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**CRESCENT GIRLS' SCHOOL
SECONDARY ONE
END OF YEAR EXAMINATION 2023**

MATHEMATICS

4052

09 October 2023

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use 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.

Calculators should be used 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 .

At the end of the examination, submit the whole Question Paper.

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 **80**.

For Examiner's Use

Question	1	2	3	4	5	6	7	8	9	10	11
Marks											
Question	12	13	14	15	16	17	18	19	20	21	22
Marks											

Table of Penalties		Qn. No.	Parent's/ Guardian's Signature	80
Presentation	-1			
Units / Accuracy	-1			

This question paper consists of 20 printed pages.

Answer **all** the questions on the question paper.

- 1** Written as a product of its prime factors, $2023 = 7 \times 17^2$.

(i) Explain why 2023 is not a perfect square.

Answer

.....

 [1]

- (ii)** $2023 \times \frac{p}{q}$ is a perfect cube greater than 1, where p and q are positive integers.

Find the values of p and q that give the smallest possible value of $2023 \times \frac{p}{q}$.

Answer $p =$

$q =$ [2]

- 2 It is given that a and b are two numbers, both greater than 40 and $a < b$.
They have a highest common factor of 21 and a lowest common multiple of 1050.
Find the value of a and b .

Answer $a = \dots\dots\dots$

$b = \dots\dots\dots$ [3]

- 3 Arrange the following numbers in increasing order.

$$0.\dot{4}\dot{7}, \quad \frac{470}{999}, \quad -\sqrt{\frac{2209}{10000}}, \quad (-0.4)^2$$

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

- 4 Use a calculator to evaluate $\sqrt[3]{\frac{16}{17}\left(\frac{7}{2^3} - \frac{5}{12}\right)}$.

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

- 5 State the number of significant figures in 0.0030650.

Answer [1]

- 6 A lorry travels at an average speed of 68.7 km/h for 1.5 hours.

- (a) By rounding these numbers correct to 1 significant figure, find an estimate of the distance travelled by the lorry.

Answer km [1]

- (b) Without doing any further calculation, explain why the actual distance is less than the answer to **part (a)**.

Answer

.....
 [1]

- 7 Expand and simplify $-3(5p-13q)+p-3q$.

Answer [2]

- 8 Factorize completely $-3ab-18a$.

Answer [2]

- 9 Write $2y+\frac{3x-1}{6}$ as a single fraction in simplest form.

Answer [2]

10 Given that $\frac{2x+y-3z}{y+3x} = \frac{x}{2y}$,

- (i) find the value of z when $x = 1$ and $y = 4$,

Answer $z = \dots\dots\dots$ [3]

- (ii) explain why if $x = 1$, then y cannot be -3

Answer

.....

 [1]

- 11** A two-digit positive number is such that the tens digit is twice as large as the ones digit.
- (i) By letting the ones digit be x , express the tens digit of the number in terms of x .

Answer [1]

- (ii) Hence, express the two-digit positive number in terms of x .

Answer [1]

- (iii) Given that the sum of the original number and the number obtained when the digits are reversed is 99, form an equation in x and find the original number.

Answer [3]

12 Amos earns \$ x every month.

He deposits 25% of his monthly earnings into a savings account, and 20% of his monthly earnings into an investment account. He gives $\frac{1}{11}$ of the remaining amount to his parents for household expenditure and spends the rest of the money on his personal monthly expenses.

- (a)** Given that Amos' personal monthly expenditure is \$3250, set up an equation in x and show that the value of x is 6500.

Answer

[2]

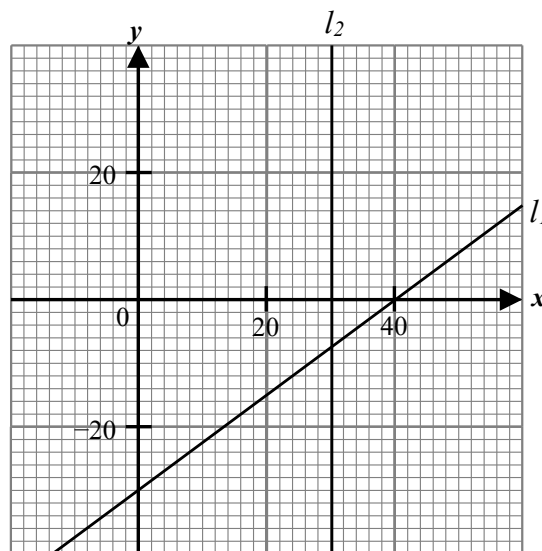
- (b) (i)** Calculate the amount of money Amos deposits monthly into the savings account.

Answer \$ [1]

- (ii) After saving for 1 year, Amos transferred the amount of money in his savings account into a fixed deposit account that pays a simple interest of 3.2 % per annum. Calculate the amount of interest Amos will receive if he puts the money in the fixed deposit account for 3 years.

Answer \$ [2]

- 13 The diagram below shows two lines l_1 and l_2 .



- (a) Find the gradient of l_1 .

Answer gradient of l_1 = [1]

- (b) Explain why the gradient of l_2 is undefined.

Answer

.....
 [1]

- 14** A special thermometer known as a helium gas thermometer uses the pressure of helium gas to measure the temperature of the surroundings.

The relationship between the temperature of the surroundings (T) in degrees Celsius ($^{\circ}\text{C}$) and the pressure of the helium gas (P) in Pascals (Pa) is given by the equation $P = 8T + P_0$, where P_0 is a constant to be determined.

The table below shows various values of T and the corresponding values of P .

$T (^{\circ}\text{C})$	25	50	100
$P (\text{Pa})$	2400	2600	3000

- (a) By using a scale of 2 cm to represent 20°C on the horizontal axis, and 2 cm to represent 500 Pa on the vertical axis, draw the graph for P (Pa) against T ($^{\circ}\text{C}$) for $0 \leq T \leq 100$ on the grid on page 11. [3]

- (b) (i) Using your graph, state the value of P_0 .

Answer $P_0 = \dots\dots\dots$ [1]

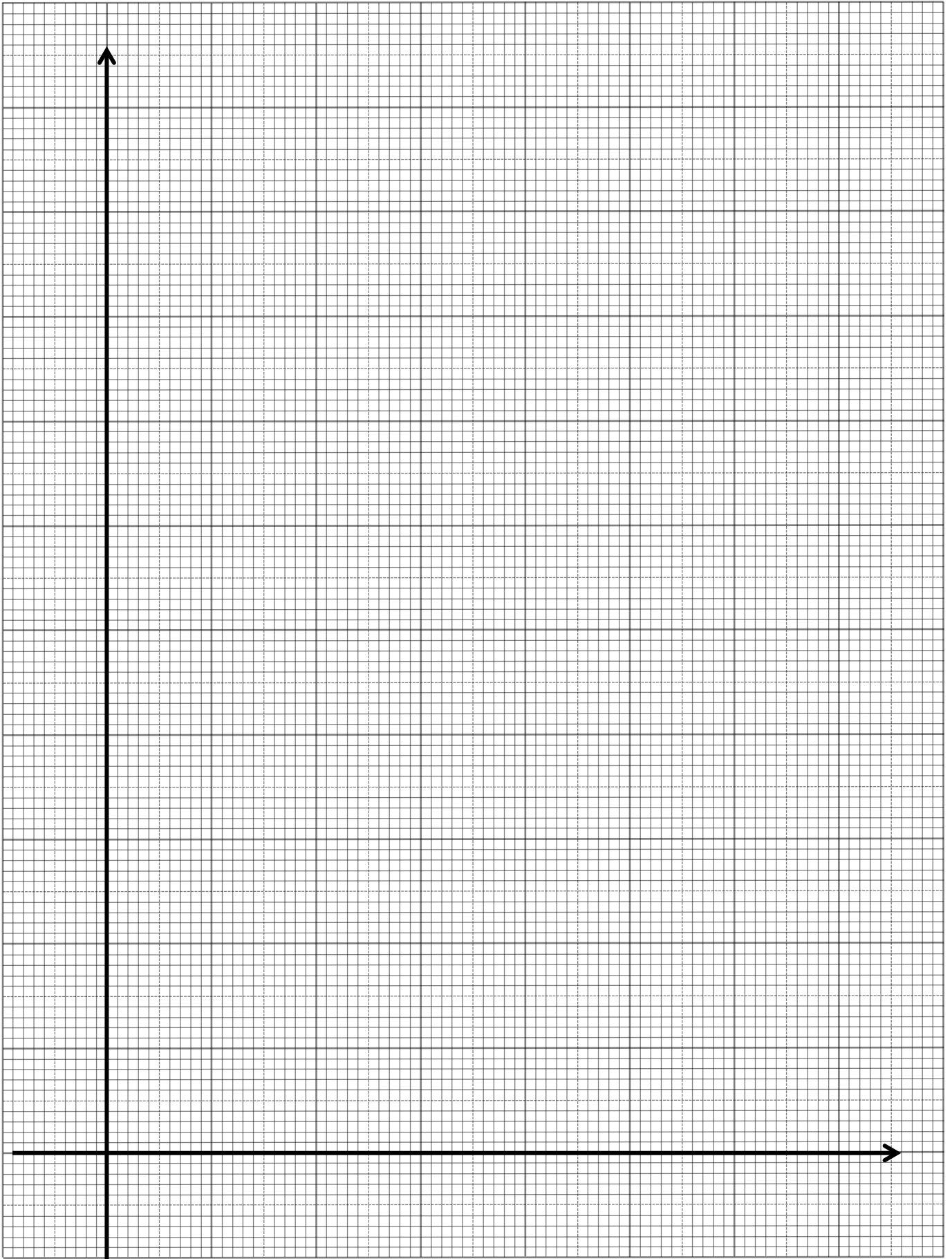
- (ii) Explain the significance of the value of P_0 in relation to the helium gas.

Answer

.....
 [1]

- (c) Using your answer from **part (b)(i)**, determine the value of T when $P = 0$.

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



- 15** In a sequence, the same number is subtracted each time to obtain the next term.

The first five terms of the sequence are

$$53 \quad x \quad y \quad z \quad 17$$

- (a)** Find the value of y .

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

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

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

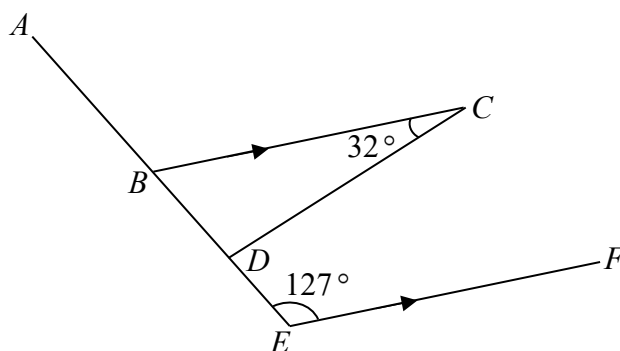
- (c)** Explain whether -305 is a term in the sequence.

Answer [1]

- 16** The diameter of the wheel of an electric scooter is 20 cm. If the electric scooter travels at an average speed of 18 km/h, find the number of revolutions made by the wheel per minute, giving your answer correct to the nearest whole number.

Answer: rev/min [3]

- 17** In the figure, $ABDE$ is a straight line and BC is parallel to EF . Find reflex angle CDE , stating the reasons clearly.



Answer reflex $\angle CDE = \dots\dots\dots^\circ$ [3]

- 18 The diagram below shows the recipe for baking Delicious Chocolate Chip Cookies.

Delicious Chocolate Chip Cookie Recipe
(Recipe makes 36 cookies)

- ☐ 1 cup butter
- ☐ 1 cup white granulated sugar
- ☐ 1 cup light brown sugar
- ☐ 2 teaspoon vanilla extract
- ☐ 2 large eggs
- ☐ 3 cups all-purpose flour
- ☐ 1 teaspoon baking soda
- ☐ $\frac{1}{2}$ teaspoon baking powder
- ☐ 1 teaspoon sea salt
- ☐ 2 cups chocolate chips



- (a) Given that 1 cup of chocolate chips weighs 160 g and 1 teaspoon of sea salt weighs 5 g, find the ratio of chocolate chips to sea salt in the recipe.

Answer : [2]

- (b) Noelle starts a home business selling chocolate chip cookies using the recipe above. Each tin of cookies that she sells contains 24 cookies.
- (i) She receives an order for 15 tins of cookies. Calculate the amount of chocolate chips she needs to buy to bake 15 tins of cookies. Give your answer in grams.

Answer g [2]

- (ii) At the supermarket, Noelle finds two brands of chocolate chips. The diagram below shows the selling price of the two brands of chocolate chips.



Brand A

\$4.55 for a box of 200 g



Brand B

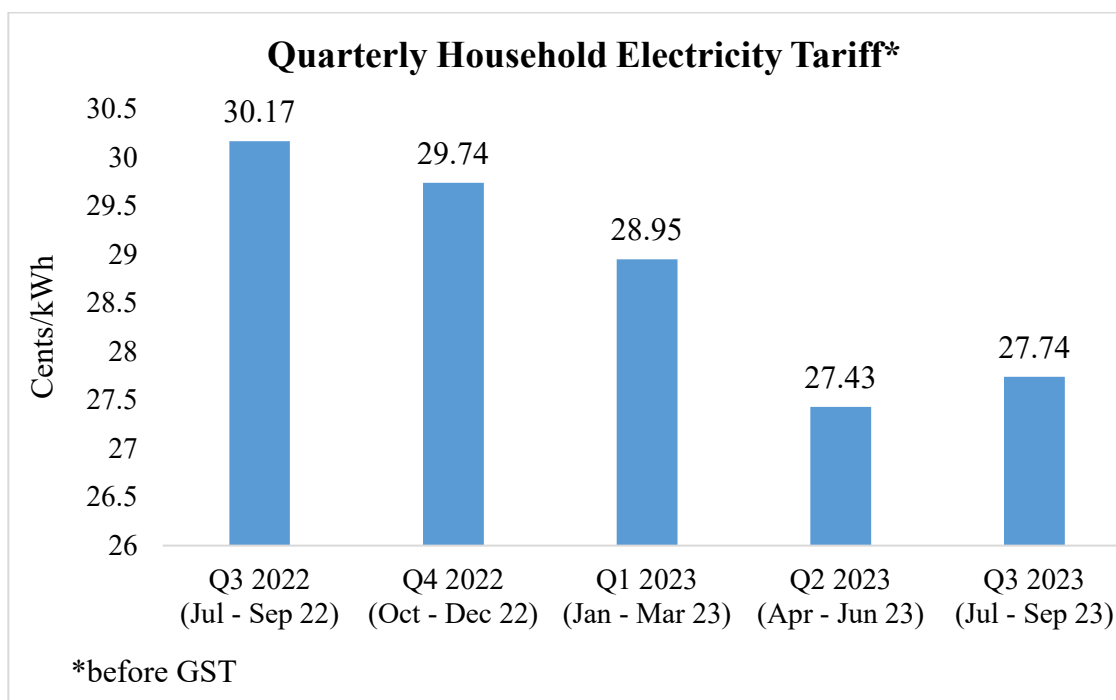
\$3.60 for a box of 150 g
(10% discount for purchase
of every 2 boxes)

To keep cost to a minimum, which brand should Noelle buy for baking the 15 tins of cookies? Justify your answer with workings.

Answer

[3]

- 19 The figure below shows the quarterly household electricity tariff from the 3rd quarter of 2022 (Q3 2022) to 3rd quarter of 2023 (Q3 2023).



- (a) (i) Calculate the percentage increase in the electricity tariff from Q2 2023 to Q3 2023 for the consumption of electricity in cents/kWh.

Answer % [2]

- (ii) Calculate the electricity tariff with 8% GST for Q3 2023.

Answer cents/kWh [2]

- (iii) Mr Yacob and his family of four stay in a 5-room HDB flat. They consume 648 kWh of electricity for the month of September in 2023. Calculate the family's electricity bill with 8% GST for that month.

Answer \$ [2]

- (b) State one feature of the bar graph that may be misleading and explain how this may lead to a misinterpretation of the bar graph.

Answer

.....

 [2]

- 20 The ratio of an interior angle to an exterior angle of an n -sided regular polygon is 13 : 2. Find the value of n .

Answer $n =$ [3]

- 21 (a)** Construct a quadrilateral $PQRS$ such that $PQ = 4$ cm, $QR = RS = 4.8$ cm, $PS = 3.6$ cm and $\angle PSQ = 90^\circ$. The line PQ is already drawn.

Answer

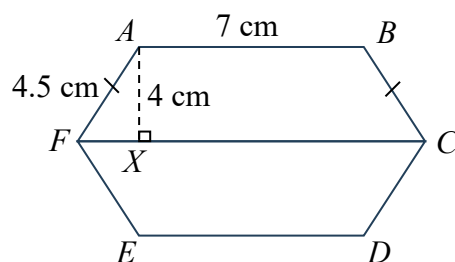
[3]

$P \text{-----} Q$

- (b)** Find the perimeter of triangle PQS .

Answer cm [2]

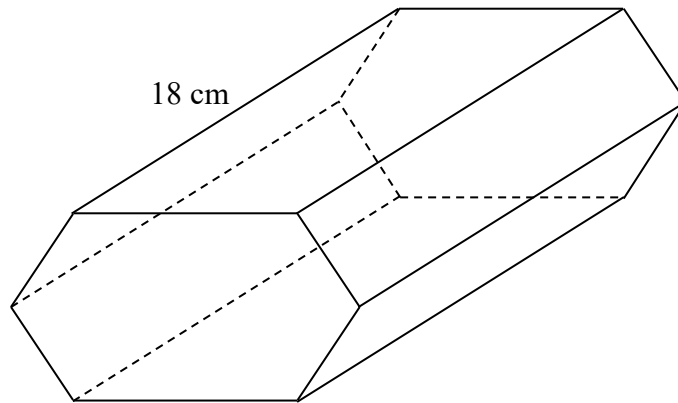
- 22** In the figure below, $ABCDEF$ is a hexagon formed by combining 2 identical trapeziums. It is given that $AB = 7$ cm, $AX = 4$ cm and $BC = FA = 4.5$ cm.



- (a)** Given that the area of hexagon $ABCDEF$ is 72 cm^2 , find the length of CF .

Answer $CF = \dots\dots\dots \text{ cm}$ [2]

- (b) A hexagonal prism is formed with hexagon $ABCDEF$ in part (a) as its base. Given that the length of the prism is 18 cm, find



- (i) the volume of the hexagonal prism,

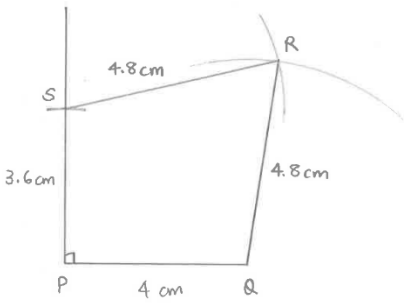
Answer cm^3 [2]

- (ii) the amount of spray paint needed to cover the entire surface of the hexagonal prism if a can of 400 ml spray paint can cover an area of 2 m^2 .

Answer ml [3]

End of Paper

Answer Key

Qn	Answer	Qn	Answer
1(i)	The exponent/power of 7 is not an even number/multiple of 2	14(b)(i)	Accept 2150, 2175, 2200, 2225, 2250.
1(ii)	$p = 8$ $q = 2023$	14(b)(ii)	It is the pressure of the gas when temperature is at 0 °C .
2	$a = 42$ $b = 525$	14(c)	$T = -275$
3	$-\sqrt{\frac{2209}{10000}}, (-0.4)^2, \frac{470}{999}, 0.4\dot{7}$	15(a)	$y = 35$
4	0.756 (3 s.f.)	15(b)	$T_n = 62 - 9n$
5	5	15(c)	Since n is not a positive integer/whole number, -305 is not a term in the sequence.
6(a)	140	16	477 revolution/min (nearest whole number)
6(b)	Both average speed and time values were rounded up/overestimated .	17	reflex $\angle CDE = 275^\circ$
7	$-14p + 36q$	18(a)	68 : 1
8	$-3a(b + 6)$	18(b)(i)	3200 g
9	$\frac{12y + 3x - 1}{6}$	18(b)(ii)	Noelle should buy Brand B as it is cheaper than Brand A.
10(i)	$z = 1\frac{17}{24}$ OR $\frac{41}{24}$ OR 1.71	19(a)(i)	1.13% (3 s.f.)
10(ii)	If $x = 1$ and $y = 3$, then the denominator on the LHS will be equal to 0 / $y + 3x = 0$, which will make the fraction undefined .	19(a)(ii)	29.96 cents/kWh (2 d.p.)
11(i)	tens digit = $2x$	19(a)(iii)	\$194.14 (2 d.p.)
11(ii)	$21x$	19(b)	The y-axis of the bar graph did not start from zero/ starts from 26 instead of 0. This may lead to one thinking that the electricity tariff in Q1 2023 is 2 times that of Q2 2023.
11(iii)	63	20	$n = 15$
12(a)	$x - 0.25x - 0.2x - \frac{1}{11}(x - 0.25x - 0.2x) = 3250$	21(a)	
12(b)(i)	\$1625	21(b)	13 cm
12(b)(ii)	\$1872	22(a)	$CF = 11$ cm
13(a)	$\frac{3}{4}$ OR 0.75	22(b)(i)	1296 cm^3
13(b)	The run / denominator is zero.	22(b)(ii)	14.4 ml

14(a)

