metres = 1000 litres]

Answer Number of trip(s) =

Time = h mins [4]

End of Paper

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HIHS 2024 Sec 2 Express EOY Math Paper 2 (Single answers)

Qn	Answer	Qn	Answer
1a	966	4bii	$\tan \angle PRQ = \frac{12}{9} = \frac{4}{3}$
1b	\$835 (to nearest dollar)		
1c	$(p-2q)(6p+r)$	5a	(a) $\frac{17}{x}$ (b) $\frac{12}{x-10}$
1d	$m = 54$	5b	
2a	11 households	5c	$\frac{17}{x} + \frac{12}{x-10} = 1$ hour $\frac{17(x-10)+12x}{x(x-10)} = 1$ $17x-170+12x = x^2-10x$ $x^2-10x-29x+170=0$ $x^2-39x+170=0$ (Shown)
2b	$\frac{1}{10}$		
2c	90°		
2d	Mode = 1 pet		
2e	Mean = 1.6 pets		
2f	The mean is the most appropriate average for this data set because - there is no extreme value in the data set - it takes into account all the data values / it involves all data values	5d	30 mins
		5e	When $x = 5$, $\frac{12}{x-10} = \frac{12}{5-10}$ will end up with <u>negative time</u> , which is <u>not possible</u> . Thus, reject the solution $x = 5$.
2g	1.76 pets (to 3 s.f.)	6a	27.3 cm^3 (to 3 s.f.)
3a	Coefficient of $q = -1$	6b	50.2 cm^2 (to 3 s.f.)
3b	$2r^2 + \frac{7}{2}rs - s^2$	6c	2.01 m^2 (to 3 s.f.)
3c	$\frac{2m}{5m-3n}$	7a	$p = -6$
3d	$a = \frac{2s-2ut}{t^2}$ or $a = \frac{2ut-2s}{-t^2}$	7b	Refer to graph on next page
		7ci	$x = 2$
4ai	6.53 cm (to 3 s.f.)	7cii	7.8 ± 0.2
4aai	40.8° (to 1 d.p.)	7ciii	$x = -1.15$ or $x = 5.15$ [± 0.05]
4bi	$\cos \angle QPR = \frac{12}{15} = \frac{4}{5}$	7d	There is <u>no intersection</u> between $y = 10.5$ (line) and $y = -x^2 + 4x + 6$ (curve), hence there is no solution.

8a	67.2 m^3 (correct to 3 s.f.) [if calculator π] or 67.16025 m^3 (exact value) [if $\pi = 3.142$]
8b	Volume of cylindrical tank $= \pi \times 2^2 \times 15$ $= 60\pi \text{ m}^3$ Max fill of truck $= 0.95 \times 60\pi \text{ m}^3$ $= 179.07078 \text{ m}^3$ or $179\,070.78 \text{ litres}$ [1 $\text{m}^3 = 1000 \text{ litres}$] Number of trips $= \frac{80\,000 \text{ litres}}{179\,070.78 \text{ litres}}$ or $\frac{80 \text{ m}^3}{179.07078 \text{ m}^3} = 0.447 \text{ trip}$ Whole number of trips = <u>1 trip</u> Least amount of time $= \frac{40 \text{ km}}{60 \text{ km/h}} \times 60 + 377 \text{ mins} + 377 \text{ mins}$ $= 40 \text{ mins} + 377 \text{ mins} + 377 \text{ mins}$ $= 794 \text{ mins}$ $= \textbf{13 h 14 mins}$

Graph for 7b and line for 7d

