

聖嬰中學

HOLY INNOCENTS' HIGH SCHOOL



Candidate Name

Class

Index Number

END OF YEAR EXAMINATION 2024
SECONDARY 2
MATHEMATICS PAPER 1

28	60
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46.6%

4052/01

Date: 8 Oct 2024

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 Lo Sock Kui

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 = $\frac{4}{3} \pi r^3$

Answer **all** the questions.

- 1 (a) Solve the inequality $c - 2 < 4(5 - c)$.

$$c - 2 < 20 - 4c$$

$$c + 4c < 20 + 2$$

$$5c < 22$$

$$c < 4.4$$

$$c < 4.4$$

Answer $c > 4.4$ ~~X~~ [2]

- (b) State the largest integer value of c which satisfies the inequality in (a).



Answer 4 [1]

- 2 A number is chosen at random from 1 to 20 inclusive.
Find the probability that the number chosen is

- (a) a multiple of 6,

multiples of 6 = 6, 12, 18

$$\frac{3}{20}$$

Answer $\frac{3}{20}$ ✓ [1]

- (b) a prime number.

prime no. = 2, 3, 5, 7, 11, 13, 17, 19

$$\frac{8}{20} = \frac{2}{5}$$

Answer $\frac{2}{5}$ ✓ [1]

3 Solve

(a) $\frac{5}{x} = \frac{4}{3},$

$15 = 4x$

$x = 3.75$

Answer $x = 3.75$ [1]

(b) $\frac{x-1}{3} + \frac{x+3}{2} = 8.$

$(x-1)(2) + (x+3)(2) = 8(3)(2)$

$2x-2+3x+9=48$

$2x+3x=48+2-9$

$5x=41$

$x=8.2$

Answer $x = 8.2$ [2]

y is inversely proportional to the square of x.

When x increases by 300%, find the percentage change in y.

Sub $y=100, x=100$

$100 = \frac{k}{100^2}$

$100 \div 100^2 = k$

$= \frac{1}{100}$

$y = \frac{1}{x^2}$

Sub $x=400$

$y = \frac{1}{400^2}$

$= \frac{1}{160000}$

$\frac{100 - \frac{1}{160000}}{100} \times 100 = 99.9999$

new $x = 4x$
new $y = \frac{k}{(new\ x)^2}$

$= \frac{k}{(4x)^2}$

$= \frac{k}{16x^2}$

$= \frac{1}{16} \left(\frac{k}{x^2} \right)$

$= \frac{1}{16} y$

original $x = 100\%$
new $x = 400\%$

change = new y - y

$= \frac{1}{16} y - y$

$= -\frac{15}{16} y$

percentage change = $\frac{-\frac{15}{16} y}{y} \times 100\%$

$= -93.75\%$

Answer -93.75% [3]

5 Solve these simultaneous equations.

$$3x + 5y = 3 \quad \text{--- ①}$$

$$3y - 2x = 17 \quad \text{--- ②}$$

From ①

$$3x = 3 - 5y$$

$$x = \frac{3 - 5y}{3} \quad \text{--- ③}$$

Sub ③ into ②

$$3y - 2\left(\frac{3 - 5y}{3}\right) = 17$$

$$3y - \frac{6 - 10y}{3} = 17$$

$$9y - 6 + 10y = 51$$

$$9y + 10y = 51 + 6$$

$$19y - 11 = 57$$

$$y = -57$$

$$y = 3$$

Sub y into ③

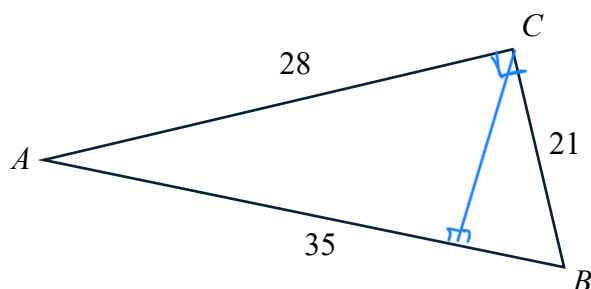
$$x = \frac{3 - 5(-57)}{3}$$

$$= 96$$

Answer $x = \dots\dots\dots 96 \times -1 \dots\dots\dots$

$y = \dots\dots\dots -57 \times -3 \dots\dots\dots [3]$

- 6 The diagram below shows triangle ABC where $AB = 35$ cm, $BC = 21$ cm and $AC = 28$ cm.



- (a) Show that triangle ABC is a right-angled triangle.

Answer $AB^2 = 35^2$ $BC^2 + AC^2 = 28^2 + 21^2$

$= 1225$ $= 1225$

Since $AB^2 = BC^2 + AC^2 = 1225$, by the converse of Pythagoras theorem, $\triangle ABC$ is a right angled triangle. ✓

[2]

- (b) Find the shortest distance from C to AB .

$$\frac{1}{2} \times 28 \times 21 = 294$$

$$294 \div \frac{1}{2} \div 35 = 16.8$$

Answer 16.8 ✓ cm [2]

7 (a) Expand $(a-b)^2$.

$$\begin{aligned} &= (a-b)(a-b) \\ &= a^2 - ab - ab + b^2 \\ &= a^2 - 2ab + b^2 \end{aligned}$$

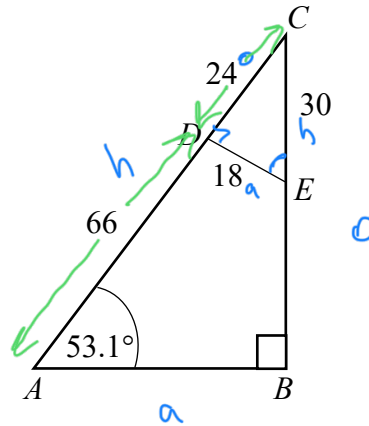
Answer $a^2 - 2ab + b^2$ ✓ [1]

~~Q12~~ Hence find the value of $a^2 + b^2$ given that $a-b=3$ and $ab=40$.

$$\begin{aligned} (a-b)^2 &= a^2 - 2ab + b^2 \\ 9 &= a^2 + b^2 - 80 \\ 9 + 80 &= a^2 + b^2 \\ &= 89 \end{aligned}$$

Answer 89 ✓ [2]

- 8 In the diagram, triangle ABC is similar to triangle EDC .
 $AD = 66$ cm, $CD = 24$ cm, $CE = 30$ cm, $DE = 18$ cm, angle $ABC = 90^\circ$ and angle $BAC = 53.1^\circ$.



Find

- (a) angle CED ,

$$\cos \angle CED = \frac{18}{30}$$

$$\angle CED = \cos^{-1} \frac{18}{30}$$

$$= 53.130$$

$$\approx 53.1$$

Answer 53.1 $^\circ$ [1]

- (b) the length of CB ,

$$\sin 53.1^\circ = \frac{CB}{66+24}$$

$$\sin 53.1^\circ \times 66 = CB$$

$$= 52.779$$

$$\approx 52.8$$

Answer 52.8 $\times$ 72 cm [2]

- (c) perimeter of quadrilateral $ABED$.

$$EB = 52.8 - 30$$

$$= 22.7791$$

$$AB = \sqrt{(66+24)^2 - 52.779^2}$$

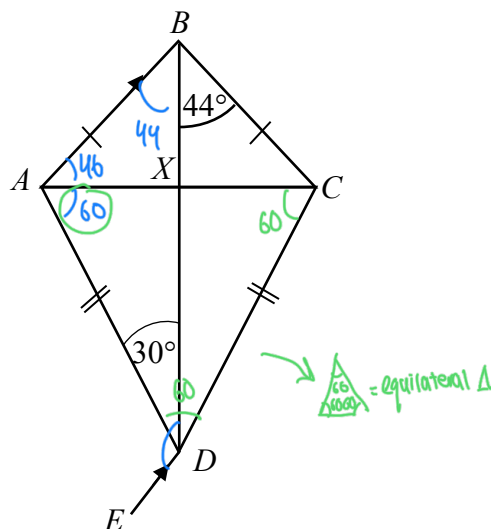
$$= 72.8997$$

$$66 + 18 + 22.7791 + 72.8997 = 179.6788$$

$$\approx 180$$

Answer 180 $\checkmark$ cm [2]

- 9 The diagram below shows a kite $ABCD$ where $AB = BC$ and $AD = CD$ with a string DE attached to it. Given that angle $CBD = 44^\circ$, angle $ADB = 30^\circ$ and ED is parallel to AB ,



- (a) State the size of angle AXD .

Answer 90 $^\circ$ [1]

- (b) Name the special type of triangle formed by ADC .

Answer equilateral isosceles triangle [1]

- (c) Find angle ADE .

$$\begin{aligned}
 \angle XBC &= \angle XBA \\
 &= 44^\circ \\
 \angle BAX &= 180^\circ - 44^\circ - 90^\circ \\
 &= 46^\circ \\
 \angle XAE &= 180^\circ - 30^\circ - 90^\circ \\
 &= 60^\circ \\
 \angle BAD &= \angle ADE \text{ (alternate } \angle\text{s)} \\
 &= 46^\circ + 60^\circ \\
 &= 106^\circ
 \end{aligned}$$

Answer 106 $^\circ$ [2]

- 10** A car travels for $1\frac{1}{2}$ hour at 72 km/h.
(a) Express its speed in m/s.

$72 \text{ km/h} = 2000 \text{ m/s}$
 $\times 100000$
 $\div 3600$

72 km/h
 $\downarrow \downarrow$
 $= 72000 \text{ m} / 3600 \text{ s}$
 $= 20 \text{ m/s}$

Answer $\frac{2000 \text{ m/s}}{20 \text{ m/s}}$ m/s [1]

- (b)** The car travels a further 40 km in 45 minutes.
Calculate the average speed for the whole journey in km/h.

$$\frac{108 + 40}{1\frac{1}{2} + 0.75} = 65.7777 \text{ km/h}$$

$$\approx 65.8 \text{ km/h}$$

Answer 65.8 km/h [3]

- 11 In a sequence, the same number is subtracted each time to obtain the next term. The first five terms of the sequence are



- (a) Find the value of p .

let d be the difference

$$14 - 3d = -19$$

$$-3d = -19 - 14$$

$$d = 11$$

$$p = 14 + 11$$

$$= 25$$

Answer $p = 25$ [2]

- (b) Write down an expression for the n th term of the sequence.

$$\begin{array}{ccccccc} T_0 & T_1 & T_2 & T_3 & T_4 & T_5 \\ 36 & 25 & 14 & 3 & r & -19 \\ & -11 & -11 & -11 & -11 & -11 \\ & \nearrow \text{diff} & & & & \\ T_n = 4n + b \rightarrow T_0 & & & & & \\ T_n = -11n + 36 & & & & & \end{array}$$

Answer $T_n = -11n + 36$ [1]

- (c) Explain with working clearly shown, why -101 is not a term of this sequence.

Answer $-11n + 36 = -101$

$-11n = -137$

.....

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..... [2]

- 12 The stem-and-leaf diagram shows the lifetime (measured to the nearest hour) of 30 batteries.

mean = average	71	0	2	3	3				
median = middle no.	71	5	6	6	6	6	9	9	9
mode = most amount	72	0	3	3	4				
range = range (9 to 9)	72	5	5	6	6	6	7	9	
consistency = most amount (everything but least no.)	73	0	0	0	2				
outliers = faraway number	73	5	5	6					
Key:	72	9	Represents 729 hours						

- (a) State the longest lifetime of the batteries.

Answer 736 ✓ hours [1]

- (b) Find the median lifetime of the 30 batteries.

$$710 + 710 + 2(713) + 715 + 4(716) + 3(719) + 720 + 2(723) + 724 + 2(725) = 12924$$

$$3(726) + 727 + 729 + 3(730) + 732 + 2(735) + 736 = 8762$$

$$(12924 + 8762) \div 30 = 722.8666$$

≈ 723

Answer 723 ✓ hours [1]

- (c) Batteries of lifetime t hours or less are considered as defective.

Given that 30% of the batteries are defective, find the value of t .

$$\frac{30}{100} \times 30 = 9$$

Answer $t =$ 716 ✓ [2]

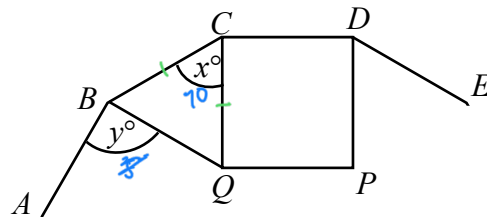
- (d) A battery is randomly selected.

Find the probability that the battery selected has a lifetime of at least 730 hours.

$$\frac{7}{30} \frac{1}{2}$$

Answer $\frac{7}{30}$ ✓ [1]

- 13 The diagram shows a regular polygon with four of its sides, AB , BC , CD and DE . $CDPQ$ is a square. Each interior angle of the polygon is 160° .



Find

- (a) the number of sides of the polygon,

$$n = \frac{360^\circ}{\text{exterior } \angle}$$

$$\frac{360}{180 - 160} = 18$$

Answer 18 sides [2]

- (b) the value of x ,

$$\frac{18 - 2(180)}{18} - 90^\circ = 70^\circ$$

Answer $x =$ 70 [1]

- (c) the value of y .

$$CB = CQ$$

$$\angle BCQ = \frac{180 - 70}{2}$$

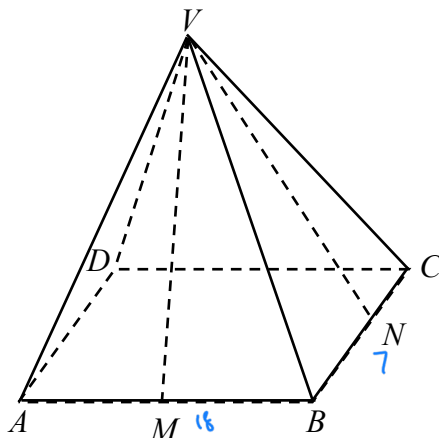
$$= 55^\circ$$

$$y = 160 - 55$$

$$= 105^\circ$$

Answer $y =$ 105 [2]

- 14 The diagram shows a right pyramid with a rectangular base $ABCD$ and vertex V .
 $AB = 18$ cm and $BC = 7$ cm.
 The slant heights, VM and VN , of the pyramid are 12.5 cm and 15 cm respectively.



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

only used for
 not 

$$\frac{1}{2} \pi \times 18 \times 12.5 + \frac{1}{2} \pi \times 7 \times 15 + 18 \times 7 = 644.3677$$

$$\approx 644$$

Answer ~~644~~ ⁴⁵⁶ cm^2 [3]

- (b) Find the volume of the pyramid.

$$\sqrt{12.5^2 - \frac{7^2}{4}} = 12$$

only for
 not  $\frac{1}{3} \pi \times 18 \times 7 \times 12 = 1563.3626$
 $\approx 1580 \text{ cm}^3$

$$\frac{1}{3} \times 18 \times 7 \times 12 = 504$$

Answer ~~1580~~ ⁵⁰⁴ cm^3 [3]

- 15** Mr Koh purchased 4 guavas, 2 papayas and 10 apples from a fruit stall.
It is given that a guava costs \$ x , an apple is 30 cents cheaper than a guava and a papaya costs 4 times an apple.

(a) Show that the total amount spent by Mr Koh is \$ $(22x - 5.4)$.

Answer
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..... [2]

(b) Given that Mr Koh spent \$22.10, find the value of x .

Answer $x =$ [1]

- 15 (c) During the durian season, the price of durian is decreased from \$13.95 per kg to \$11.25 per kg.
The durian seller says that the price of the durians have dropped by more than 20%.
Do you agree?
Show your workings clearly.

Answer

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..... [2]

END OF PAPER