

Cambridge Assessment International Education

O LEVEL 4024

MATHEMATICS

Topical Paper &

June 2023 – June 201*

Question arranged New to Old

All Variants | Mark Scheme

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Answers	4)'

1. Number

201,

1 4024/21/M/J/18/Q1(c)

(i) Write 540 as the product of its prime factors.

Answer [2]

(ii) p is the smallest possible integer such that $540p$ is a square number.

Find $\sqrt{540p}$, giving your answer as the product of its prime factors.

Answer [2]

2 4024/22/M/J/18/Q4(b&c)

(a) Find the lowest common multiple (LCM) of 140 and 770.

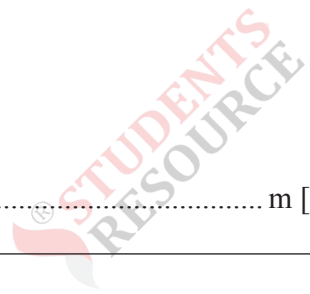
Answer [2]

(b) A rectangular field measures 450 m by 306 m.

The whole field is divided into identical square plots with no land remaining.

Find the largest possible side length for the squares.

Answer m [2]

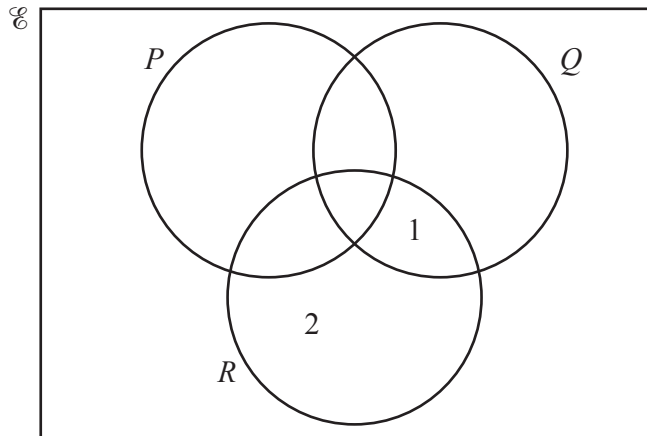


2021

4024/21/M/J/23/Q5

- 3 (a) $\mathcal{U} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$
 $P = \{x : x \text{ is a multiple of } 3\}$
 $Q = \{x : x \text{ is an odd number}\}$
 $R = \{x : x \text{ is a factor of } 24\}$

(i) Complete the Venn diagram.



[3]

(ii) Find $n(R')$.

..... [1]

(iii) List the elements of $(P \cup R) \cap Q$.

..... [1]

(iv) Describe, in words, the type of number represented by $P \cap R \cap Q'$.

..... [1]

(v) A number, m , is chosen at random from the elements of R .

Find the probability that m is a multiple of 3.

..... [2]



(b) $M = 2^{2x} \times 3^4 \times 5 \times 7$
 $N = 2^3 \times 3^{x-y} \times 5^2$

The lowest common multiple (LCM) of M and N is $2^8 \times 3^6 \times 5^2 \times 7$.

(i) Find the value of x and the value of y .

$x = \dots\dots\dots$

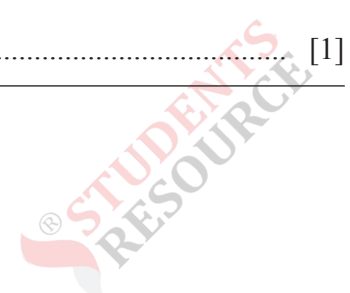
$y = \dots\dots\dots$ [2]

(ii) Find the largest square number that is a factor of M .

$\dots\dots\dots$ [1]

(iii) Find the highest common factor (HCF) of M and N .
 Give your answer as a product of its prime factors.

$\dots\dots\dots$ [1]



202&

4024/2&/O/N/22/Q(

- 4 (a) $\mathcal{C} = \{x : x \text{ is an integer } 10 \leq x \leq 40\}$
 $P = \{x : x \text{ is a multiple of 6}\}$
 $Q = \{x : x \text{ is a square number}\}$

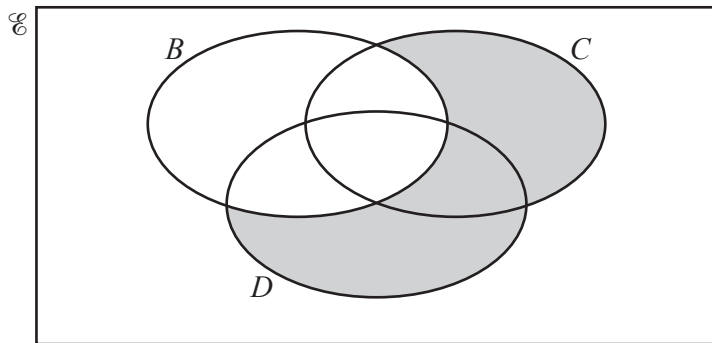
(i) Write down the elements of $P \cup Q$.

..... [1]

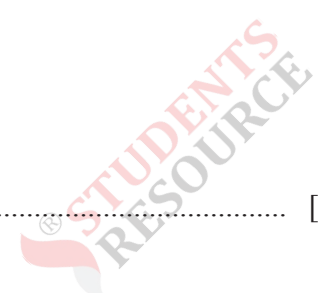
(ii) Find $n(P' \cap Q)$.

..... [1]

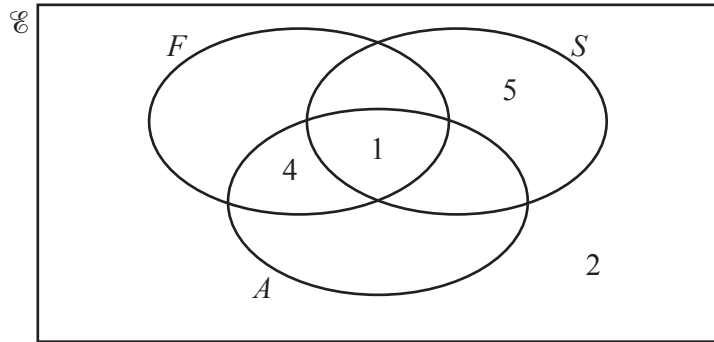
(b) Use set notation to describe the shaded region in the Venn diagram.



..... [1]



- (c) In a college, students can study French (F), Spanish (S) and Arabic (A).
 A group of 25 students are asked which languages they study.
 Some of the results are shown in the Venn diagram.



- (i) All students who study both Arabic and Spanish also study French.
 7 students study French only.
 8 students study Arabic.

Use this information to complete the Venn diagram.

[2]

- (ii) Two of the 25 students are selected at random.
 Find the probability that they both study Spanish only.

..... [2]

- (iii) Three of the students are selected at random from those who study French.
 Find the probability that only one of them also studies Arabic.

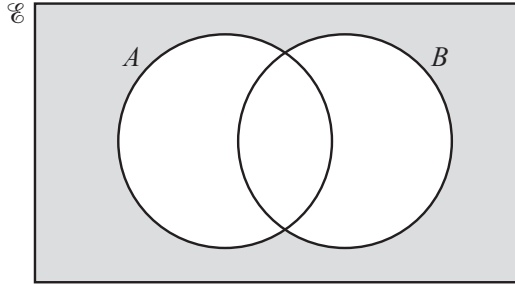
..... [3]



2021

4024/22/M/J/21/Q5

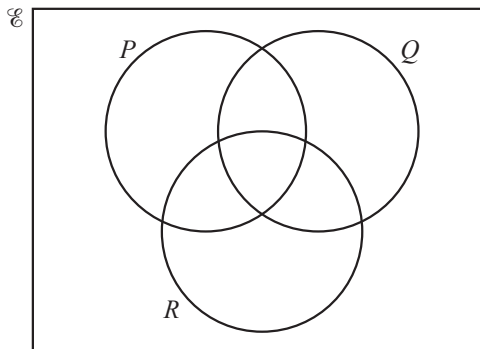
(a) Use set notation to describe the subset shaded in the Venn diagram.



..... [1]

- (b) $U = \{ 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 \}$
 $P = \{ x : x \text{ is a factor of } 36 \}$
 $Q = \{ x : x \text{ is a multiple of } 4 \}$
 $R = \{ x : 3 \leq x \leq 6 \}$

(i) Complete the Venn diagram.



[3]

(ii) List the elements of $P \cap (Q \cup R)'$.

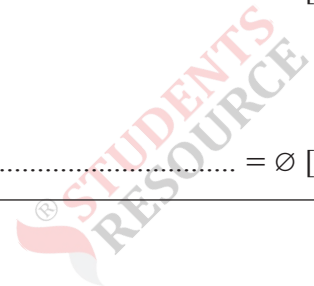
..... [1]

(iii) Find $n(P \cup Q)$.

..... [1]

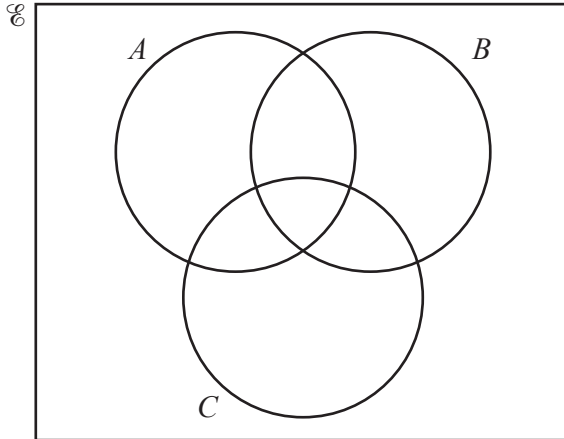
(iv) Use set notation to complete the statement.

..... = \emptyset [1]



(4024/21/M/J/21/Q5

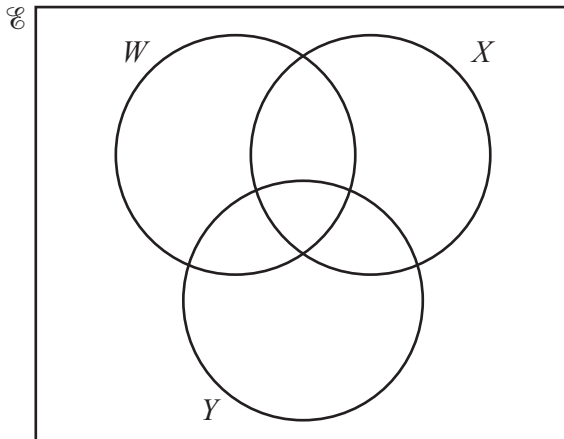
(a) Shade the subset $A \cap B \cap C$.



[1]

- (b) $U = \{ A, C, E, G, H, J, N, R, T, Z \}$
 $W = \{ x : x \text{ has rotational symmetry of order } 2 \}$
 $X = \{ x : x \text{ has line symmetry} \}$
 $Y = \{ R, A, N, G, E \}$

(i) Complete the Venn diagram.



[3]

(ii) List the elements of $X \cap (W \cup Y)'$.

..... [1]

(iii) Find $n(W \cup X \cup Y)'$.

..... [1]

(iv) Using set notation, complete this statement.

..... = \emptyset

[1]

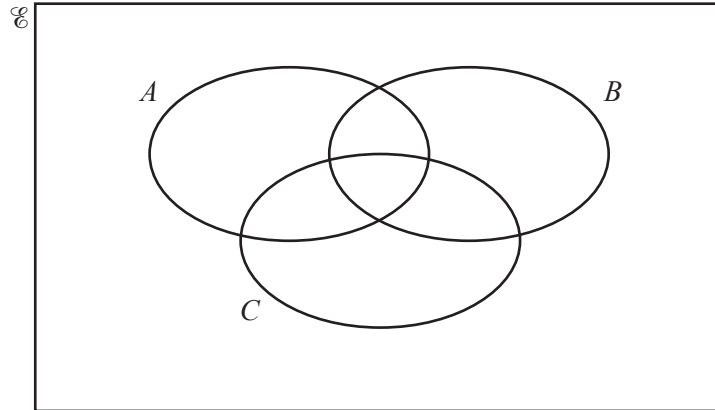


201-

) **4024/22/O/N/19/Q5**

- (a) $\mathcal{E} = \{x : x \text{ is an integer } 1 \leq x \leq 16\}$
 $A = \{x : x \text{ is an even number}\}$
 $B = \{x : x \text{ is a square number}\}$
 $C = \{x : x \text{ is a factor of } 100\}$

(i) Complete the Venn diagram.



[3]

(ii) Find $n(A' \cup B)$.

..... [1]

(iii) $p \in A \cap C$

Write down all the possible values of p .

..... [1]

(b) Ateeq has a set of 16 cards numbered from 1 to 16.

(i) He takes a card from the set at random.

Find the probability that the card shows an odd square number.

..... [1]



(ii) Ateeq takes two cards at random from the set of 16 cards.

Find the probability that both cards show even numbers that are factors of 100.

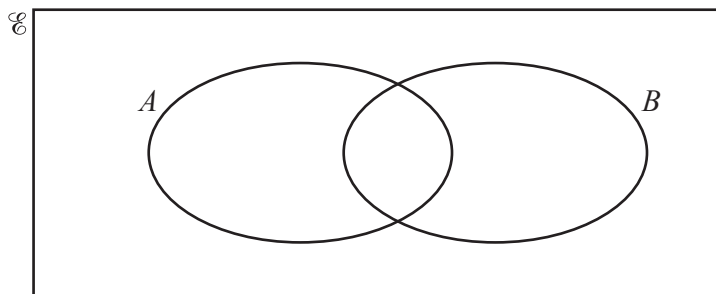
..... [2]

201,

* 4024/21/O/N/18/Q4

- (a) $\mathcal{U} = \{x : x \text{ is an integer } 1 \leq x \leq 10\}$
- $A = \{x : x \text{ is a factor of } 20\}$
- $B = \{x : x \text{ is a multiple of } 4\}$

(i) Complete the Venn diagram.



[2]

(ii) State $n(A \cup B)$.

Answer [1]

(iii) Describe in words the set $A \cap B'$.

Answer [1]



(b) 30 people are asked what type of fruit they like.
Of these people,

- 5 say they like both oranges and bananas
- 12 say they like oranges
- 8 say they like neither oranges nor bananas.

(i) By drawing a Venn diagram, or otherwise, find the number of people who like bananas but not oranges.

Answer [2]

(ii) Two of the 30 people are selected at random.

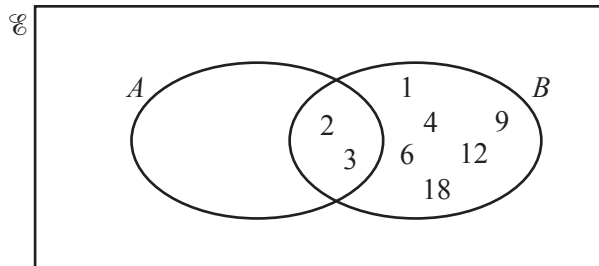
Find the probability that they both like oranges but not bananas.

Answer [2]



+ 4024/22/M/J/18/Q4(a)

- $\mathcal{C} = \{x : x \text{ is an integer } 1 \leq x \leq 18\}$
- $A = \{x : x \text{ is a prime number}\}$
- $B = \{1, 2, 3, 4, 6, 9, 12, 18\}$



(i) Complete the Venn diagram to illustrate this information. [1]

(ii) Complete the description of the set B .

Answer $B = \{x : x \text{ is a factor of } \dots\dots\dots\}$ [1]

(iii) Find $n(A \cup B)$.

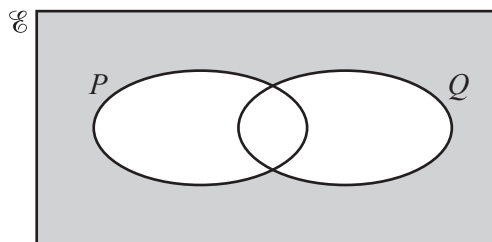
Answer [1]

(iv) List the elements of $A' \cap B$.

Answer [1]

4024/21/M/J/18/Q1

(a) Use set notation to describe the shaded region in the Venn diagram.

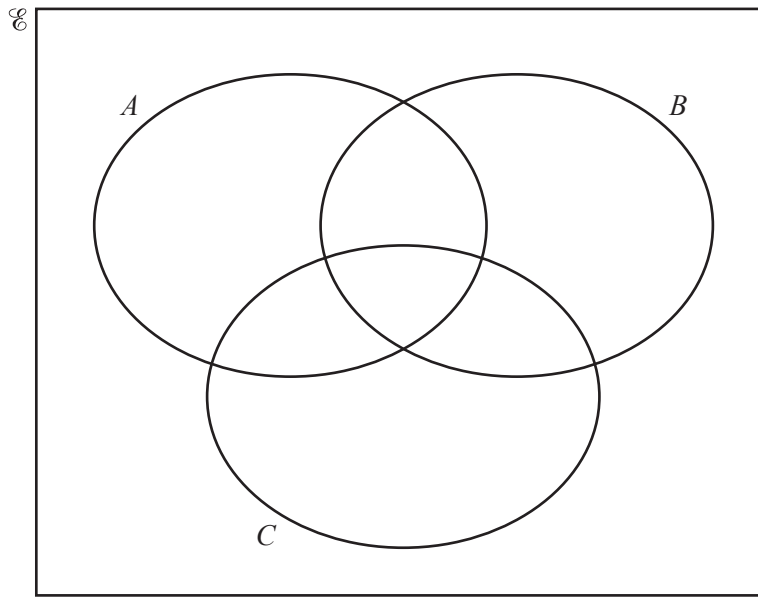


Answer [1]

- (b) $\mathcal{C} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$
- $A = \{x : x \text{ is a factor of } 12\}$
- $B = \{x : x \text{ is a multiple of } 2\}$
- $C = \{x : x \text{ is a square number}\}$



(i) Show this information on the Venn diagram below.



[2]

(ii) Find $n(A \cap B)$.

Answer [1]

(iii) Find $n(A \cap (B \cup C))$.

Answer [1]

(iv) One subset in the Venn diagram in **part (b)(i)** has no elements.

Use set notation to describe this subset.

Answer [1]



201+

- 4024/22/O/N/17/Q6

(a) $\mathcal{E} = \{x : x \text{ is an integer and } 10 \leq x \leq 20\}$

$A = \{x : x \text{ is an odd number}\}$

$B = \{x : x \text{ is a multiple of } 5\}$

(i) Find $n(A \cap B)$.

Answer [1]

(ii) Find $A' \cup B$.

Answer [1]

(iii) A number, r , is chosen at random from \mathcal{E} .
Find the probability that $r \in A \cup B$.

Answer [1]

(b) In a survey, 40 people were asked what they had read that day.

- A total of 10 people had read a book
- A total of 24 people had read a newspaper
- 14 people had read neither a book nor a newspaper

(i) By drawing a Venn diagram, or otherwise, find the number of people who had read both a book and a newspaper.

Answer [2]

(ii) Two of the 10 people who had read a book are selected at random.
Work out the probability that they had both read a book and a newspaper.

Answer [2]



201*

%\$ 4024/22/M/J/16/Q6

- (a) $\mathcal{E} = \{ 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 \}$
 $A = \{ x : x \text{ is a prime number} \}$
 $B = \{ x : x \text{ is an even number} \}$
 $C = \{ x : x \text{ is a multiple of } 5 \}$

(i) List the members of the subsets

(a) $B \cap C$,

Answer [1]

(b) $(A \cup B \cup C)'$,

Answer [1]

(c) $A \cap B'$.

Answer [1]

(ii) A number q is chosen at random from \mathcal{E} .

Find the probability that $q \in A \cap B'$.

Answer [1]

(b) $\mathbf{X} = \begin{pmatrix} 3 & -1 \\ 2 & 0 \end{pmatrix}$ $\mathbf{Y} = \begin{pmatrix} 2 & 2 \\ -1 & 1 \end{pmatrix}$

Find

(i) $2\mathbf{X} + \mathbf{Y}$,

Answer $\left(\begin{array}{c} \\ \end{array} \right)$ [2]

(ii) \mathbf{Y}^{-1} .

Answer $\left(\begin{array}{c} \\ \end{array} \right)$ [2]



+ "GhUbXUfX : cfa

2017

1 4024/22/M/J/17/Q2

The table below shows the population, given to the nearest thousand, of some countries.

Country	Population in 2014	Population in 2015
Pakistan	185 133 000	188 169 000
China	1 393 784 000	1 402 007 000
South Korea	49 512 000	49 765 000
Thailand	67 223 000	67 438 000

(a) In 2015, how much larger was the population of Pakistan than the population of South Korea?

Answer [1]

(b) Which country had the smallest increase in population between 2014 and 2015?

Answer [1]

(c) Write the population of South Korea in 2014 in standard form.

Answer [1]

(d) Find the percentage increase in population of Pakistan from 2014 to 2015.

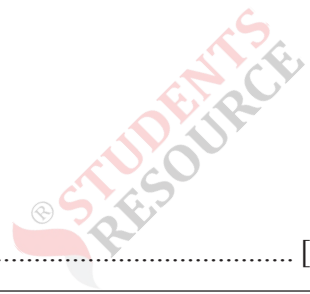
Answer % [2]

(e) The population of Cambodia in 2015 was 15 677 000.

Given that the increase in population from 2014 to 2015 was 1.68%, calculate the population of Cambodia in 2014.

Give your answer correct to 3 significant figures.

Answer [3]



2010

2 4024/22/M/J/10/Q3

The mass and diameter of the planets in the inner solar system are shown in the table.

Planet	Mass (kg)	Diameter (km)
Mercury	3.30×10^{23}	4880
Venus	4.87×10^{24}	12 100
Earth	5.97×10^{24}	12 800
Mars	6.42×10^{23}	6790

- (a) List the planets in order of mass, starting with the lowest. [1]
- (b) Find the radius, in kilometres, of Mars, giving your answer correct to 1 significant figure. [1]
- (c) Giving your answer in standard form, find the total mass, in kilograms, of Venus and Mars. [1]
- (d) [Volume of a sphere = $\frac{4}{3} \pi r^3$]
Giving your answer in standard form, find the volume, in cubic kilometres, of the Earth. [2]

%\$"@]a]hg`cZ5WWW fUbVh

202&

4024/2&/O/N/22/Q1

- 1 (a) Hala travels from London to Marseille by train.
 She must change trains in Paris.
 The journey from London to Paris takes 2 hours 28 minutes.
 The journey from Paris to Marseille takes 3 hours 30 minutes.
 The local time in Marseille and in Paris is 1 hour ahead of the local time in London.

(i) Complete the timetable for Hala’s journey.

Local time		Local time	
London depart	Paris depart	19 31
Paris arrive	16 50	Marseille arrive

[2]

(ii) Work out how long Hala waits in Paris before the train to Marseille departs.

.....hours minutes [1]

- (b) The exchange rate between dollars (\$) and pounds (£) is $\$1 = \pounds 0.75$.
 The exchange rate between dollars (\$) and euros (€) is $\$1 = \text{€}r$.
 Hala changes £250 into euros.
 She receives €290.
 Calculate the value of r .

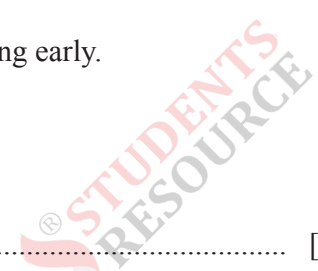
$r =$ [3]

- (c) (i) Josef books a holiday for 3 people.
 The holiday costs \$420 per person.
 Josef pays a deposit of 20% of the total cost of the holiday.
 Calculate the amount Josef pays as the deposit.

\$ [2]

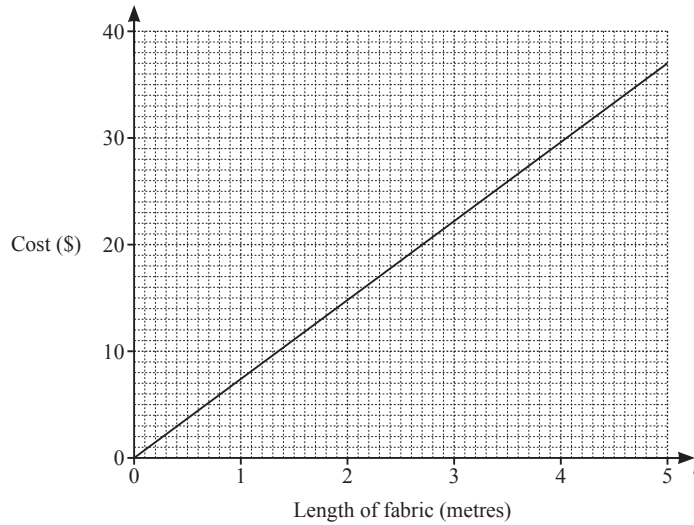
- (ii) Josef pays a total of \$85.68 for airport parking for 8 days.
 This price includes a reduction of 15% of the full price for booking early.
 Calculate the full price for airport parking for 1 day.

\$ [3]



4024/21/M/J/22/Q3

4 (a) The graph shows the cost, in dollars, of buying a length of fabric t metres long.



(i) Use the graph to find the cost of buying 3.8 m of fabric.

\$ [1]

(ii) Samira buys k metres of fabric.
 She pays with a \$20 note and receives \$1.50 change.
 Use the graph to find the value of k .

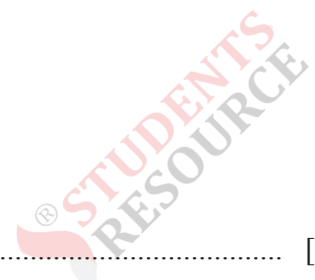
$k =$ [2]

(b) Anita cuts 10 m of fabric into three lengths to make a blouse, a skirt and a dress.
 The lengths of fabric needed to make the blouse, the skirt and the dress are in the ratio 6 : 8 : 11.
 Find the length of the fabric that is cut to make the dress.

..... m [2]

(c) The upper bound for the area of a rectangular piece of fabric is 8.8125 m^2 .
 The width of the piece of fabric is 2.3 metres, correct to the nearest 0.1 m.
 The length of the piece of fabric is d metres, correct to the nearest 0.1 m.
 Find the value of d .

$d =$ [3]



202%

4024/21/O/N/21/Q1

- 5 (a) In October, Sara is charged \$84.25 for water.
A tax of 8% is added to this amount.

Calculate the total amount Sara is charged for water in October including tax.

\$ [2]

- (b) The table shows the rates that Sara is charged for her gas and electricity supply.
She is charged a fixed amount each day plus an amount for each unit used.

	Cost for one day	Cost for one unit
Gas	23 cents	4.3 cents
Electricity	28 cents	16 cents

- (i) Sara uses a total of 960 units of gas in the 30 days of November.

Calculate the total amount, in dollars, Sara is charged for gas in November.

\$ [2]

- (ii) Sara is charged a total of \$30.80 for electricity in the 30 days of November.

Calculate the number of units of electricity she used.

..... units [3]



- (c) The amount of electricity generated is measured in Gigawatt hours (GWh).
The table shows information about the amount of electricity generated in different countries.

Country	Electricity generated in 2010 (GWh)	Electricity generated in 2016 (GWh)
Australia	2.37×10^5	2.43×10^5
Japan	1.09×10^6	1.03×10^6
Spain	2.91×10^5	2.64×10^5
Turkey	2.03×10^5	2.62×10^5

- (i) Calculate how much more electricity was generated in Japan than in Australia in 2016.
Give your answer in standard form.

..... GWh [1]

- (ii) Calculate the percentage increase in electricity generated in Turkey from 2010 to 2016.

..... % [2]

- (iii) There was a 4% decrease in the amount of electricity generated in Spain from 2013 to 2016.

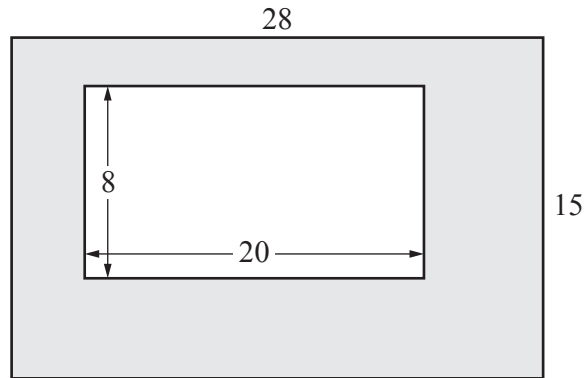
Calculate the amount of electricity generated in Spain in 2013.

..... GWh [2]



2020

(4024/22/M/J/20/Q2(b)



NOT TO
SCALE

A rectangle 20 cm by 8 cm is cut from a rectangle 28 cm by 15 cm.
Each measurement is given correct to the nearest centimetre.

Calculate the upper bound for the area of the shaded region.

.....cm² [3]



2018

) 4024/21/M/J/18/Q6(b)

A rectangular field has dimensions 220 m by 350 m, each correct to the nearest 10 metres.
Calculate the upper bound for the area of the field.

Answer m² [2]
