STUDENT NAME	

CLASS		REGISTER NUMBER		

MATHEMATICS

4052/02

Paper 2

10 October 2023
2 hours 15 minutes

Candidates answer on the question paper
Additional Materials: graph paper

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** the 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 π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 90.

For Examiner's Use	
Total	**/90**

Do not turn over this question paper until you are told to do so.

This question paper consists of **21** printed pages.

[Turn Over

Mathematical Formulae

Compound Interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Answer **all** the questions

1   **(a)** By writing each number correct to 1 significant figure, estimate the value of

$$\frac{\sqrt{54.3 \times 7.9}}{3.56}.$$

Answer ....   [2]

(b) Given $0.65 \times 10^3 = a \times 10^{-1}$, find the value of a.

Answer ....   [2]

2   **(a)** Given that $7^{-5} \times 7^{2k} = 1$, find the value of k.

Answer k = ...   [2]

(b) Solve the inequality $3x - 5 < 15 - 2x \leq x + 22$.

Answer ....   [3]

(c) Represent your answer in part **(b)** on the number line given.

[1]

[Turn Over
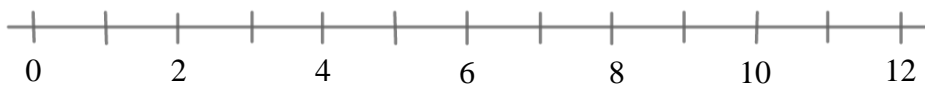
3   **(a)** Alice uses all 320 one-centimetre cubes to make a décor, which is in the shape of a cuboid. The perimeter of the top of the cuboid is 26 cm.

Given that each side of the cuboid has a length greater than 3 cm, find the height of the cuboid.

Answer ....   [3]

(b) Given $4320 = 2^5 \times 3^3 \times 5$. Find the smallest positive integer n such that $\dfrac{4320}{n}$

is a perfect cube.

Answer n=.................................   [1]

4   The temperature at the base of Mt Everest is $5°C$.

The temperature at the top of Mt Everest is $-11°C$.

(a) Find the difference between the two temperatures.

Answer ....°C   [1]

(b) Assuming that the temperature falls at a steady rate as height increases and the height of Mt Everest is 8850 m. At a particular point, the temperature is $0°C$, how high is this point above the base of Mt Everest?

Answer .... m   [2]

5   **(a)** The length of a rectangle is increased by 10%. At the same time, its breadth is decreased by 18%. Find the percentage increase or decrease in its area.

Answer ....%   [3]

[Turn Over

(b) Ken is returning to Singapore from Tokyo. He decided to book the following flight.

Depart – Tokyo to Singapore

From (time)	To (time)	Price (¥)
Tokyo	Singapore	32400

Fares include airport tax and fuel surcharge.

Add-ons: ¥6200 for 20 kg check-in baggage, meal, drink and snack.

Ken decided to purchase the add-ons. He booked the flight using his credit card which requires him to pay a processing fee at 5% of the total fare.

The exchange rate for the day was:

1 Singapore dollar (SGD) = 106.80 Japanese Yen (¥)

Calculate the total amount of money Ken needs to pay in Singapore dollars.

Answer $.................................   [3]

6   **(a)** A housewife planned to buy \$30 worth of vegetables at x cents per kg. Write down an expression, in terms of x, for the number of kg she planned to buy.

Answer ....kg   [1]

(b) She found that the price of vegetables had decreased by 6 cents per kg. Write down an expression in terms of x for the number of kg she can buy for \$30 now.

Answer ....kg   [1]

(c) Given that she actually bought $5\frac{5}{9}$ kg more than she had planned, form an equation in x and show that it reduces to $x^2 - 6x - 3240 = 0$.

Answer   [3]

(d) Solve the quadratic equation $x^2 - 6x - 3240 = 0$ and use your answer to find the number of kg of vegetables she bought after the price had decreased.

Answer ....kg   [3]

[Turn Over

7   The table below shows some values of x and the corresponding values of y, where

$y = x^2 + \dfrac{3}{x}$.

x	0.5	1	1.5	2	2.5	3	3.5	4
y	6.25	4	a	5.5	7.45	10	13.11	16.75

(a) Find the value of a.

Answer a = ...   [1]

(b) On the grid on **page 9**, draw the graph of $y = x^2 + \dfrac{3}{x}$ for $0.5 \le x \le 4$ [3]

(c) Using your graph, estimate the solution of the equation $9 = x^2 + \dfrac{3}{x}$.

Answer x = ... , ...   [2]

(d) By drawing a tangent, find the gradient of the curve at the point where $x = 3$.

Answer ....
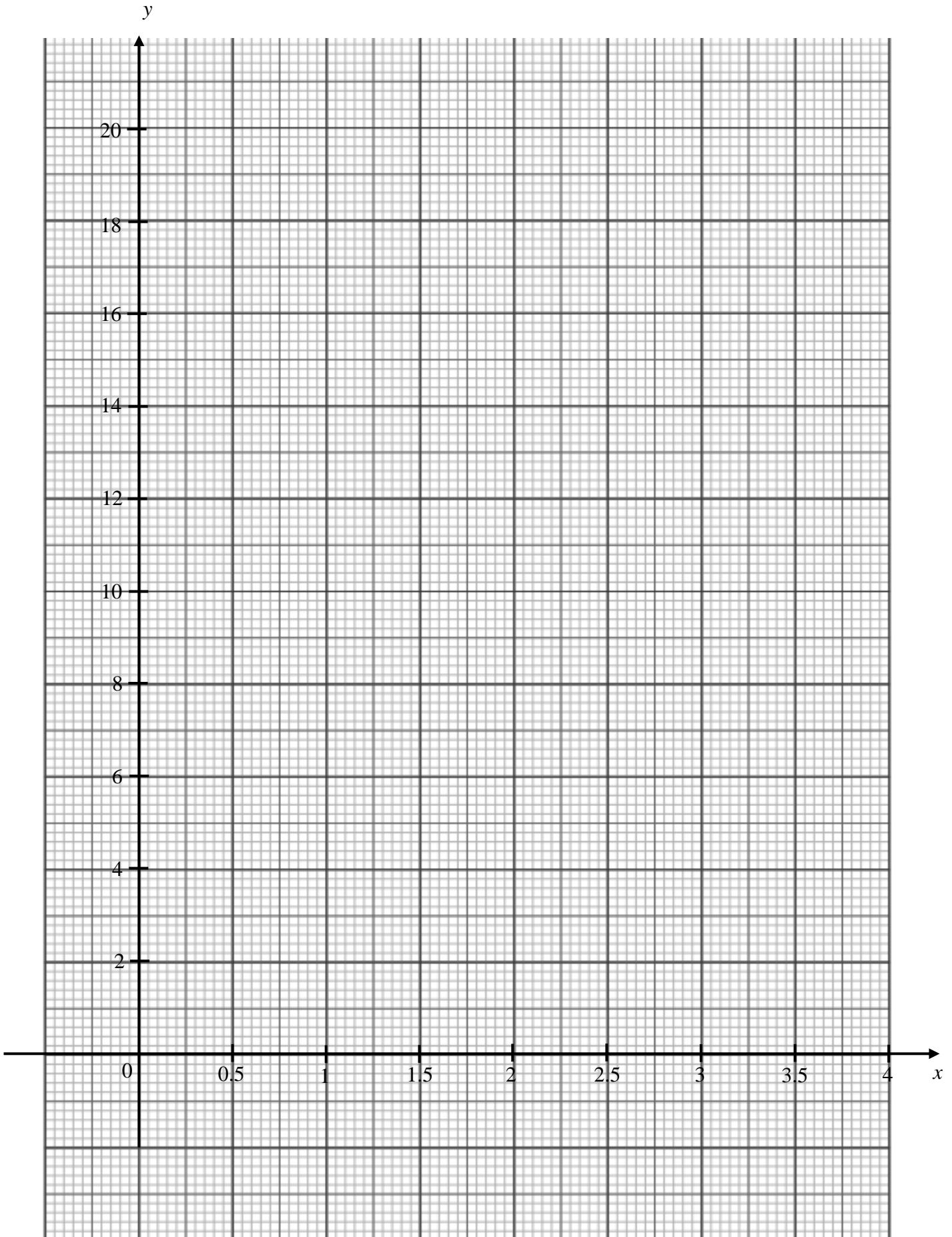
[2]

(e) A line of equation $y = k$, where k is a constant, is a tangent to the curve.

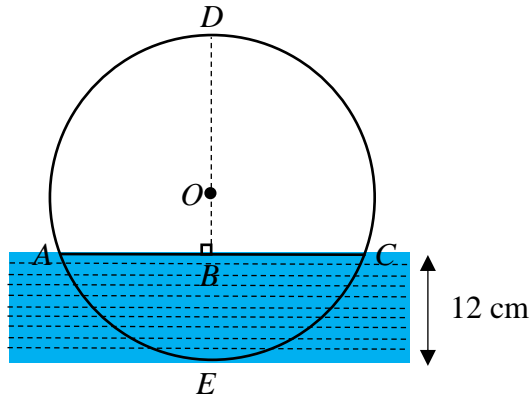Draw this tangent and find the value of k.   [2]

8   A cylindrical pipe is partially submerged in water.

The cross-section of the pipe is a circle of centre *O* and radius 17 cm, passing through *A*, *D*, *C* and *E*.

ABCD is a major segment of the circle that is above the water level, angle *ABD* = 90°.

(a) Show that angle *AOB* = 72.9°, correct to 1 decimal place.

Answer   [2]

(b) Calculate the major arc length *ADC*.

Answer .... cm   [3]

(c) Calculate the area of minor sector *OAEC*.

Answer .... cm^2 [2]

(d) Calculate the area of the minor segment *ABCE*.

Answer .... cm^2 [2]

[Turn Over

9   In the diagram, *ABCD* is a rectangular plane inclined at 30º to the horizontal
     rectangular plane *ABEF*. *G* is a point on *BC* such that *CG* = 12 cm and θ is the
     angle between *AG* and *AH*. *H* is a point on *BE* and located vertically below *G*.
     AB = 40 cm and *AF* = 35 cm.
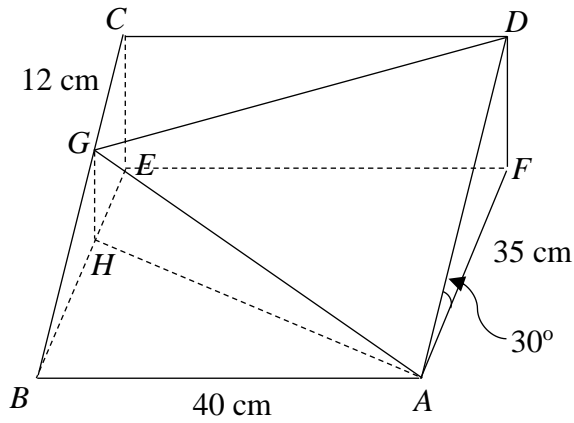
(a) Find the length of *AD*.

Answer ....cm   [2]

(b) Show that *BG* = 28.415 cm.

Answer   [2]

(c) Hence, find the length of *AG*.

Answer ....cm   [2]

(d) Find the length of *HG*.

Answer ....cm   [2]

(e) Find the area of triangle *GAD*.

Answer ....cm^2 [2]

10   **(a)** Rearrange the formula $\dfrac{x+y}{5} = \dfrac{z}{3}$ to make x the subject.

Answer x =.......................... [2]

(b) Given $y = 2$ and $z = -3$, find the value of x.

Answer x =.......................... [1]

11
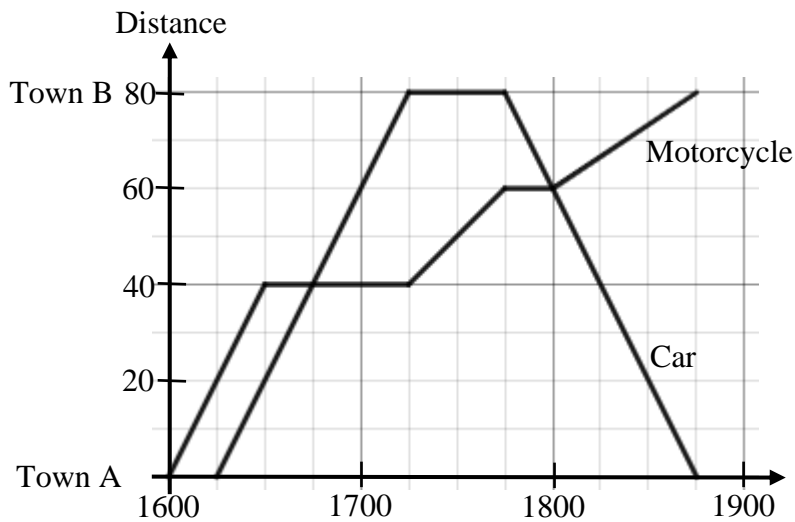
The graph shows the journey of a motorcycle and a car between Town A and Town B, which are 80 km apart.

(a) At what time did the motorcycle and car first meet?

Answer .... [1]

(b) How far away from Town B was the motorcycle when it stopped for a
15 minute rest?

Answer ....km   [1]

(c) Find the speed of the car travelling from Town A to B.

Answer ....km/h   [1]

(d) Find the average speed of the car for the whole journey.

Answer ....km/h   [2]

12   *ABEF* is a parallelogram and *C* lies on the intersection of *AB* and *FD* produced.

ABC and *FDC* is a straight line.
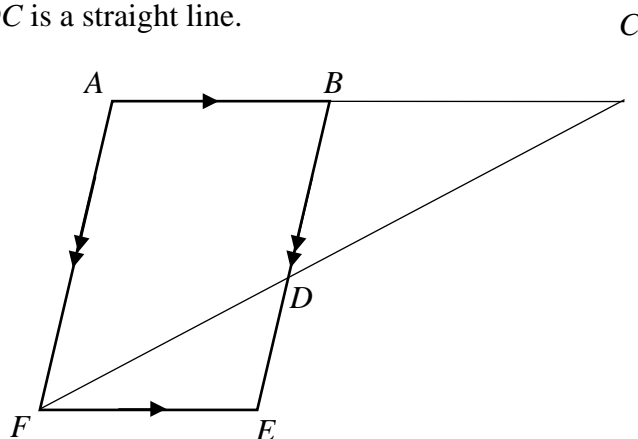
[2]

(a) Prove that triangle *BDC* is similar to triangle *EDF*.

Answer

(b) Given that *DE* : *BD* is 2 : 3, find the value of $\dfrac{\text{Area of triangle } BDC}{\text{Area of triangle } EDF}$.

Answer ....   [2]

(c) Given triangle *BDC* is similar to triangle *AFC* and area of triangle *BDC* is 54 cm². Find the area of triangle *AFC*.

Answer ....cm²   [3]

(d) Find the value of $\dfrac{\text{Area of triangle } BDC}{\text{Area of trapezium } ABDF}$.

Answer ....   [2]

[Turn Over

13 To encourage water conservation, the poster in Figure 1 shares some tips on how to save water when performing daily household routines.
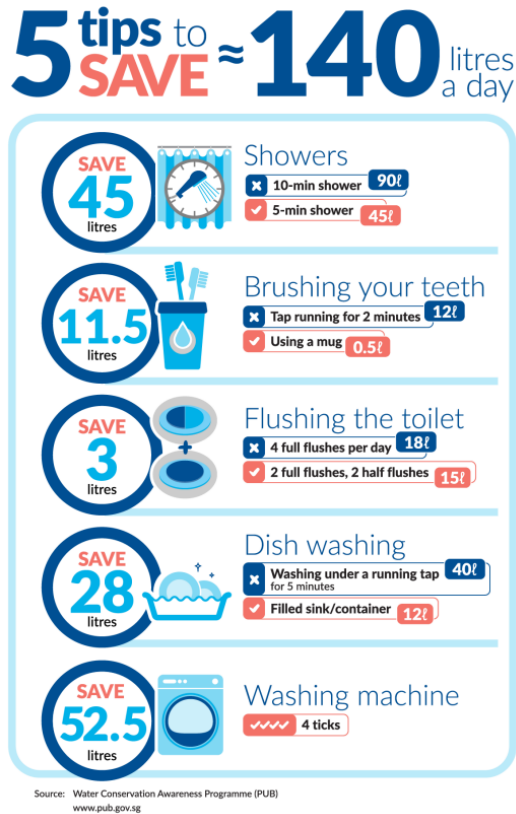

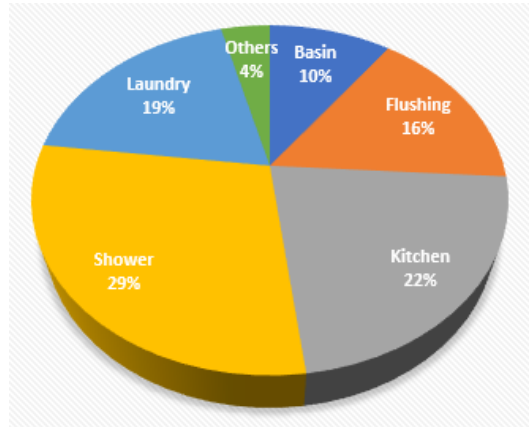
Figure 1: 5 tips to save water

Figure 2: Eileen's household water consumption for June 2022

(a) Based on Figure 1, calculate the rate of water flow from a running tap in litres per minute when brushing one's teeth.

Answer ....litres/min   [1]

(b) Given that a toilet is flushed 16 times a day with 10 full flushes and 6 half flushes, what is the total daily water usage for the household for the category 'Flushing the toilet' based on Figure 1?

[Note: A half flush does not necessarily use half the water required for a full flush]

Answer ....litres   [2]

(c) Figure 2 shows the distribution of water consumption for Eileen's household for June 2022. A total of 8208 litres was used for laundry. Calculate the total water usage for June 2022.

Answer .... litres   [2]

[Turn Over

(d) Water tariffs are charged according to two types of rates as shown in Table 1 below. There is an additional Water Conservation Tax that is charged on the final tariff.
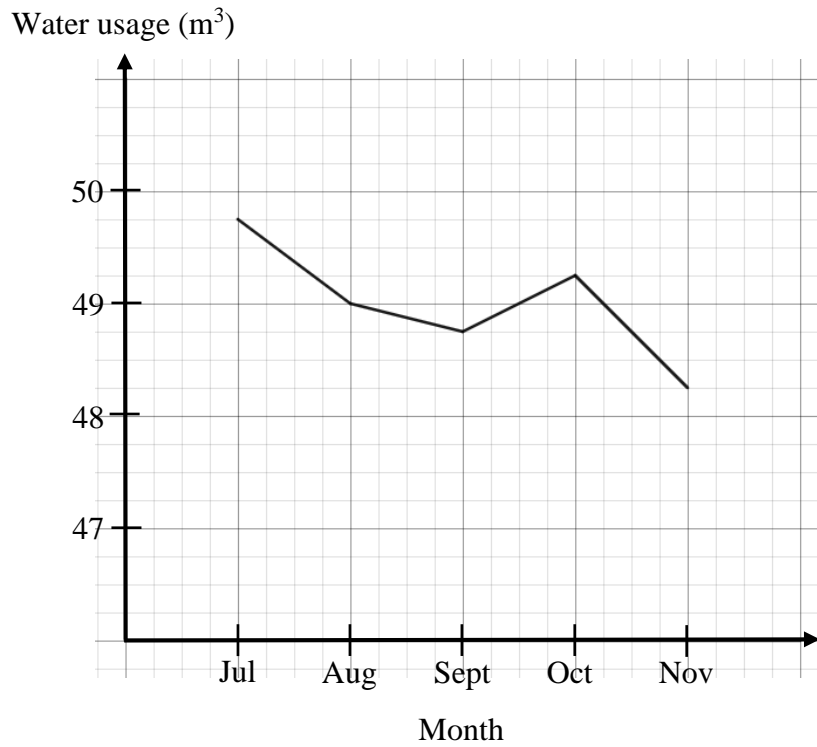
Consumption (m^3 per month)	$0 \ m^3$ to $40 \ m^3$	$> 40 \ m^3$
Tariff	$1.21 per m^3	$1.52 per m^3
Water Conservation Tax	50% of Tariff	65% of Tariff

Calculate the total water bill for Eileen's household for June 2022.

[1 litre = 0.001 m^3]

Answer $.................................   [4]

(e) The line graph shows Eileen's water usage for the past 5 months in 2022. She decided to set aside some money for her December 2022 water bill. Suggest a reasonable amount that she should set aside for her water bill. Justify your answer with workings.

Water usage (m^3)

Month

Answer [4]

End of Paper

[Turn Over