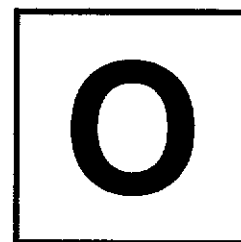




# NAVAL BASE SECONDARY SCHOOL PRELIMINARY EXAMINATION 2024



Name \_\_\_\_\_ ( )

Class \_\_\_\_\_

**MATHEMATICS**

**4052/01**

**Paper 1**

**21 August 2024**

Candidates answer on the Question Paper

**2 hours 15 minutes**

## 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 staples, paper clips, glue or correction fluid.

Answer **all** questions.

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 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  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in  $\pi$ .

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

The total of the marks for this paper is **90**.

<i>Item</i>	<i>For examiner's use</i>
<i>Presentation</i>	
<i>Accuracy</i>	
<i>Units</i>	
<i>Total</i>	
<i>Parent's Signature</i>	

This paper consists of **24** printed pages.

[Turn over

**Mathematical Formulae***Compound interest*

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

*Mensuration*

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

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

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

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

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

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

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

*Trigonometry*

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

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

*Statistics*

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

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

**[Turn over**

3

Answer all the questions.

1 Calculate  $\sqrt[4]{13.5^2 - \frac{6.56}{0.37}}$ .

Answer ..... [1]

---

2 Simplify

(a)  $3x^2 \times 4y^5$ .

Answer ..... [1]

(b)  $3(2x-1)-5$ .

Answer ..... [1]

---

3 Factorise completely  $2x^3 - 13x^2 + 6x$ .

Answer ..... [2]

---

[Turn over

- 4 The sine of an angle is 0.6, find the two possible values for angle.

*Answer*  $x = \dots\dots\dots^\circ$  or  $x = \dots\dots\dots^\circ$  [2]

---

- 5 A class of 12 boys and 8 girls took a test.  
The girl's marks were 3, 6, 7, 8, 9, 9, 10 and 10.

- (a) Find the mean mark for the girls.

*Answer* .....mark [1]

- (b) The mean mark for the boys were 8.0.  
Find the mean mark for the whole class.

*Answer* .....mark [2]

---

**[Turn over**

- 6 (a) The number  $12250 \times \frac{p}{q}$  is a perfect cube.  $p$  and  $q$  are prime numbers.

Find  $p$  and  $q$ .

*Answer*  $p = \dots\dots\dots$

$q = \dots\dots\dots$ [3]

- (b)  $x$  is a number between 700 and 800.

The highest common factor of  $x$  and 12 250 is 250.

Find the smallest possible value of  $x$ .

*Answer*  $x = \dots\dots\dots$  [1]

---

[Turn over

7 Given that  $81^{2x} \times 9^x = 27$ , find  $x$ .

*Answer* ..... [2]

---

8 Raj has 120 one-centimetre cubes.  
He arranges all of the cubes into a cuboid.  
The perimeter of the top of the cuboid is 20 cm.  
Each side of the cuboid has a length greater than 3 cm.

Find the height of the cuboid.

*Answer* ..... cm [2]

---

**[Turn over**

7

9

$$T = 2\pi\sqrt{\frac{L}{g}}$$

Rearrange the formula to make  $g$  the subject.

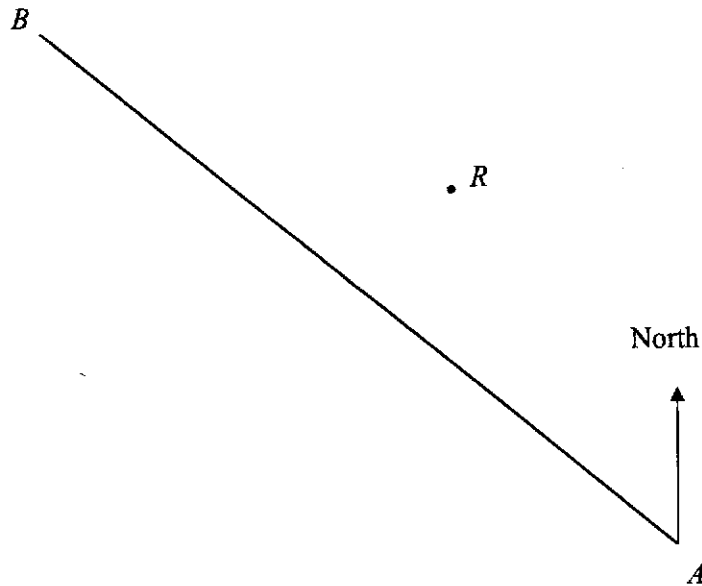
*Answer*  $g = \dots\dots\dots$  [3]

---

[Turn over

10

Scale: 1 cm to 5 km



In the scale drawing,  $R$  is the centre of a rock bed,  $A$  is a ship and  $B$  is a port.  
The line  $AB$  shows the ship's course.

- (a) Measure the bearing of  $B$  from  $A$ .

Answer .....° [1]

- (b) The rock bed covers a 25 km radius.

If the ship were to stay on course, state the distance at which the ship will first hit the rock bed.

Answer ..... km [2]

---

[Turn over



- 11 The table below shows the amount of time spent playing online games by a group of children in one particular week.

Time ( $h$ hours)	Frequency
$0 < h \leq 2$	4
$2 < h \leq 4$	9
$4 < h \leq 6$	15
$6 < h \leq 8$	13
$8 < h \leq 10$	7
$10 < h \leq 12$	2

- (a) (i) Calculate an estimate of the mean time spent playing online games that week.

*Answer* .....hours [1]

- (ii) Explain why this is only an estimate of the mean time these children spent playing online games that week.

*Answer* ..... [1]

- (b) Calculate an estimate of the standard deviation of the time spent playing online games that week.

*Answer* .....hours [2]

---

[Turn over

10

12 Solve the simultaneous equations.

$$\frac{x}{4} - \frac{y}{2} = 2$$

$$3x = 19 + 4y$$

You must show your working.

*Answer*  $x = \dots\dots\dots$

$y = \dots\dots\dots$  [3]

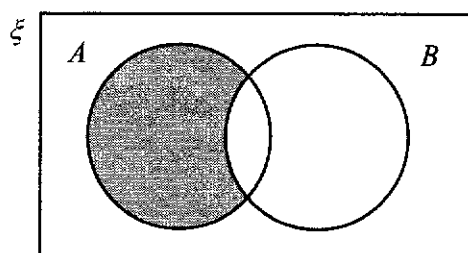
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[Turn over

13 (a) Factorise  $5xy - 20y$ .

*Answer* ..... [1]

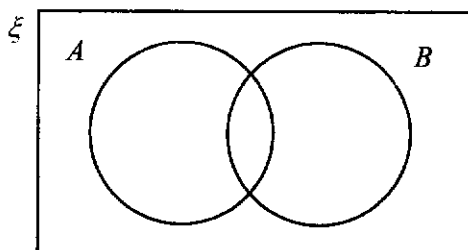
(b) (i) Use set notation to describe the shaded region.



*Answer* ..... [1]

(ii) On the Venn diagram, shade the region which represents  $A \cup B'$ .

*Answer*



[1]

[Turn over

- 14 (a) A bag contains black, blue and yellow balls.  
A ball is picked at random from the bag.

The probability that the ball is blue is  $\frac{5}{9}$ .

The probability that the ball is yellow is  $\frac{2}{15}$ .

Find the probability that the ball is black.

*Answer* ..... [1]

- (b) Another bag contains 10 red balls, 7 white balls and 8 blue balls.  
A further  $n$  white balls are added to the bag.

The probability of picking a white ball is now  $\frac{2}{5}$ .

Find the value of  $n$ .

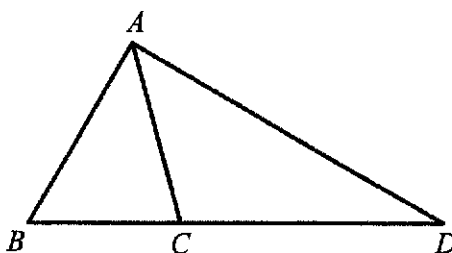
*Answer*  $n =$  ..... [2]

---

[Turn over

13

15



In the diagram,  $BCD$  is a straight line and  $BC : CD = 3 : 5$ .

Calculate the area of triangle  $ABC$  as a percentage of the area of the triangle  $ABD$ .

*Answer* .....% [2]

---

- 16  $x$  and  $y$  are related such that  $x$  is inversely proportional to the square of  $y$ .  
If  $y$  is increased by 400%, find the percentage change in  $x$ .

*Answer* .....% [3]

---

[Turn over

17 The numbers 1 to 100 are arranged in a table as shown below.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
91	92	93	94	95	96	97	98	99	100

A *L*-shaped shaded frame can be placed around various numbers throughout the table.

$L_n$  is used to refer to the shaded frame that is drawn around a particular number. For example,  $L_2$  refers to the shaded frame shown above drawn around the number 2.

(a) State the largest  $L_n$ .

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

(b) Write and simplify an expression, in terms of  $n$ , for the sum of the numbers in  $L_n$ .

Answer  $\dots\dots\dots$  [2]

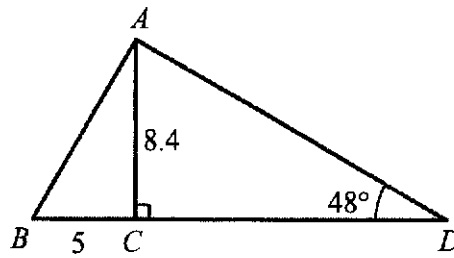
(c) Explain why the sum of the numbers is always a multiple of 3.

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

[Turn over

15

18



In the triangle  $ABD$ ,  $AC$  is perpendicular to  $BD$ .  
 Angle  $ADC = 48^\circ$ ,  $AC = 8.4$  cm and  $BC = 5$  cm.

Calculate

(a) angle  $ABC$ ,

Answer ..... $^\circ$  [2]

(b)  $AD$ .

Answer .....cm [2]

[Turn over

- 19 Solve the equation  $x^2 + 5x - 16 = 0$  by completing the square.  
Give your solutions correct to two decimal places.

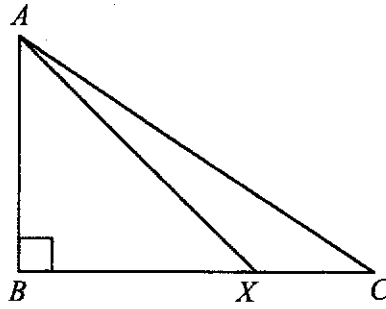
*Answer*  $x = \dots\dots\dots$  or  $\dots\dots\dots$  [4]

---

**[Turn over**



20



In triangle  $ABC$ , angle  $ABC = 90^\circ$ ,  $BX = 2XC$  and  $\sin \angle AXC = \frac{3}{5}$ .

Express as a fraction in its lowest terms,

(a)  $\tan \angle AXB$ ,

Answer ..... [2]

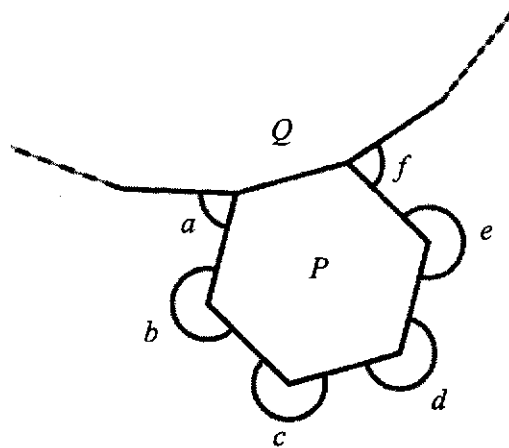
(b)  $\tan \angle ACB$ .

Answer ..... [2]

---

[Turn over

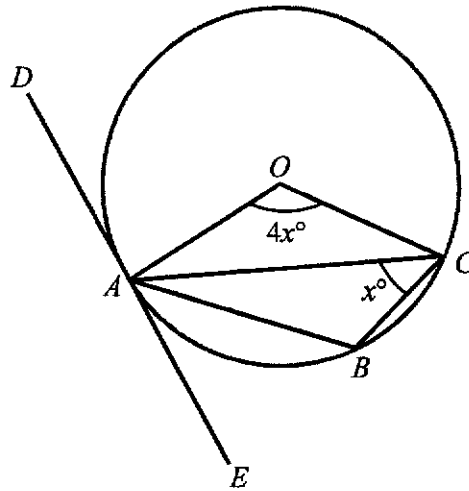
- 21 The diagram shows a regular hexagon  $P$  and a regular  $n$ -sided polygon  $Q$ . Polygon  $Q$  has an exterior angle of  $18^\circ$ .



Find the sum of angles  $a$ ,  $b$ ,  $c$ ,  $d$ ,  $e$  and  $f$ .

Answer ..... $^\circ$  [4]

[Turn over



$A$ ,  $B$  and  $C$  are points on the circle, centre  $O$ .  
 $DE$  is a tangent to the circle at  $A$ .  
 Angle  $AOC = 4x^\circ$  and angle  $ACB = x^\circ$ .

Find, in terms of  $x$ , the following.  
 Give a reason for each step of your answer.

(a) angle  $ABC$ ,

Answer ..... $^\circ$  [2]

(b) angle  $BAE$ .

Answer ..... $^\circ$  [2]

---

[Turn over

23 A vaccine was introduced to a virus in an experiment.

The number,  $N$ , of virus  $t$  hours after being introduced to the vaccine is given by

$$N = v \times 0.9^{2t},$$

where  $v$  is the amount of vaccine introduced.

(a) After 1 hour, the number of virus has decreased to 81 000.

Find  $v$ .

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

(b) Find in terms of  $k$ , the number of virus when  $0.81^t = k$ .

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

(c) Find the decrease in the number of virus after 2 hours as a percentage of the number of virus at the beginning.

Answer  $\dots\dots\dots\%$  [2]

(d) Which of these diagrams represent the graph of  $N$  against  $t$ ?

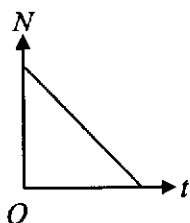


Diagram 1

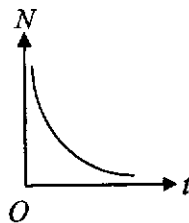


Diagram 2

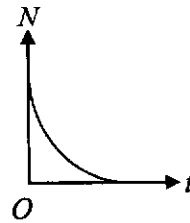


Diagram 3

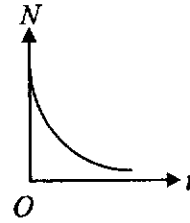


Diagram 4

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

[Turn over

- 24 (a) **Underline** the following ratios that are equivalent to the ratio  $a : b$ .

*Answer*

$$\frac{1}{b} : \frac{1}{a} \quad a^3 : b^3 \quad 3a : 3b \quad a+1 : b+1$$

[2]

- (b) John and Sam each have an amount of money.  
The ratio John's amount : Sam's amount = 6 : 2.

John gives Sam \$13.

The new ratio John's amount : Sam's amount = 2 : 5.

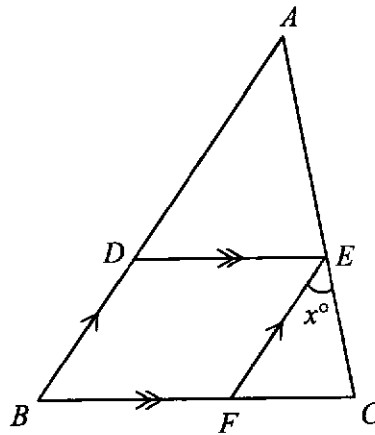
Find how much money John has now.

*Answer* \$ ..... [4]

---

[Turn over

25



The diagram shows triangle  $ABC$  and parallelogram  $BDEF$ .  
 $FE$  bisects angle  $DEC$  and angle  $FEC = x^\circ$ .

- (a) Find angle  $ECF$  in terms of  $x$ .  
 Give a reason for each step of your answer.

Answer .....

.....

.....[2]

- (b) Show that triangle  $AED$  is similar to triangle  $ECF$ .

Answer .....

.....

.....

.....[3]

- (c) State another triangle that is similar to  $AED$  and  $ECF$ .

Answer Triangle ..... [1]

[Turn over

- 26 A baking school offers beginner, intermediate and advanced baking classes on weekdays and weekends in August this year.

The matrix **B** shows the number of participants attending the baking classes in August.

$$\mathbf{B} = \begin{pmatrix} & \text{beginner} & \text{intermediate} & \text{advanced} \\ \text{weekdays} & 22 & 20 & 9 \\ \text{weekends} & 8 & 10 & 11 \end{pmatrix}$$

- (a) The fees for the beginner, intermediate and advanced baking classes are \$30, \$40 and \$50 respectively.

Represent the class fees by a  $3 \times 1$  matrix **F**.

*Answer F =* [1]

- (b) Evaluate the matrix  $\mathbf{C} = \mathbf{BF}$ .

*Answer C =* [2]

- (c) State what the elements of **C** represent.

*Answer* .....

.....[1]

**[Turn over**

(d) In September, there were a different number of participants attending baking classes.

The number of participants attending beginner classes decreased by 20%.

The number of participants attending intermediate classes increased by 10%.

The number of participants attending advanced classes tripled.

Calculate the percentage increase in the total amount of fees between the August and September classes.

*Answer* .....% [3]

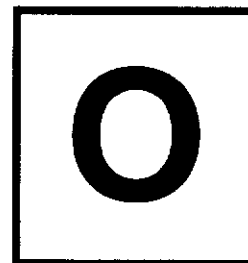
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**----End of Paper ----**





**NAVAL BASE SECONDARY SCHOOL  
PRELIMINARY EXAMINATION, 2024**



Name \_\_\_\_\_ ( ) Class \_\_\_\_\_

**MATHEMATICS**

4052/02

Paper 2

22 August 2024

Candidates answer on the Question Paper.

2 hour 15 minutes

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<i>Item</i>	<i>For examiner's use</i>
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<i>Accuracy</i>	
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[Turn over

**Mathematical Formulae***Compound Interest*

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*Statistics*

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

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

Answer all the questions.

1 (a) Solve  $\frac{x}{5} + \frac{2x-3}{4} = -6$ .

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

(b) Simplify  $\frac{2(p-3q)}{10r} \div \frac{(3q-p)^2}{r}$ .

Answer  $\dots\dots\dots$  [2]

[Turn over

4

(c) Solve the inequality  $x+1 \leq \frac{7x-2}{4} < \frac{5x+19}{5}$ .

*Answer* ..... [3]

(d) Simplify  $\frac{2y^2+7y-9}{4y^2-81}$ .

*Answer* ..... [3]

---

[Turn over

- 2 (a) Cheryl wants to open a fixed deposit account with either Bank *H* or Bank *L* for a period of 4 years.

The following are the promotions offered by the two banks.

<b>Bank <i>H</i></b>	<b>Bank <i>L</i></b>
<u>Fixed Deposit Account</u>	<u>Fixed Deposit Account</u>
<ul style="list-style-type: none"> <li>• Minimum deposit of \$10 000.</li> <li>• For the first \$10 000, earn 0.05% simple interest per annum.</li> <li>• For the subsequent amount, earn 0.95% simple interest per annum.</li> </ul>	<ul style="list-style-type: none"> <li>• No minimum amount required.</li> <li>• Compound interest at the rate of 0.8% per annum.</li> </ul>

- (i) Cheryl deposited \$30 000 into Bank *H*.

Calculate the total amount in her account after 4 years.

*Answer* \$..... [3]

[Turn over

- (ii) Cheryl claimed that Bank *H* offers a better deal than Bank *L*.

Do you agree with Cheryl's claim?  
Justify your conclusion with clear calculations.

*Answer*

.....  
 .....  
 .....

[3]

- (b) (i) The exchange rate between Singapore Dollars (S\$) and Chinese Yuan (CNY) is S\$1 = CNY5.33.

The exchange rate between Hong Kong dollars (HK\$) and Singapore Dollars is HK\$1 = S\$0.17.

Tan is planning a trip to Hong Kong and Guangzhou.  
He finds these hotel prices on a website.

Guangzhou Hotel	CNY825
Hong Kong Hotel	HK\$825

By comparing the exchange rates, explain which hotel charges a cheaper rate per night.

Show your working clearly.

*Answer*

The ..... hotel charges a cheaper rate per night.

[2]

[Turn over

- (b) (ii) Tan books 4 nights in the Hong Kong hotel and 2 nights in the Guangzhou hotel. He pays using his credit card. The credit card company converts the prices to Singapore dollars and charges a fee of  $k\%$  for the currency conversion.

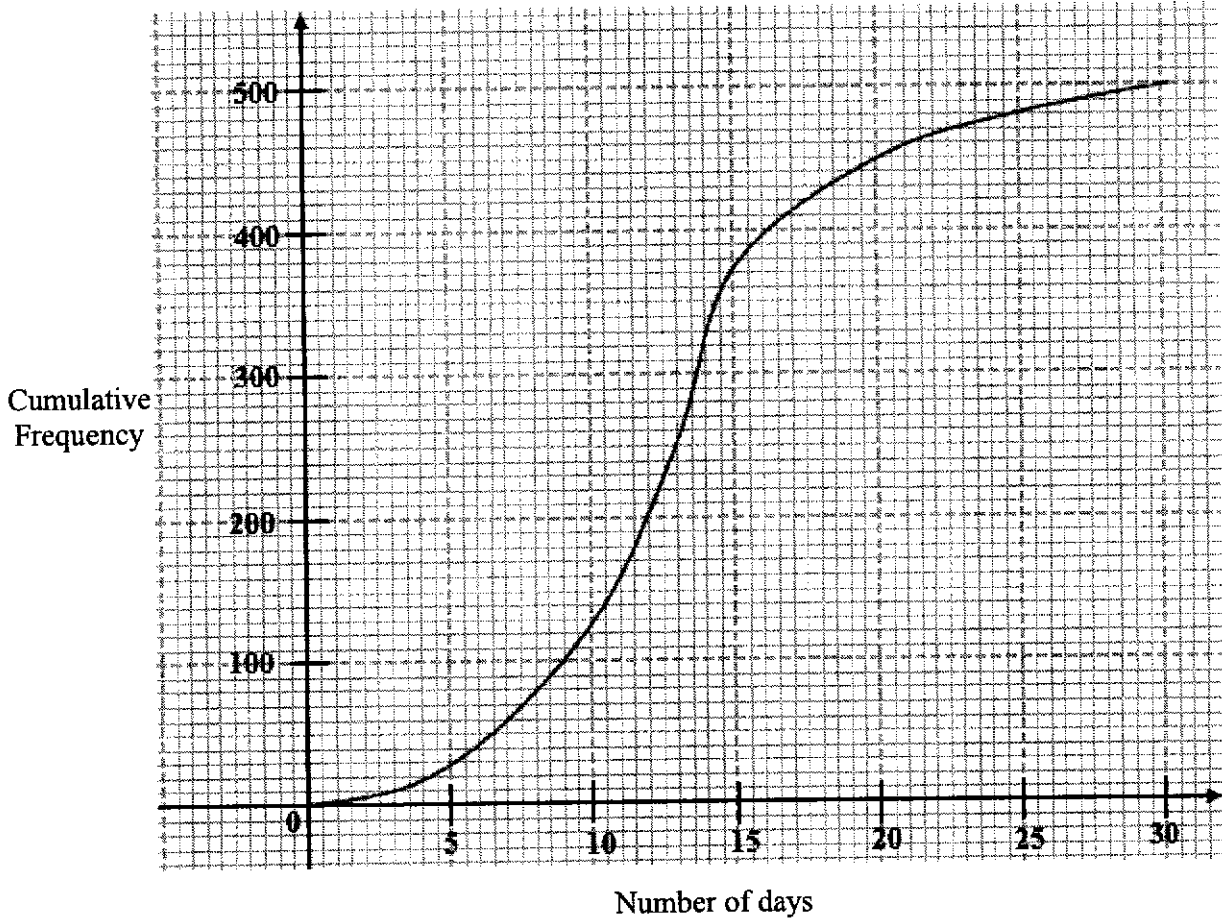
Given that the total amount Tan pays for the two hotels, including the credit card fee, is \$890, find the value of  $k$ .

---

*Answer*  $k = \dots\dots\dots$  [4]

[Turn over

- 3 (a) In February 2021, a survey was carried out to find the number of days 500 patients stayed at a hospital. The graph shows the cumulative frequency curve for the data collected.



Use the curve to estimate

- (i) the median number of days,

Answer ..... days [1]

- (ii) the interquartile range of the number of days,

Answer ..... days [2]

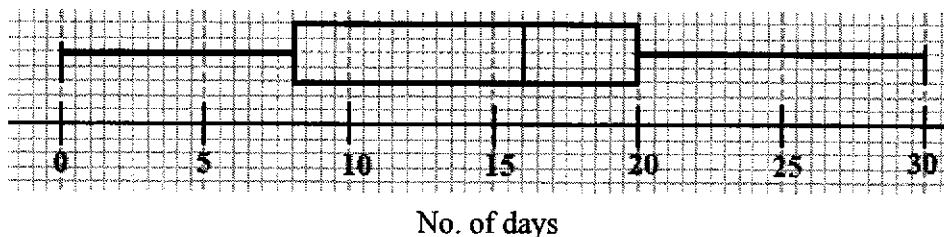
- (iii) the percentage of patients who stayed more than 20 days in the hospital.

Answer ..... % [2]

[Turn over



- (b) In February 2022, the same survey was carried out again on another 500 patients with the following result shown in the box-and-whisker plot below.



Make two comments comparing the number of days stayed in the hospital in February 2021 and February 2022.  
Use figures to support your answer.

*Answer*

1. ....
2. ....

[3]

- (c) One patient in February 2021 was selected at random.

Find the probability that the patient stayed for at most 20 days.

*Answer* ..... [1]

- (d) Two patients in February 2022 were selected at random.

Find the probability that one of the patients stayed for at most 8 days while the other stayed for more than 8 days.

*Answer* ..... [2]

- 4 (a) Complete the table of values for  $y = \frac{x^3}{5} - x^2 + 2$ .

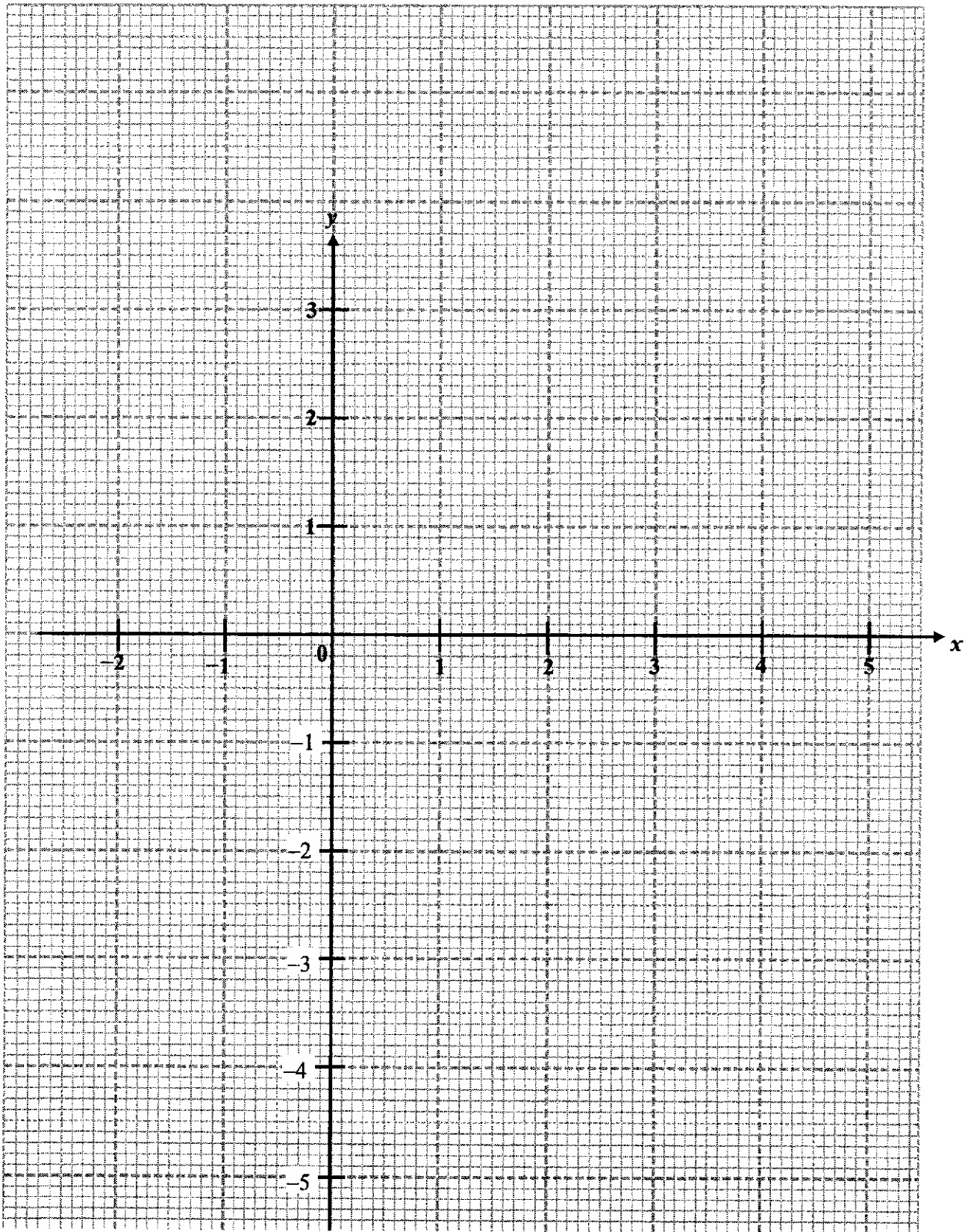
$x$	-2	-1	0	1	2	3	4	5
$y$	-3.6		2	1.2	-0.4	-1.6	-1.2	

[2]

- (b) On the grid in the next page, draw the graph of  $y = \frac{x^3}{5} - x^2 + 2$  for  $-2 \leq x \leq 5$ .

[3]

Answer (b), (c) and (d)



[Turn over

12

- (c) By drawing a tangent, find the gradient of the curve at the point when  $x = 4$ .

*Answer* ..... [2]

- (d) By drawing a suitable straight line on the grid, solve the equation  $\frac{x^3}{5} - x^2 + 1 = 0$ .

*Answer*  $x =$  ..... or ..... or ..... [3]

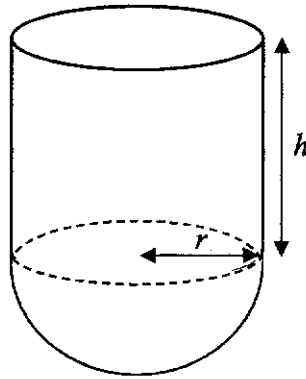
- (e) “ $y = k$  will always have exactly three intersections with  $y = \frac{x^3}{5} - x^2 + 2$  when  $k$  is negative.”

The above statement is false. Suggest a possible value of  $k$ .

*Answer*  $k =$  ..... [1]

[Turn over

- 5 (a) The diagram shows a container which consists of a cylinder of radius  $r$  cm and height  $h$  cm joined to a hemisphere of radius  $r$  cm.



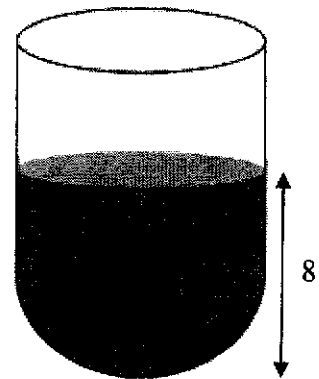
- (i) Given that the ratio of the volume of the hemisphere to the volume of the cylinder is 1 : 3, show that  $h = 2r$ .

*Answer* .....

[2]

- (ii) The container is filled with water to a depth of 8 cm.

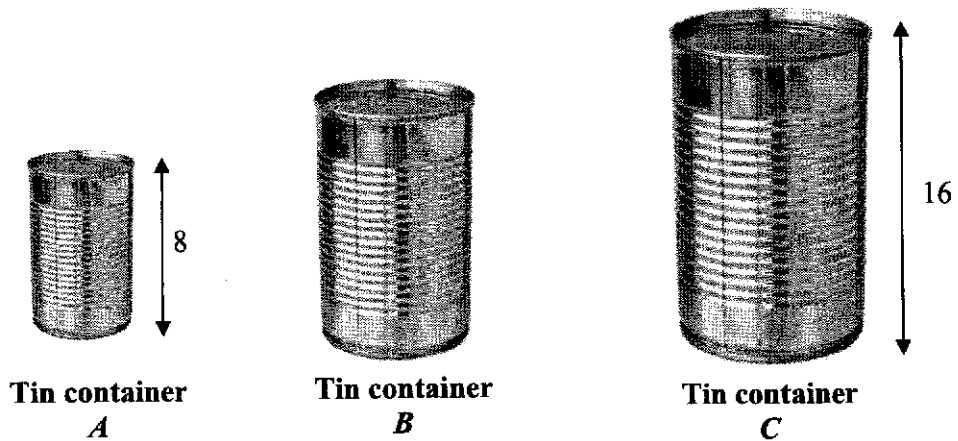
Find an expression, in terms of  $\pi$  and  $r$ , for the surface area of the container that is in contact with the water.



*Answer* .....  $\text{cm}^2$  [2]

[Turn over

- (b) Three tin containers are geometrically similar.  
The heights of tin container *A* and tin container *C* are 8 cm and 16 cm respectively.



- (i) The base area of tin container *B* is  $\frac{25}{64}$  of the base area of tin container *C*.

Calculate the height of tin container *B*.

*Answer* ..... cm [2]

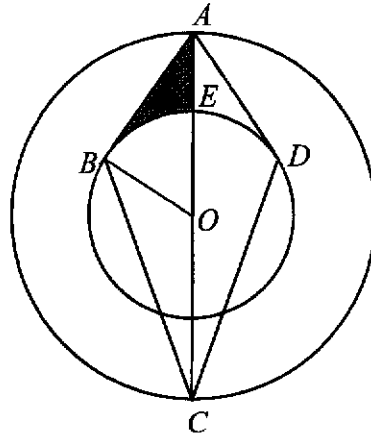
- (ii) The weight of tin container *C* is 450 g.

Calculate the weight of tin container *A*.

*Answer* ..... g [2]

[Turn over

- 6 The diagram, not drawn to scale, shows two concentric circles, centre  $O$ .  
 $AB$  and  $AD$  are tangents to the smaller circle at  $B$  and  $D$  respectively, centre  $O$ .  
 $AC$  is the diameter of the larger circle.



- (a) Show that triangle  $ABC$  is congruent to triangle  $ADC$ .  
 Give a reason for each statement you make.

.....

.....

.....

.....

.....

.....

[3]

- (b) The radius of the larger circle is 8 cm and angle  $BAO = 42.5^\circ$ .  
 (i) Calculate the area of triangle  $AOB$ .

Answer ..... cm<sup>2</sup> [3]

[Turn over

16

- (ii) Calculate the area of the shaded region.

*Answer* ..... cm<sup>2</sup> [3]

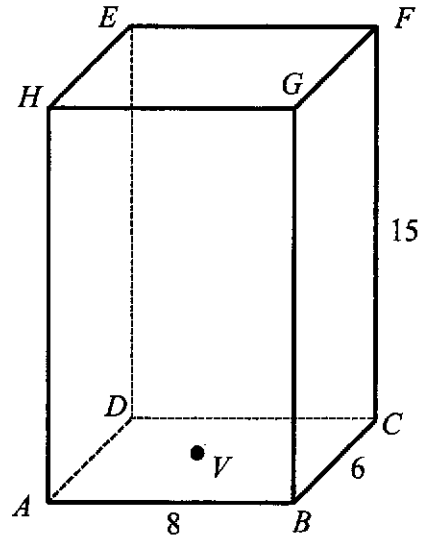
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**[Turn over**



17

7



In the diagram,  $ABCDEFGH$  is a cuboid with dimensions 8 cm by 6 cm by 15 cm.  $V$  is the centre of the rectangular base.

- (a) Show that  $EV = 15.8$  cm, correct to 3 significant figures.

*Answer*

[2]

[Turn over

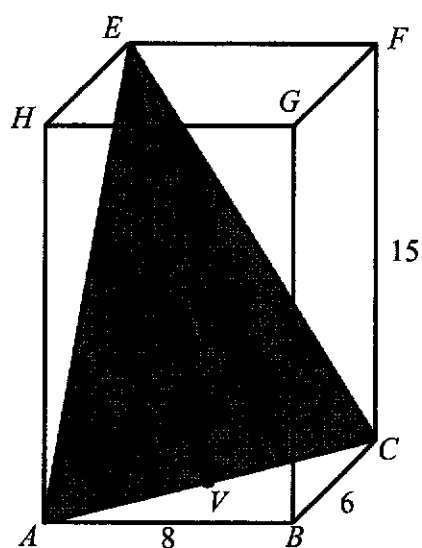
(b) Calculate angle  $ACE$ .

*Answer* .....° [4]

**[Turn over**

19

- (c) A pyramid  $EDAC$  is cut out from the cuboid.



Find the remaining volume of the cuboid.

Answer .....  $\text{cm}^3$  [3]

[Turn over

20

- 8 (a)  $A$  is the point  $(1, -4)$  and  $B$  is the point  $(-7, -2)$ .

The point  $C$  is the result of the translation of point  $B$  by  $\begin{pmatrix} 5 \\ 4 \end{pmatrix}$ .

- (i) Find the length of  $AB$ .

*Answer* ..... units [1]

- (ii) Write down the column vector  $\overline{AB}$ .

*Answer*  $\overline{AB} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$  [1]

- (iii) Find the coordinates of point  $C$ .

*Answer* (....., .....) [1]

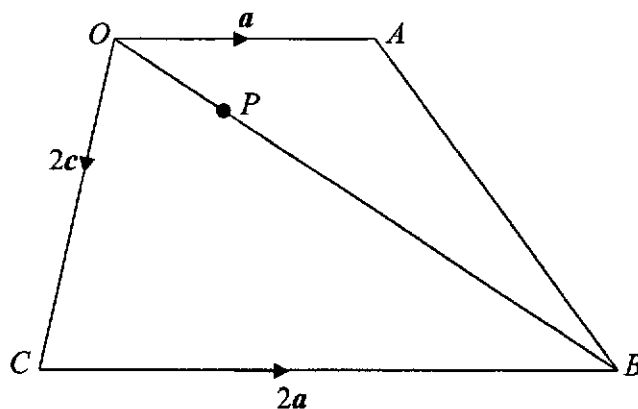
- (iv) Find the equation of the line  $AC$ .

*Answer* ..... [3]

[Turn over

21

(b)



$OACB$  is a trapezium.

$\overrightarrow{OA} = \mathbf{a}$ ,  $\overrightarrow{OC} = 2\mathbf{c}$  and  $\overrightarrow{CB} = 2\mathbf{a}$ .

$OP : PB = 1 : 3$ .

- (i) Express  $\overrightarrow{OB}$  in terms of  $\mathbf{a}$  and  $\mathbf{c}$ , as simply as possible.

Answer ..... [1]

- (ii) Express  $\overrightarrow{CP}$  in terms of  $\mathbf{a}$  and  $\mathbf{c}$ , as simply as possible.

Answer ..... [2]

- (iii) Explain why  $C$ ,  $P$  and  $A$  do not lie on a straight line.

.....  
 .....  
 .....

[2]

[Turn over

- (iv) Write down the value of  $\frac{\text{area of triangle } OBC}{\text{area of trapezium } OABC}$ .

*Answer* ..... [1]

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[Turn over

- 9 The table below shows the price board displayed at a petrol station on 12 April 2023.

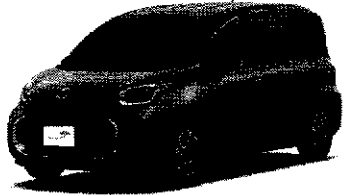
Grade	Pump price (per litre)	Nett price (per litre)
Levo 98	\$3.41	$x$
Levo 95	\$2.92	\$2.77
Levo Diesel	\$2.69	\$2.55

Pump price refers to the price before a discount is given, whereas nett price refers to the price after a discount is given. The discount given for the 3 grades is the same.

- (a) Find the value of  $x$ .

*Answer*  $x = \dots\dots\dots$  [1]

- (b) Mrs Ong always drives her car from her house in Singapore to Malacca to visit her parents.  
Below is some information about her car.

Fuel tank capacity: 11.0952 gallon	
Fuel consumption: 47 miles per gallon (mpg)	

Fuel consumption is distance travelled per unit volume of fuel used.

1 mpg = 0.42554 km/ litres.

1 gallon = 3.7855 litres.

Mrs Ong decided to visit her parents during Labour Day.  
She pumped a full tank of Levo 95 for the car and drove a distance of 244 km.  
The tank was left with 70% of fuel in the end.

Mrs Ong made two claims:

“The fuel consumption was 47 mpg.”

and

“The total discount she received would allow her to travel an extra distance of approximately 13.6 km.”

Were her claims correct?

Justify your decisions and show your calculations clearly.

*Answer*



*Answer*

.....

.....

[7]

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**End of Paper**

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**Answer Scheme**  
**Sec 4E/5N Mathematics Preliminary Examination Paper 1, 2024**

Qn	Answer	Marks	Remarks
1a	3.58	B1	
2a	$12x^2y^5$	B1	
2b	$6x - 8$	B1	$3(2x - 4)$ not accepted
3	$2x^3 - 13x^2 + 6x$ $= x(2x^2 - 13x + 6)$ $= x(2x - 1)(x - 6)$	B1, B1	Fact. x or quadratic expression B1, B1
4	$36.9^\circ$ or $143.1^\circ$	B1, B1	
5a	7.75	B1	

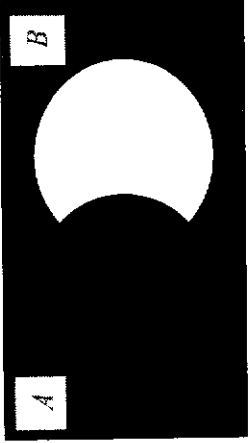
Qn	Answer	Marks	Remarks
5b	$\frac{(12 \times 8) + (3 + 6 + 7 + 8 + 9 + 9 + 10 + 10)}{20}$ $= \frac{96 + (62)}{20}$ $= \frac{158}{20}$ $= 7.9$	M1    A1	
6a	$12250 \times \frac{p}{q}$ $12250 = 2 \times 5^3 \times 7^2$ $p = 7 \quad q = 2$	B1 B1, B1	
6b	$12250 = 2 \times 5^3 \times 7^2$ $x = 2 \times 5^3 \times 3$ <p>-----</p> $\text{HCF} = 250 = 2 \times 5^3$ $\therefore x = 750$		
7	$81^{2x} \times 9^x = 27$ $(3^4)^{2x} \times (3^2)^x = 3^3$ $8x + 2x = 3$ $x = \frac{3}{10} / 0.3$ <p>or</p> $9^{4x} \times 9^x = 9^{1.5}$ $5x = 1.5$ $x = 0.3$ $x = \frac{3}{10} / 0.3$	B1   M1 A1	See base 3 or base 9

Qn	Answer	Marks	Remarks																		
8	<p><u>Top</u> Perimeter = 20 length + breadth = 10</p> <table border="1"> <thead> <tr> <th>Paired No.</th> <th>Area of top</th> <th>Height</th> </tr> </thead> <tbody> <tr> <td>1, 9</td> <td>Reject &lt; 3</td> <td></td> </tr> <tr> <td>2, 8</td> <td>Reject &lt; 3</td> <td></td> </tr> <tr> <td>3, 7</td> <td>Reject ≤ 3</td> <td></td> </tr> <tr> <td>4, 6</td> <td>4 × 6 = 24</td> <td>Height = <math>\frac{120}{24} = 5</math></td> </tr> <tr> <td>5, 5</td> <td>Reject, cannot be same length = cube</td> <td></td> </tr> </tbody> </table> <p><b>Or</b> <math>120 = 2 \times 2 \times 2 \times 3 \times 5</math> By trial and error, Height = 5 cm</p>	Paired No.	Area of top	Height	1, 9	Reject < 3		2, 8	Reject < 3		3, 7	Reject ≤ 3		4, 6	4 × 6 = 24	Height = $\frac{120}{24} = 5$	5, 5	Reject, cannot be same length = cube		<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p>Prime factors</p>
Paired No.	Area of top	Height																			
1, 9	Reject < 3																				
2, 8	Reject < 3																				
3, 7	Reject ≤ 3																				
4, 6	4 × 6 = 24	Height = $\frac{120}{24} = 5$																			
5, 5	Reject, cannot be same length = cube																				
9	$T = 2\pi \sqrt{\frac{L}{g}}$ $\frac{T}{2\pi} = \sqrt{\frac{L}{g}}$ $\frac{L}{g} = \frac{T^2}{(2\pi)^2}$ $g = \frac{4\pi^2 L}{T^2}$	<p>M1</p> <p>M1</p> <p>A1</p>	<p>Divide <math>2\pi</math></p> <p>Square both sides</p>																		

Qn	Answer	Marks	Remarks
10a	$310^\circ \pm 1^\circ$ (309°–311°)	B1	
10b	See behind (Construct 5 cm radius) 4/4.5/5 km (Convert to km)	M1 A1	
11ai	$Mean = \frac{282}{50}$ = 5.64	B1	
11aii	<ul style="list-style-type: none"> <li>- There is no exact data of each child's time spent on playing online games</li> <li>- The average for time spent on playing games is used in the calculation</li> <li>- The time spent is given as a range of values</li> <li>- The mid value average is used when calculating the mean</li> </ul>	B1	
11b	$SD = \sqrt{\frac{1906}{50} - \left(\frac{282}{50}\right)^2}$ = 2.51	M1 (ecf mean) A1	Show correct substitution of each value in formula



Qn	Answer	Marks	Remarks
12	$\frac{x}{4} - \frac{y}{2} = 2 \text{-----(1)}$ $3x = 19 + 4y \text{-----(2)}$ $(1) \times 4$ $x - 2y = 8$ $x = 8 + 2y \text{-----(3)}$ <p>sub (3) into (2)</p> $3(8 + 2y) = 19 + 4y$ $24 + 6y = 19 + 4y$ $y = -2.5$ $x = 8 + 2(-2.5)$ $x = 3$	<p>M1</p> <p>A1</p> <p>A1</p>	
13a	$5y(x - 4)$	BI	
13bi	$A \cap B'$ $A' \cap B'$ $B' \cap (A \cup B)$	BI	

Qn	Answer	Marks	Remarks
13bii	$\xi$ 	B1	
14a	$1 - \frac{5}{9} - \frac{2}{15}$ $= \frac{14}{45}$	B1	

Qn	Answer	Marks	Remarks
14b	<p>3 parts -- &gt; 10 + 8 balls</p> <p>1 part -- &gt; 6 balls</p> <p>2 parts -- &gt; 12 balls</p> <p><math>n = 12 - 7</math></p> <p><math>n = 5</math> balls</p> <p><b>OR</b></p> $\frac{7+n}{10+7+8+n} = \frac{2}{5}$ <p><math>3n = 15</math></p> <p><math>n = 5</math></p> <p><b>OR</b></p> <p>P(pick red and blue balls) = <math>\frac{3}{5}</math></p> <p>3 parts -- &gt; 10 + 8 balls</p> <p>1 part -- &gt; 6 balls</p> <p>2 parts -- &gt; 12 balls</p> <p><math>n = 12 - 7</math></p> <p><math>n = 5</math> balls</p>	<p>MI</p> <p>AI</p>	
15	$\frac{3}{5+3} \times 100\%$ <p>= 37.5%</p>	<p>MI</p> <p>AI</p>	



Qn	Answer	Marks	Remarks
	<b>Method 2</b> $k = xy^2$ $x_1 = \frac{xy^2}{(5y)^2}$ $x_1 = \frac{x}{25}$ $x - \frac{x}{25} = \frac{24x}{25}$ $\text{Percentage change} = \frac{\frac{24x}{25}}{x} \times 100\%$ $= 96\%$	M1	
17a	90	B1	
17b	$L_n = (n-1) + (n-1) + 10 + n + 10$ $= 3n + 18$	B1 (See 3n) B1 (See 18)	
17c	$L_n = 3n + 18$ $= 3(n+6)$ <i>shown</i>	B1 (no ecf)	
18a	$\tan \angle ABC = \frac{8.4}{5}$ $\angle ABC = 59.2^\circ$ OR $AB = 9.77548$ $\angle ABC = \sin^{-1}\left(\frac{8.4}{9.77548}\right)$ $\angle ABC = 59.2^\circ$	M1 A1	

Qn	Answer	Marks	Remarks
18b	$\sin 48^\circ = \frac{8.4}{AD}$ $AD = 11.3$	M1 A1	
19	$x^2 + 5x - 16 = 0$ $(x + 2.5)^2 - (2.5)^2 = 16$ $(x + 2.5)^2 = 6.25 + 16$ $(x + 2.5)^2 = 22.25$ $x + 2.5 = \pm\sqrt{22.25}$ $x = -2.5 \pm \sqrt{22.25}$ $x = 2.22 \text{ or } -7.22$	M1 M1 A1, A1	See completing the sq Sq rt
20a	$\sin \angle AXC = \frac{3}{5}$ $BX = 4$ $\tan \angle AXB = \frac{3}{4}$	M1 A1	
20b	$\tan \angle ACB = \frac{3}{4+2}$ $= \frac{1}{2}$	M1 A1	

Qn	Answer	Marks	Remarks
21	<p>Polygon Q interior <math>\angle(Q) = 180^\circ - 18^\circ</math> <math>= 162^\circ</math></p> <p>sum of interior <math>\angle</math> hexagon (P) <math>= (6 - 2) \times 180^\circ</math> <math>= 720^\circ</math></p> <p><math>162^\circ + 162^\circ + a + b + c + d + e + f + 720^\circ = 360^\circ \times 6</math> <math>a + b + c + d + e + f + 1044^\circ = 2160^\circ</math> <math>a + b + c + d + e + f = 1116^\circ</math></p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>Int. angle for Q</p> <p>Int. angle for P</p>
22a	<p>Reflex <math>\angle AOC = 360^\circ - 4x^\circ</math> (Angles at a point)</p> <p><math>\angle ABC = \frac{360^\circ - 4x^\circ}{2}</math> (Angle at centre = twice angle at circum)</p> <p><math>= 180^\circ - 2x^\circ</math></p>	<p>M1</p> <p>A1</p>	
22b	<p><math>\angle BAC = 180^\circ - x^\circ - (180^\circ - 2x^\circ)</math> (Sum of angles in a tri.) <math>= x^\circ</math></p> <p><math>\angle BAE = 90^\circ - (90^\circ - 2x^\circ) - x^\circ</math> (rad <math>\perp</math> tan) <math>= x^\circ</math></p>	<p>M1</p> <p>A1</p>	
23a	<p><math>N = v \times 0.9^{2t}</math></p> <p><math>81\,000 = v \times 0.9^2</math></p> <p><math>v = 100\,000</math></p>	<p>BI</p>	

Qn	Answer	Marks	Remarks
23b	$N = v \times 0.9^{2t}$ $N = v \times 0.81^t$ $N = kv$ $k = \frac{N}{v}$ or $k = 100000k$	B1	
23c	At $t = 2$ hours $N = 100\,000 \times 0.9^{2(2)}$ $N = 65\,610$ $\text{Percentage decrease} = \frac{100\,000 - 65\,610}{100\,000} \times 100\%$ $= 34.39\%$	M1  A1	ecf 100 000
23d	Diagram 4	B1	
24a	$\frac{1}{b} : \frac{1}{a}$ and $3a : 3b$	-1 (1 incorrect) -2 (2 or more incorrect)	



Qn	Answer	Marks	Remarks
24b	<p> <math>J : S</math>  <math>6 : 2</math> (multiple 7)  <math>42 : 14</math> </p> <p> <math>J : S</math>  <math>2 : 5</math> (multiple 8)  <math>16 : 40</math> </p> <p>           Difference in John's units = <math>42 - 16</math>  <math>= 26</math>  <math>26 \text{ units} \text{ ----} &gt; \\$13</math>  <math>1 \text{ unit ----} &gt; \\$0.5</math>  <math>16 \text{ units ----} &gt; 16 \times \\$0.5 = \\$8</math> </p> <p>OR</p> $\frac{6x - 13}{2x + 13} = \frac{2}{5}$ $x = 3.5$ $6x - 13$ $= 6(3.5) - 13$ $= 8$	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	

Qn	Answer	Marks	Remarks
25a	<b>Method 1</b> $\angle DEF = \angle FEC = x^\circ$ (FE bisects $\angle DEC$ ) $\angle DEF = \angle EFC = x^\circ$ (Alt $\angle$ , $DE \parallel BC$ ) $\angle ECF = 180^\circ - x^\circ - x^\circ$ (Angles in a str. line) $= 180^\circ - 2x^\circ$	M1 A1	State angle $EFC = x$
	<b>Method 2</b> $\angle DEF = \angle FEC = x^\circ$ (FE bisects $\angle DEC$ ) $\angle ECF = 180^\circ - 2x^\circ$ (int. $\angle$ , $DE \parallel BC$ )	M1 A1	State angle $EFC = x$
25b	$\angle DAE = \angle FEC = x^\circ$ (Corresp. $\angle$ , $FE \parallel DA$ ) $\angle ABF = \angle ADE = \angle EFC = x^\circ$ (Corresponding angle) $\angle AED = \angle ECF = 180^\circ - 2x^\circ$ (interior angle) Triangle $\angle AED$ is similar triangle $\angle ECF$ (AA similarity test)	M1, M1, A1	Any two reason stated  State sim. test
	<b>Additional Working</b> $\angle AED = 180^\circ - 2x^\circ$ (Angles in a str. line) $\angle DEF = \angle DBF = x^\circ$ (Opp. $\angle$ , in a parallelogram) $\angle DBF = \angle ADE = x^\circ$ (Corresp. $\angle$ , $DE \parallel BF$ ) $\angle DAE = \angle FEC = x^\circ$ (Corresp. $\angle$ , $FE \parallel DA$ )		
25c	ACB	B1	
26a	$F = \begin{pmatrix} 30 \\ 40 \\ 50 \end{pmatrix}$	B1	

Qn	Answer	Marks	Remarks
26b	$C = \begin{pmatrix} 22 & 20 & 9 \\ 8 & 10 & 11 \end{pmatrix} \begin{pmatrix} 30 \\ 40 \\ 50 \end{pmatrix}$ $C = \begin{pmatrix} 1910 \\ 1190 \end{pmatrix}$	B1, B1	B1 for 1 correct element
26c	<p>- 1910 represents the total fees for beginner, intermediate and advanced classes on weekdays.</p> <p>- 1190 represents the total fees for beginner, intermediate and advanced classes on weekends.</p>	B1	
26d	<p>Participants in September</p> $\text{Beginner} = (22 + 8) \times 0.8 = 24$ $\text{Intermediate} = (20 + 10) \times 1.1 = 33$ $\text{Advanced} = (20) \times 3 = 60$ $\text{Total fees for September} = (24 \times 30) + (33 \times 40) + (60 \times 50)$ $= 5040$ $\text{Percentage increase} = \frac{5040 - 3100}{3100} \times 100\%$ $= 62.6\% \text{ or } 62\frac{18}{31}\%$	M1  M1 A1	See total fees for Sept
<b>Total</b>		<b>90</b>	

Scale: 1 cm to 5 km

In the scale drawing,  $A$  is the centre of a rock bed,  $A$  is a ship and  $B$  is a port. The line  $AB$  shows the ship's course.

(a) Measure the bearing of  $B$  from  $A$ .

*Answer* ...

(b) The rock bed covers a 25 km radius.

Will the ship's course clear the rock bed? Justify your answer.

NAVAL BASE SECONDARY SCHOOL  
PRELIMINARY EXAMINATION, 2024  
Paper 2  
Marking Scheme

Qns	Solution	Marking Scheme	Remarks
1(a)	$x + \frac{2x-3}{5} = -6$ $\frac{4x + 5(2x-3)}{20} = -6$ $4x + 10x - 15 = -120$ $14x = -120 + 15$ $14x = -105$ $x = -7.5$	M1 A1	
1(b)	$\frac{2(p-3q)}{10r} \div \frac{(3q-p)^2}{r}$ $= \frac{2(p-3q)}{10r} \times \frac{r}{(3q-p)^2}$ $= \frac{2(p-3q)}{10r} \times \frac{r}{(p-3q)^2}$ $= \frac{1}{5(p-3q)} \text{ or } \frac{-1}{5(3q-p)} \text{ or } \frac{-1}{15q-5p}$	M1 A1	

NAVAL BASE SECONDARY SCHOOL  
PRELIMINARY EXAMINATION, 2024

Paper 2  
Marking Scheme

<p>1(c)</p>	<p><b>Method 1:</b>  <math>x+1 \leq \frac{7x-2}{4} &lt; \frac{5x+19}{5}</math>  <math>x+1 \leq \frac{7x-2}{4}</math> and <math>\frac{7x-2}{4} &lt; \frac{5x+19}{5}</math>  <math>4(x+1) \leq 7x-2</math> <math>5(7x-2) &lt; 4(5x+19)</math>  <math>4x+4 \leq 7x-2</math> <math>35x-10 &lt; 20x+76</math>  <math>-3x \leq -6</math> <math>35x-20x &lt; 76+10</math>  <math>x \geq 2</math> <math>15x &lt; 86</math>  <math>x &lt; 5\frac{11}{15}</math>  <math>\therefore 2 \leq x &lt; 5\frac{11}{15}</math> or <math>2 \leq x &lt; \frac{86}{15}</math></p> <p><b>OR</b></p>	<p>M1 --- <math>x \geq 2</math>  M1 --- <math>x &lt; 5\frac{11}{15}</math>  A1 --- <math>2 \leq x &lt; 5\frac{11}{15}</math></p>	<p>Deduct 1m for <math>2 \leq x &lt; 5.73</math>  No marks given for <math>5\frac{11}{15} &gt; x \geq 2</math></p>
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NAVAL BASE SECONDARY SCHOOL  
 PRELIMINARY EXAMINATION, 2024  
 Paper 2  
 Marking Scheme

	<p><b>Method 2:</b></p> $x + 1 \leq \frac{7x - 2}{4} < \frac{5x + 19}{5}$ $20(x + 1) \leq 5(7x - 2) < 4(5x + 19)$ $20x + 20 \leq 35x - 10 < 20x + 76$ $20x + 30 \leq 35x < 20x + 86$ $30 \leq 15x < 86$ $2 \leq x < 5\frac{11}{15} \text{ or } 2 \leq x < \frac{86}{15}$	<p>M1</p> <p>M1</p> <p>A1</p>	
1(d)	$\frac{2y^2 + 7y - 9}{4y^2 - 81}$ $= \frac{(2y + 9)(y - 1)}{(2y + 9)(2y - 9)}$ $= \frac{y - 1}{2y - 9}$	<p>M1 --- correct numerator</p> <p>M1 --- correct denominator</p> <p>A1 [10]</p>	<p>Deduct 1m for changing y to x:</p> $\frac{(2x + 9)(x - 1)}{(2x + 9)(2x - 9)} = \frac{x - 1}{2x - 9}$
2(a)(i)	<p>First \$10 000:</p> $\text{Interest} = \frac{10000 \times 4 \times 0.05}{100} = \$20$ <p>Next \$20 000:</p> $\text{Interest} = \frac{20000 \times 4 \times 0.95}{100} = \$760$ <p>Total amount = \$30 000 + \$20 + \$760 = \$30 780</p>	<p>M1</p> <p>M1</p> <p>A1</p>	

NAVAL BASE SECONDARY SCHOOL  
 PRELIMINARY EXAMINATION, 2024  
 Paper 2  
 Marking Scheme

2(a)(ii)			If 2a(i) or 2a(ii) wrong, no marks given for correct conclusion.
Bank L: Total amount = $30000 \left( 1 + \frac{0.8}{100} \right)^4$  = \$30 971.58	M1		
Since the total amount in Bank L > total amount of Bank H after 4 years, I <u>disagree</u> with Cheryl's claim.	A1	A1	



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2(b)(i)	<p><b>Hong Kong Hotel:</b>                  HK\$1 = S\$0.17                  HK\$825 = S\$(825 × 0.17) = S\$140.25</p> <p><b>Guangzhou Hotel:</b>                  S\$1 = CNY\$5.33                  CNY\$825 = S\$ <math>\frac{825}{5.33}</math> = S\$154.78</p> <p>The Hong Kong hotel charges a cheaper rate per night.</p> <p><b>OR</b>                  HK\$1 = S\$0.17                  S\$1 = HK\$ <math>\frac{1}{0.17}</math> = HK\$5.8823</p> <p>Since S\$1 can get HK\$5.8823, by comparison with S\$1 = CNY\$5.33, CNY\$ is stronger than HK\$. Thus the Hong Kong hotel charges a cheaper rate per night.</p>	<p style="text-align: center;">} M1                  (either \$140.25 or \$154.78)</p> <p>A1</p>	
2(b)(ii)	<p>Total cost                  = <math>(4 \times 825 \times 0.17) + (2 \times 825 \times \frac{1}{5.33})</math>                  = 561 + 309.5684                  = S\$870.5684  <math>k = \frac{890 - 870.5684}{870.5684} \times 100</math>  <math>k = 2.23\%(3s.f)</math></p>	<p>M2 – Total cost in SGD</p> <p>M1                  A1 [12]</p>	
3(a)(i)			

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3(a)(ii)	Interquartile range = 15 - 10 = 5	M1 A1																			
3(a)(iii)	Percentage $= \frac{500 - 450}{500} \times 100$ = 10%	M1 A1																			
3(b)	Median in February 2021 = 13 is less than median in February 2022 = 16. Hence, the patients generally stayed longer in February 2022.	B1	If IQR in 3a(ii) wrong, answer will be wrong.																		
3(c)	Interquartile range in Feb 2021 = 5 is less than interquartile range of Feb 2022 = 12. Hence, the number of days stayed in February 2022 is generally less consistent/more wide spread.	B1 B1 B1 - state the figures correctly	Need to state the figures on the answer line.																		
3(d)	Probability $= \left( \frac{125}{500} \times \frac{500 - 125}{499} \right) + \left( \frac{500 - 125}{500} \times \frac{125}{499} \right)$ $= \frac{375}{998}$	B1 M1 A1 [11]	1m given for either of the fractions is correct.																		
4(a)	<table border="1" style="width: 100%; text-align: center;"> <tbody> <tr> <td><math>x</math></td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td><math>y</math></td> <td>-3.6</td> <td>0.8</td> <td>2</td> <td>1.2</td> <td>-0.4</td> <td>-1.6</td> <td>-1.2</td> <td>2</td> </tr> </tbody> </table>	$x$	-2	-1	0	1	2	3	4	5	$y$	-3.6	0.8	2	1.2	-0.4	-1.6	-1.2	2	B2 (B1 for each correct value)	
$x$	-2	-1	0	1	2	3	4	5													
$y$	-3.6	0.8	2	1.2	-0.4	-1.6	-1.2	2													

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4(b)	Refer to the graph.	P2 - Plotting of correct points (P1 for at most 2 points plotted incorrectly). C1 - Smooth curve.	
4(c)	Refer to graph for tangent drawn.  Using (3, - 2.8) and (5, 0.4), Gradient = $\frac{0.4 - (-2.8)}{5 - 3}$ = 1.6 (Accept 1.1 to 2.2)	B1 – tangent drawn	
4(d)	$\frac{x^3}{5} - x^2 + 2 = 1$ Refer to graph for $y = 1$ drawn.  Using the graph, $x = -0.9$ (accept - 0.8 to -1.0) or $x = 1.1$ (accept 1.0 to 1.2) or $x = 4.75$ (accept 4.6 to 4.9)	B1  B1 } B1 B1	
4(e)	True: 3 intersections - $-1.7 < k < 0$ False: $k < -1.7$ Accept all negative values	B1 [11]	
5(a)(i)	$3\left(\frac{2}{3}\pi r^3\right) = \pi r^2 h$ $2\pi r^3 = \pi r^2 h$ $2r = h$ (shown)	M1  A1	

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5(a) (ii)	$2\pi r^2 + 2\pi r(8-r)$ $= 2\pi r^2 + 16\pi r - 2\pi r^2$ $= 16\pi r$	M1 for either $2\pi r^2$ or $2\pi r(8-r)$ seen A1
5(b)(i)	$\frac{h_B}{h_C} = \sqrt{\frac{25}{64}}$ $\frac{h_B}{16} = \frac{5}{8}$ $h_B = \frac{5}{8} \times 16$ $h_B = 10$	M1 – Square root     A1
5(b) (ii)	$\frac{V_A}{V_C} = \left(\frac{8}{16}\right)^3$ $\frac{V_A}{450} = \frac{1}{8}$ $V_A = \frac{1}{8} \times 450$ $V_A = 56.25g$	M1 - $\left(\frac{8}{16}\right)^3$ OR $\left(\frac{1}{2}\right)^3$ seen   A1 [8]
6(a)	$AB = AD$ (tangents drawn from ext. point) angle $BAC =$ angle $DAC$ (tangents drawn from ext. point) $AC$ is a common side. $\triangle ABC \equiv \triangle ADC$ (SAS)	M1 (for only 1 condition) M2 (for all 3 conditions)  A1

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6(b)(i)	$\angle ABO = 90^\circ$ $AB = 8 \cos 42.5$ $AB = 5.8982186 \text{ cm}$ Area of triangle $= \frac{1}{2} \times 8 \times 5.8982186 \sin 42.5$ $= 15.93911$ $= 15.9 \text{ cm}^2$ (3s.f) <b>OR</b> $OB = 8 \sin 42.5$ $OB = 5.40472$ Area of triangle $= \frac{1}{2} \times AB \times OB$ $= \frac{1}{2} \times 5.8982186 \times 5.40472$ $= 15.9 \text{ cm}^2$	M1 (for either $AB$ or $OB$ )  M1 A1  M1 (for either $AB$ or $OB$ )  M1 A1	
6(b)(ii)	$\angle AOB = 180 - 90 - 42.5 = 47.5^\circ$ $\angle ABO = 90^\circ$ $OB = 8 \sin 42.5$ $OB = 5.404721 \text{ cm}$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <b>OR</b> <math>OB = \sqrt{8^2 - 5.8982186^2}</math>  <math>OB = 5.404721 \text{ cm}</math>            [M1]         </div> Area of sector $OBE$	M1 (allow e.c.f)	

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	$= \frac{47.5}{360} \times \pi \times 5.404721^2$ $= 12.10842$ $= 12.1 \text{ cm}^2$ <p>Area of shaded region  <math>= 15.93911 - 12.10842</math>  <math>= 3.83 \text{ cm}^2</math> (3 s.f.)</p>	M1 (allow e.c.f)	
		A1 [9]	
7(a)	$DV = VB$ $= \frac{1}{2} \sqrt{6^2 + 8^2}$ $= 5 \text{ cm}$ <i>EV</i> $= \sqrt{15^2 + 5^2}$ $= \sqrt{250}$ $= 15.8113883008 \text{ cm}$ $= 15.8 \text{ cm}$ (3s.f) (shown)	M1	
7(b)	<i>EC</i> $= \sqrt{15^2 + 8^2}$ $= 17 \text{ cm}$ <b>If <math>EV = 15.8 \text{ cm}</math></b> $\cos \angle ACE = \cos \angle VCE$	A1	
		M1	
		M1	

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<p>7(b)</p>	<p> <math>15.8^2 = 17^2 + 5^2 - 2(17)(5) \cos \angle VCE</math>  <math>-64.36 = -170 \cos \angle VCE</math>  <math>\angle VCE = \cos^{-1} \frac{64.36}{170}</math>  <math>\angle VCE = 67.75373</math>  <math>\angle VCE = 67.8^\circ</math> (1d.p)                 </p> <p> <b>If <math>EV = \sqrt{250}</math> cm</b>  <math>\cos \angle ACE = \cos \angle VCE</math>  <math>(\sqrt{250})^2 = 17^2 + 5^2 - 2(17)(5) \cos \angle VCE</math>  <math>-64 = -170 \cos \angle VCE</math> </p> <p> <math>\angle VCE = \cos^{-1} \frac{64}{170}</math> <span style="border: 1px solid black; padding: 2px;">M1</span>  <math>\angle VCE = 67.88476</math>  <math>\angle VCE = 67.9^\circ</math> (1d.p) <span style="border: 1px solid black; padding: 2px;">A1</span> </p>	<p>M1</p> <p>A1</p>	
<p> <b>OR</b>                      In <math>\triangle AEC</math>,  <math>EC = \sqrt{15^2 + 8^2}</math>  <math>= 17</math> cm  <math>AE = \sqrt{15^2 + 6^2}</math>  <math>= \sqrt{261}</math> cm                 </p>		<p>M1 --- any 2 lengths correct (<math>EC</math>, <math>AE</math> or <math>AC</math>)</p>	

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	$AC = \sqrt{8^2 + 6^2}$ $= 10 \text{ cm}$ Using cosine rule, $(\sqrt{261})^2 = 10^2 + 17^2 - 2(10)(17) \cos \angle ACE$ $\cos \angle ACE = \frac{128}{340}$ $\angle ACE = \cos^{-1} \left( \frac{128}{340} \right)$ $\angle ACE = 67.88^\circ$ $\angle ACE = 67.9^\circ \text{ (1d.p)}$	<p>M1</p> <p>M1</p> <p>A1</p>	
7(c)  Volume of cuboid $= 8 \times 6 \times 15$ $= 720 \text{ cm}^3$ Volume of pyramid $= \frac{1}{3} \times \left( \frac{1}{2} \times 6 \times 8 \right) \times 15$ $= 120 \text{ cm}^3$  Remaining volume of the cuboid $= 720 - 120$ $= 600 \text{ cm}^3$		<p>M1</p> <p>M1</p> <p>A1</p>	
8(a)(i)	Length of AB		



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	$= \sqrt{(1 - (-7))^2 + (-4 - (-2))^2}$ $= \sqrt{8^2 + (-2)^2}$ $= 8.25 \text{ units}^2 \text{ (3 s.f)}$	B1	
8(a)(ii)	$\overline{OA} = \begin{pmatrix} 1 \\ -4 \end{pmatrix}, \overline{OB} = \begin{pmatrix} -7 \\ -2 \end{pmatrix}$ $\overline{AB} = \overline{AO} + \overline{OB}$ $\overline{AB} = - \begin{pmatrix} 1 \\ -4 \end{pmatrix} + \begin{pmatrix} -7 \\ -2 \end{pmatrix}$ $\overline{AB} = \begin{pmatrix} -8 \\ 2 \end{pmatrix}$	B1	
8(a)(iii)	$\overline{OC} = \begin{pmatrix} -7 \\ -2 \end{pmatrix} + \begin{pmatrix} 5 \\ 4 \end{pmatrix}$ $\overline{OC} = \begin{pmatrix} -2 \\ 2 \end{pmatrix}$ $C(-2, 2)$	B1	
8(a)(iv)	Gradient $= \frac{-4 - 2}{1 - (-2)}$ $= -2$ Subst (1, -4)	M1 (allow e.c.f (a)(iii))	
		M1	

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	$y = -2x + c$ $-4 = -2(1) + c$ $c = -2$ Equation of line: $y = -2x - 2$	A1	
8(b)(i)	$\overline{OB} = 2c + 2a$ OR $\overline{OB} = 2a + 2c$ OR $\overline{OB} = 2(a + c)$	B1	
8(b)(ii)	$\overline{OP} = \frac{1}{4}\overline{OB}$ $\overline{OP} = \frac{1}{4}(2c + 2a)$ $\overline{CP} = \overline{CO} + \overline{OP}$ $\overline{CP} = -2c + \frac{1}{4}(2c + 2a)$ $\overline{CP} = -\frac{3}{2}c + \frac{1}{2}a$ OR $\overline{CP} = \frac{1}{2}a - \frac{3}{2}c$ <b>OR</b> $\overline{CP} = \overline{CB} + \overline{BP}$ $\overline{CP} = 2a - \frac{3}{4}(2c + 2a)$ $\overline{CP} = -\frac{3}{2}c + \frac{1}{2}a$ $\overline{CA} = -2c + a$	M1  A1  M1 A1	
8(b)(iii)	<b>OR</b> $\overline{PA} = \overline{PO} + \overline{OA}$ $\overline{PA} = -\frac{1}{2}c - \frac{1}{2}a + a$ $\overline{PA} = \frac{1}{2}a - \frac{1}{2}c = \frac{1}{2}(a - c)$	M1	If $\overline{CP}$ is wrong, then no A1 mark.

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	$\overline{CP} = -\frac{3}{2}c + \frac{1}{2}a$ $\overline{CP} = \frac{1}{2}(-3c + a)$	A1	
8(b)(iv)	Since $\overline{CA} \neq k\overline{CP}$ , $C$ , $P$ and $A$ do not lie on a straight line. $\frac{2}{3}$	B1 [12]	
9(a)	$x = \frac{3.41}{2.92} \times 2.77$ $= \$3.234$ $= \$3.23$ (2d.p) <b>OR</b> $x = \frac{3.41}{2.69} \times 2.55$ $= \$3.232$ $= \$3.23$ (2d.p)	B1	Accept 3.26 and 3.27 as answers.
9(b)	Fuel consumption of car $= 47 \times 0.42554$ $= 20.00038km / l$ Fuel tank capacity	M1 (either fuel consumption of car or fuel tank capacity is correct)	

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$= 11.0952 \times 3.7855$ $= 42.00087967$ <p>Amount of fuel used  <math>= 30\% \times 42.0008796</math>  <math>= 12.600263887</math></p> <p>Fuel consumption  <math>= \frac{244}{12.60026388}</math>  <math>= 19.364 \text{ km / l}</math>  <math>= 19.4 \text{ km / l (3s.f.)} &lt; 20.00038 \text{ km / l}</math></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><b>Alternative solution:</b>                  Fuel consumption  <math>= \frac{19.364}{0.42554}</math>  <math>= 45.5 \text{ mpg} &lt; 47 \text{ mpg}</math></p> </div>	M1
<p>Since fuel consumption is lesser, Mrs Ong claim for fuel consumption was incorrect.</p>	A1
<p>Total discount  <math>= (\\$2.92 - \\$2.77) \times 12.60026388</math>  <math>= \\$1.890039582</math></p>	M1
<p>Extra amount of fuel  <math>= \frac{1.890039582}{2.77}</math>  <math>= 0.6823247587</math>                  Extra distance</p>	M1

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$= 20.00038 \times 0.682324758$ $= 13.64675$ $= 13.6 \text{ km (3s.f)}$ <p>Mrs Ong claim for the extra distance was correct.</p> <p><b>OR</b></p> <p>Total discount  <math>= (\\$2.92 - \\$2.77) \times 42.0008796</math>  <math>= \\$6.30013194</math></p> <p>Extra amount of fuel  <math display="block">\frac{6.30013194}{2.77}</math> <math display="block">= 2.27441581</math></p> <p>Extra distance  <math>= 20.00038 \times 2.2744158</math>  <math>= 45.489</math>  <math>= 45.5 \text{ km (3s.f)}</math></p> <p>Mrs Ong claim for the extra distance was incorrect.</p>	<p>M1  A1 [8]</p> <p>M1</p> <p>M1</p> <p>M1  A1</p>	
	<b>Total</b>	<b>90 marks</b>

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Q4(b)

