

Question 1

25 Marks

(a) Find the value of each of the following.

(i) $2.5 - 1.5 \times 0.1$

$$2.5 - 0.15 = 2.35.$$

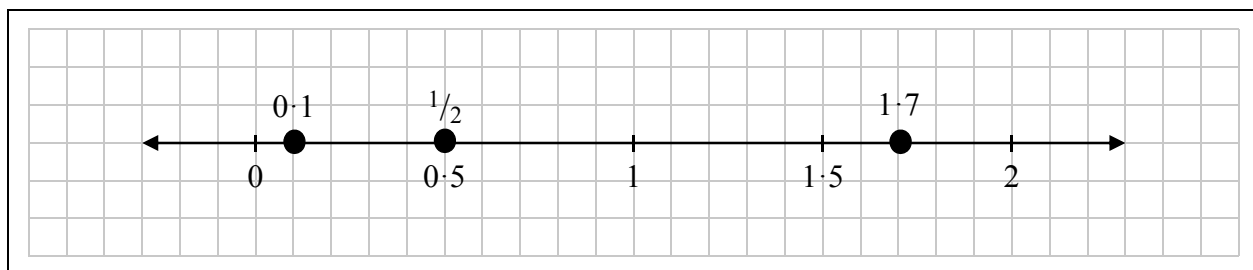
(ii) $\sqrt{5+1.25}$

$$\sqrt{6.25} = 2.5.$$

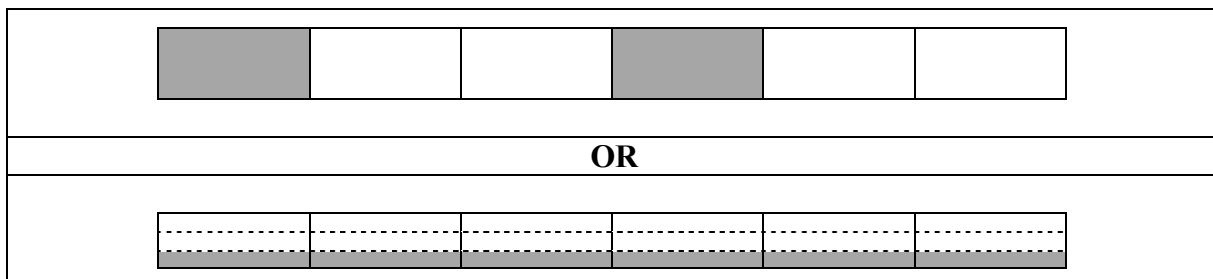
(iii) $(-2)^3$

$$-8.$$

(b) Show each of the following numbers on the number line below. **Label** each one clearly.



(c) (i) Shade in $\frac{1}{3}$ of the following strip.



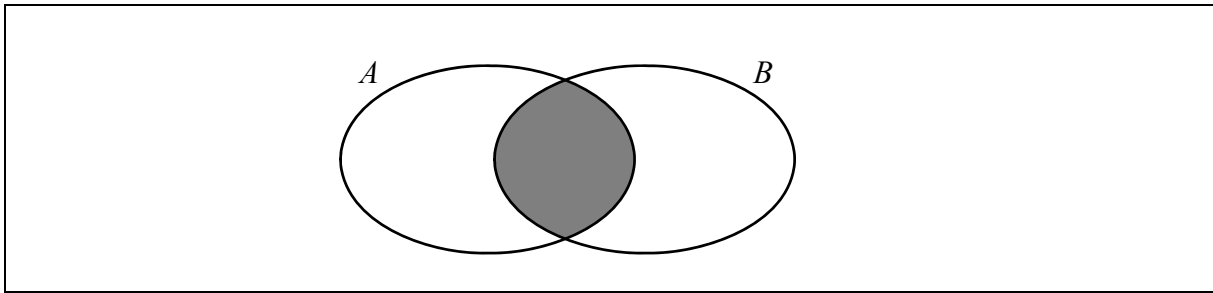
(ii) Fill in the two blanks below, to show two fractions that have the same value as $\frac{1}{3}$.

$$\frac{1}{3} = \frac{2}{6} = \frac{4}{12}$$

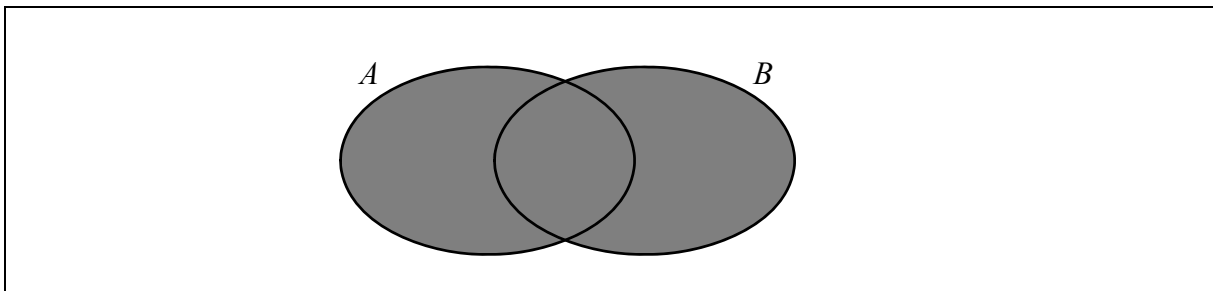
Question 2

20 Marks

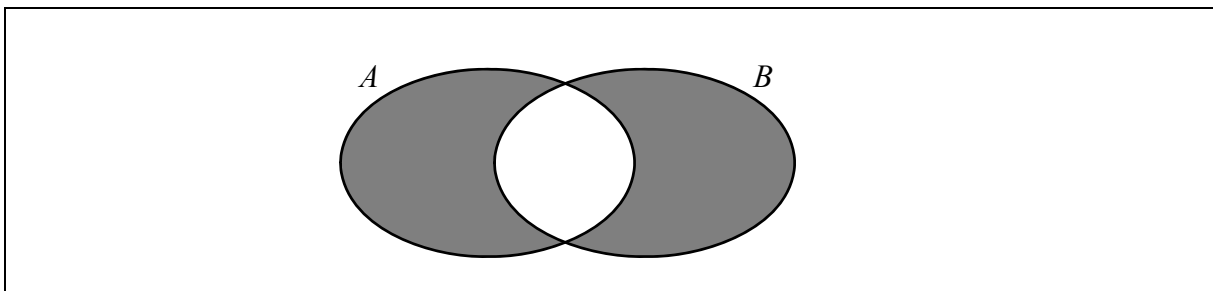
- (a) On the Venn diagram below, **shade in** the region that represents $A \cap B$.



- (b) On the Venn diagram below, **shade in** the region that represents $A \cup B$.



- (c) On the Venn diagram below, **shade in** the region that represents $(A \cup B) \setminus (A \cap B)$.



- (d) Put a tick (✓) in the correct box to show which of the following represents the elements that are **in A but not in B** .

| | | |
|--------------------------|--------------------------|-------------------------------------|
| $B \setminus A$ | $A + B$ | $A \setminus B$ |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

Question 3**25 Marks**

Daniel wants to buy a bike. The usual price of the bike is €320.
The bike is on “special offer” in three different shops.

- (a) **Shop A** offers **10% off** the usual price of the bike.

Fill in the table to show the “special offer” price of the bike in this shop.

| | |
|---------------|---------------------------------|
| | $10\% = €320 \times 0.10 = €32$ |
| \Rightarrow | $90\% = 320 - 32 = €288$ |
| | “Special offer” price: €288. |

- (b) **Shop B** offers $\frac{1}{4}$ **off** the usual price of the bike.

Fill in the table to show the “special offer” price of the bike in this shop.

| | | |
|---------------|---|----------|
| | $\frac{1}{4} = €320 \times \frac{1}{4}$ | $= €80$ |
| \Rightarrow | Rest = $320 - 80$ | $= €240$ |
| | “Special offer” price: | €240. |

- (c) In **Shop C**, Daniel can pay **€60 now, plus €20 at the end of each month for 12 months.**

Fill in the table to show the “special offer” price of the bike in this shop.

| | | |
|--|------------------------|--------------|
| | $60 + (20 \times 12)$ | $= 60 + 240$ |
| | | $= €300$ |
| | “Special offer” price: | €300. |

- (d) Do you think Daniel should buy the bike in shop **A**, **B**, or **C**?

Give a reason for your answer.

| | |
|-----------|--|
| Answer: | Shop B |
| Reason: | Cheapest at €240 |
| OR | |
| Answer: | Shop C |
| Reason: | Doesn't have to pay all the money now. |

Question 4**25 Marks**

For her birthday, Rachael went to Belfast with her family.

They left Dublin at 2:50 p.m. and arrived in Belfast 2 hours and 20 minutes later.

- (a) At what time did they arrive in Belfast?

5:10 p.m.

The hotel room cost £140 sterling. The exchange rate was £1 sterling = €1.28.

- (b) Find the cost of the hotel room, in euro (€).

$$140 \times 1.28 = €179.20$$

The family went to a concert in Belfast.

An adult's ticket cost €80. A child's ticket cost €60.

- (c) Write the cost of a child's ticket as a percentage of the cost of an adult's ticket.

$$\frac{60}{80} \times 100 = 75\%.$$

There were 4000 people at the concert.

The ratio of children to adults at the concert was 3:5.

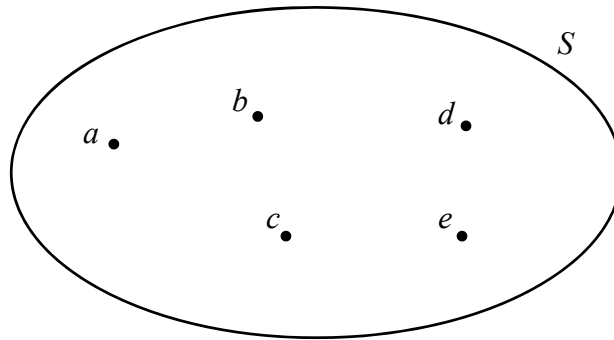
- (d) Find the number of children at the concert.

$$3 + 5 = 8.$$

$$\frac{3}{8} \times 4000 = 1,500.$$

Question 5**10 Marks**

The set S is shown in the Venn diagram below. It has 5 elements.



Some students are asked to write down **subsets** of S that have **3 elements** each.
Eoin writes down the subset $\{a, c, d\}$.

(a) Write down **two more subsets** of S that have 3 elements each.

Subset 1 = $\{a, b, e\}$

Subset 2 = $\{b, c, e\}$

Clíodhna writes down $\{a, b, w\}$.

(b) Explain why this is **not** a subset of S .

w is not an element of S .

Question 6**20 Marks**

A juice bar makes smoothies in two sizes, small and large.
Their menu is shown below.

| Smoothie | Small | Large |
|------------------|-------|-------|
| Strawberry Slurp | €2.00 | €4.00 |
| Banana Boost | €1.50 | €3.00 |
| Apple Swirl | €1.80 | €3.60 |
| Lemon Crush | €2.10 | €4.20 |

Gary buys a **small** Lemon Crush and a **large** Apple Swirl.

- (a) Find the total cost of these two smoothies.

$$2.10 + 3.60 = €5.70.$$

Elaine wants to buy two small smoothies and one large smoothie. She has €7 to spend.

- (b) **Complete** the sentence to show one combination of smoothies that Elaine could buy.
Find the total cost of these three smoothies.

| |
|--|
| Small Strawberry Slurp, small Banana Boost , and large Banana Boost . Cost = $2.00 + 1.50 + 3.00 = €6.50$. |
| OR |
| Small Strawberry Slurp, small Apple Swirl , and large Banana Boost . Cost = $2.00 + 1.80 + 3.00 = €6.80$. |
| OR |
| Small Strawberry Slurp, small Strawberry Slurp , and large Banana Boost . Cost = $2.00 + 2.00 + 3.00 = €7.00$. |

The juice bar makes another smoothie, an Orange Twist.

A **small** Orange Twist costs €1.60.

- (c) Use the prices in the menu above to work out how much a **large** Orange Twist costs.
There is a relationship between the prices of the small and large smoothies in the menu.

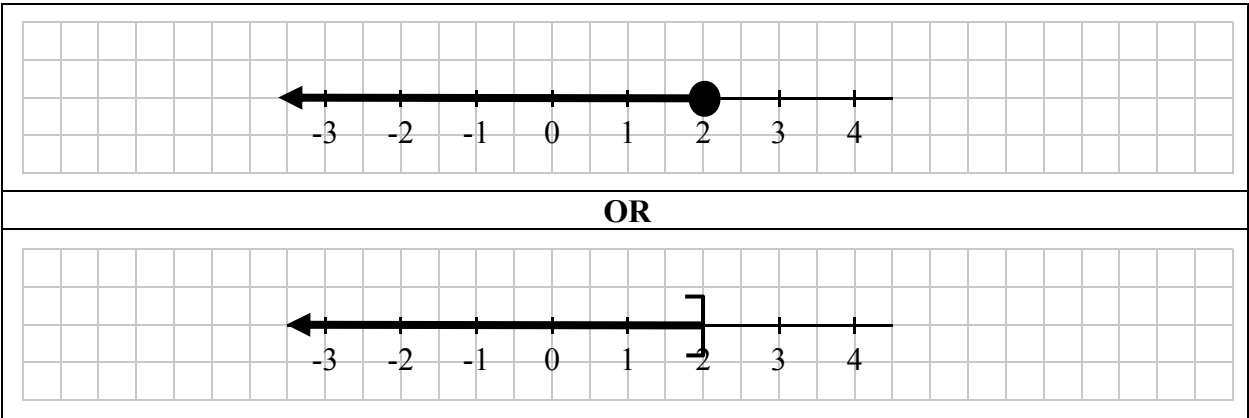
$$1.60 \times 2 = €3.20.$$

Question 7

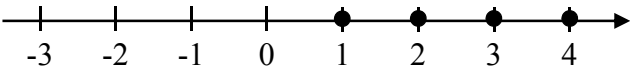
20 Marks

a) Graph the following inequality on the number line below.

$$x \leq 2, \quad x \in \mathbb{R}$$



(b) Put a tick (✓) in the correct box in the table to show which inequality is graphed on the number line below.

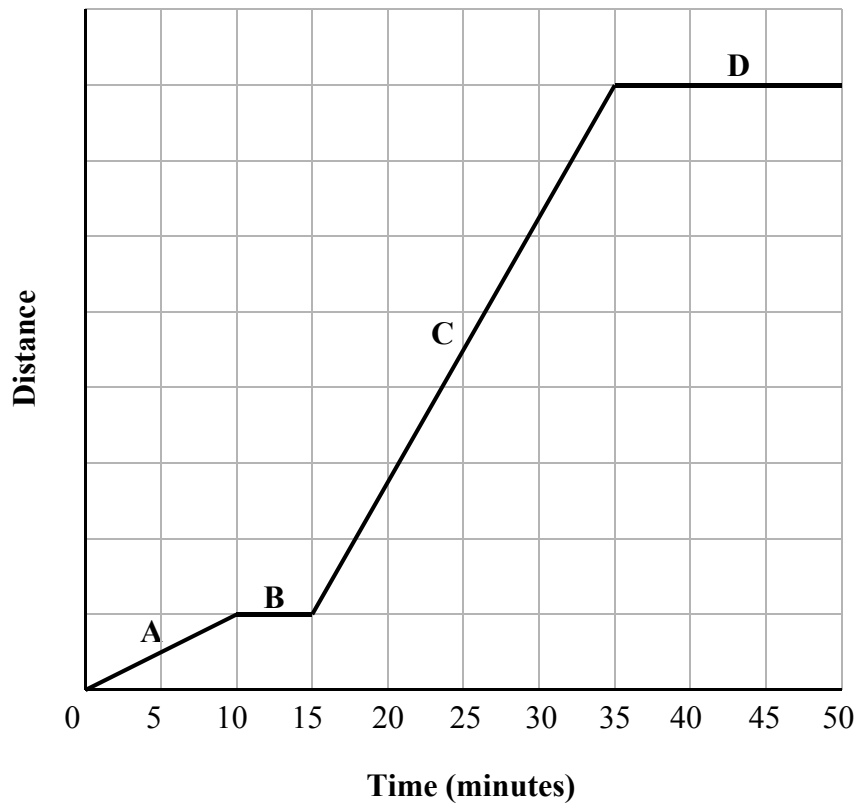


| Inequality | Put a tick (✓) in one box only |
|------------------------------------|--------------------------------|
| $x \leq 1, \quad x \in \mathbb{N}$ | |
| $x \geq 1, \quad x \in \mathbb{N}$ | ✓ |
| $x > 1, \quad x \in \mathbb{N}$ | |
| $x < 1, \quad x \in \mathbb{N}$ | |

Question 8

20 Marks

- (a) Gráinne is taking part in a training session.
The graph shows the distance she travelled during the session.
The four parts of the graph are labelled A, B, C, and D.



- (a) Write the letters A, B, C, and D into the table to match each description with the correct part of the graph.

| Description | Part of the Graph |
|------------------------------|-------------------|
| Gráinne runs for 20 minutes | C |
| Gráinne stops for 15 minutes | D |
| Gráinne walks for 10 minutes | A |
| Gráinne stops for 5 minutes | B |

- (b) Gráinne runs 4 km in 20 minutes at a steady pace.
Find her speed in km per hour.

| | | |
|------------------------------------|--|------------|
| Speed = Distance ÷ Time = 12 km/h. | | |
| OR | | |
| ⇒ | 4km in 20 minutes 12 km in 60 minutes | = 12 km/h. |

Question 9**40 Marks**

Factorise fully each of the following.

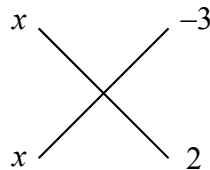
(a) $7x - 21y$

$$7(x - 3y)$$

(b) $x^2 - 25$

$$x^2 - 5^2 = (x + 5)(x - 5)$$

(c) $x^2 - x - 6$



Answer: $(x - 3)(x + 2)$

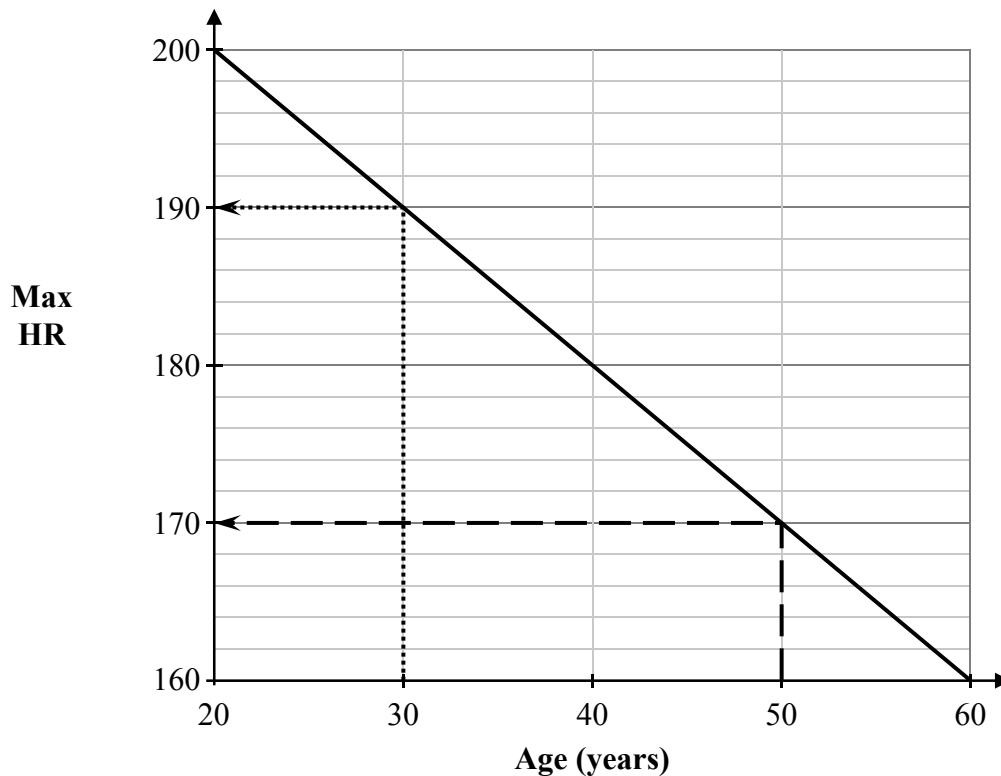
OR

$$\begin{aligned}x^2 - x - 6 &= x^2 - 3x + 2x - 6 \\&= x(x - 3) + 2(x - 3) \\&= (x + 2)(x - 3)\end{aligned}$$

Question 10**35 Marks**

A gym has three different formulas to estimate your maximum heart rate (Max HR), given your age in years. Different formulas can give different estimates.

The **first formula** is shown in the graph below.



- (a) Use the graph above to find the Max HR for someone aged 30 years and someone aged 50 years. Show your work on the graph.

Max HR for 30 years = **190**

Max HR for 50 years = **170**

[See working out on graph.]

- (b) Part of the formula that gives this graph is shown below.
Fill in the missing number in the formula.

Max HR = **220** minus your Age

The **second formula** for finding Max HR is:

$$\text{Max HR} = 210 \text{ minus Half your Age.}$$

(c) Use this formula to find the Max HR for someone aged 60 years.

$$\begin{aligned}\text{Max HR} &= 210 - 30 \\ &= 180\end{aligned}$$

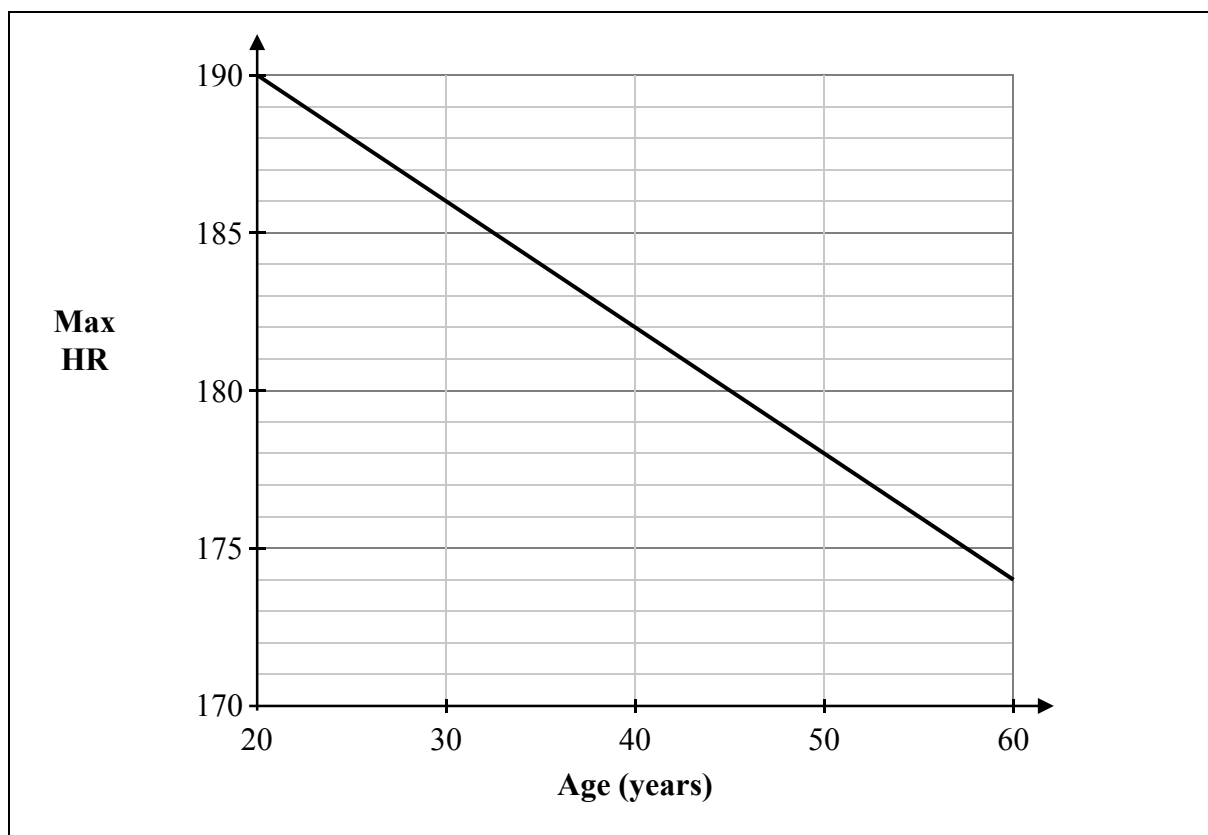
The **third formula** is shown in the table on the right.

The pattern in the Max HR column is a **linear** pattern.

(d) Complete the table.

| Age (years) | Max HR |
|-------------|--------|
| 20 | 190 |
| 30 | 186 |
| 40 | 182 |
| 50 | 178 |
| 60 | 174 |

(e) Using the values in the table, draw a graph on the grid below to show the Max HR for all ages from 20 years to 60 years.



Question 11**40 Marks**

- (a)**
- Solve the equation
- $5x - 10 = 3x + 2$
- .

$$5x - 10 = 3x + 2$$

$$5x - 3x = 2 + 10$$

$$2x = 12$$

$$x = 6.$$

- (b)**
- John says that
- $x = 4$
- is a solution of
- $x^2 - 2x - 8 = 0$
- .
- Show**
- that John is correct.

$$\text{Sub in: } (4)^2 - 2(4) - 8 = 0$$

$$\Rightarrow 16 - 16 = 0$$

OR

$$x^2 - 2x - 8 = 0$$

$$\Rightarrow (x + 2)(x - 4) = 0$$

$$\Rightarrow x = 4 \quad [\text{or } x = -2]$$

OR**Shows** long division: $x - 4$ divides in evenly to $x^2 - 2x - 8$.

- (c)**
- Solve the simultaneous equations:

$$x + y = 11$$

$$x - y = -5.$$

$$\begin{array}{r} x + y = 11 \\ x - y = -5 \\ \hline \end{array}$$

$$\Rightarrow 2x = 6$$

$$\Rightarrow x = 3$$

$$\Rightarrow y = 8$$

OR

$$\text{Second equation: } x = y - 5$$

$$\text{Sub into first equation: } y - 5 + y = 11$$

$$\Rightarrow 2y = 16$$

$$\Rightarrow y = 8$$

$$\Rightarrow x = 3$$

Question 12

20 Marks

Martin creates a pattern of numbers using the instructions in the table below.
The first number is filled in.

(a) Complete the table.

| Instruction | First Number | Second Number | Third Number |
|-----------------------------|--------------|---------------|--------------|
| Starting Number | 5 | 6 | 7 |
| Multiply by 3 | 5×3 | 6×3 | 7×3 |
| Subtract 5 from your answer | $15 - 5$ | $18 - 5$ | $21 - 5$ |
| Outcome | 10 | 13 | 16 |

(b) Martin picks a starting number and, using the instructions, gets an outcome of 1.
Find the **starting number** he picked.

| |
|---|
| <p>Trial and Improvement: $(2 \times 3) - 5 = 1$ Answer = 2.</p> |
| OR |
| <p>Reverse operations: $1 + 5 = 6$ $6 \div 3 = 2$ Answer = 2.</p> |
| OR |
| <p>Outcomes form linear pattern: $16 \rightarrow 13 \rightarrow 10 \rightarrow 7 \rightarrow 4 \rightarrow 1$ Corresponding starting numbers: $7 \rightarrow 6 \rightarrow 5 \rightarrow 4 \rightarrow 3 \rightarrow 2$ Answer = 2.</p> |

(c) When the starting number is k , what is the **outcome**? Give your answer in terms of k .

| |
|-----------|
| $3k - 5.$ |
|-----------|