

MATHEMATICS

Junior Certificate Ordinary Level

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2018 SEC Examination

Paper 1

1. (a) (i) $4 \times 20 = 80$
 $\quad\quad\quad + 100$

Total: €180

(ii) $\begin{array}{r} 240 \\ - 100 \\ \hline 140 \end{array}$ Needs €140
 No. of months = $\frac{140}{20} = 7$

7 months

(b) 320 Lisa saves €270 in 18 weeks.

$\begin{array}{r} 320 \\ - 50 \\ \hline 270 \end{array}$ Per week = $\frac{270}{18} = 15$

€15

2. (a) (i) An odd number

2	5	8	1
---	---	---	---

 (Any number ending in 1, 5 or 9)

(ii) A multiple of 5

9	8	2	5
---	---	---	---

 (Any number ending in 0 or 5)

(b)

9	8	5	2
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3. (a)

6

,

10

,

14

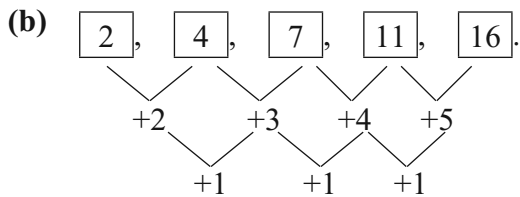
,

18

,

22

.



4. (a)

Number of folds	1	2	3	4	5	6
Number of layers	2	4	8	16	32	64
	2^1	2^2	2^3	2^4	2^5	2^6

(b) $2^8 = 256$ or 6 folds 64 layers
 $2^9 = 512$ 7 folds 128 layers
 Needs 9 folds 8 folds 256 layers
9 folds 512 layers

- (c) linear quadratic exponential

Justification:

If number of folds = n

then number of layers = 2^n

or Every term is the previous term multiplied by 2.

- (d) After 1 more fold 1 million \times 2 layers = 2 million
 After 2 more folds 2 million \times 2 = 4 million
 After 3 more folds 4 million \times 2 = 8 million

5. (a) (i) Answer = 07:28

(ii) 9:25
 -7:28

or 8:85
 -7:28
 1:57

or 3 mins short of 2 hours = 1 hr 57 mins

1 hour 57 mins

- (b) (i) Answer: $\frac{1}{15}$ $\frac{1}{12}$ $\frac{1}{5}$ $\frac{1}{4}$

(ii) Speed = $\frac{\text{Distance}}{\text{Time}} = \frac{90}{1\frac{1}{4}}$
 = 72 km/hr

6. (a) (i) 20% of 30 000 = $\frac{20}{100} \times 30\,000$
 = €6000 gross tax

(ii) Net Tax = 6000
 - 3300
 €2700

Net Pay = 30 000
 - 2700
 €27 300

(b) 5% of 800 = $\frac{5}{100} \times 800$
 = 40

Pay after rise = 800 + 40
 = €840

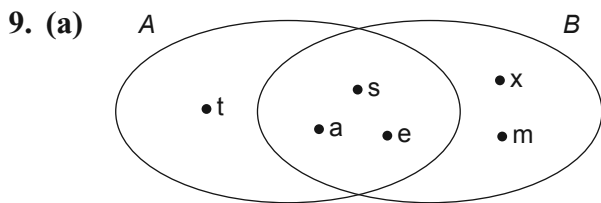
7. (a) $\frac{51.24}{0.90} = \text{€}56.93$
 (b) $15\% \text{ of } 65 = \frac{15}{100} \times 65$
 $= 9.75$

Cost = $65 - 9.75$
 $= \boxed{\text{€}55.25}$

(c) (i) Profit = $\text{€}8$

(ii) $\frac{8}{20} \times 100$
 $= \boxed{40\%}$

8. (a) (i) If Emma goes to **6 classes** per month in Gym **B**, it will cost $\text{€} \boxed{50}$.
 (ii) Gym **A** and Gym **B** cost **the same** for $\boxed{4}$ classes per month.
 (iii) If Emma goes to **10 classes** per month, then Gym \boxed{B} will be cheaper.
 (b) “Gym B costs $\text{€} \boxed{20}$ per month, plus $\text{€} \boxed{5}$ for each class.”



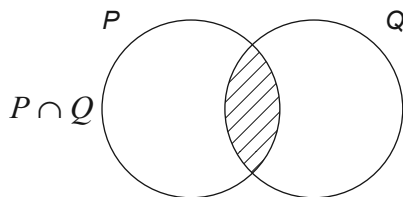
(i) $A = \boxed{\{t, a, s, e\}}$

(ii) $A \cap B = \boxed{\{a, s, e\}}$

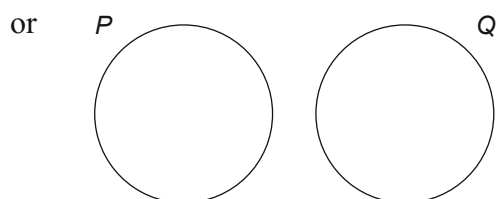
(iii) $B \setminus A = \boxed{\{x, m\}}$

- (b) always true sometimes true never true

Justification:



Shaded area is subset of P

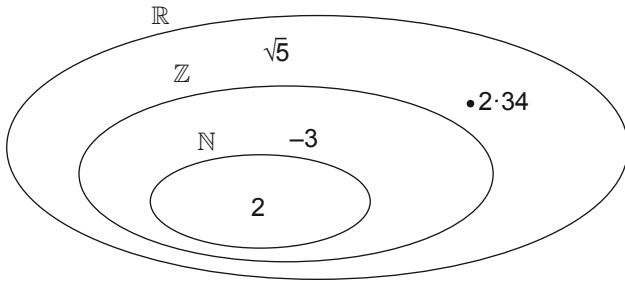


$P \cap Q = \{ \}$ which is subset of P

10. (a) $\sqrt{5} \approx 2.24$

Answer = , , , .

(b)



11. (a)

Person	Description of their age	Age, in years (in terms of E)
Eoin	Eoin's age	E
Grace	7 years younger than Eoin	$E - 7$
Evan	Twice as old as Eoin	$2E$
Aoibhe	3 years older than Eoin	$E + 3$

(b) $E - 7 = \frac{E}{2}$

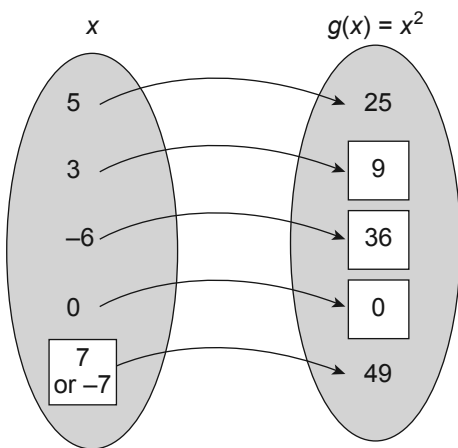
$2(E - 7) = E$

$2E - 14 = E$

$2E - E = 14$

$E = 14$

12. (a)



There are two possible answers for the x value going to 49: 7 or -7

(b) Range =

(c) $3^7 \times 3^7 = 3^{\text{14}}$

13. (a) $4(5) - 3(2)$

$= 20 - 6$

$= \text{14}$

(b) $3x + 15 + 4x + 6 = 0$

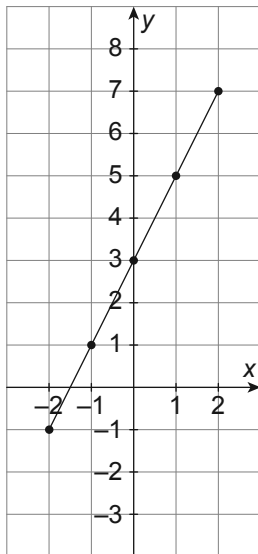
$$7x + 21 = 0$$

$$7x = -21$$

$$x = -\frac{21}{7}$$

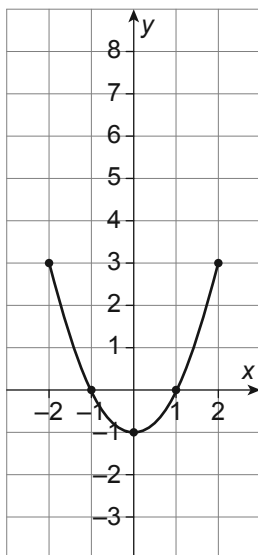
$$\boxed{x = -3}$$

14. (a)



x	$2x + 3$	y
-2	$2(-2) + 3 = -4 + 3 =$	-1 (-2, -1)
-1	$2(-1) + 3 = -2 + 3 =$	1 (-1, 1)
0	$2(0) + 3 = 0 + 3 =$	3 (0, 3)
1	$2(1) + 3 = 2 + 3 =$	5 (1, 5)
2	$2(2) + 3 = 4 + 3 =$	7 (2, 7)

(b)



x	$x^2 - 1$	y
-2	$(-2)^2 - 1 = 4 - 1 =$	3 (-2, 3)
-1	$(-1)^2 - 1 = 1 - 1 =$	0 (-1, 0)
0	$(0)^2 - 1 = 0 - 1 =$	-1 (0, -1)
1	$(1)^2 - 1 = 1 - 1 =$	0 (1, 0)
2	$(2)^2 - 1 = 4 - 1 =$	3 (2, 3)

15. (a) $3(x + 2y)$

(b) $2x(x - 4) + 7(x - 4)$

$$= 2x^2 - 8x + 7x - 28$$

$$= 2x^2 - x - 28$$

(c) (i) $(x - 2)(x + 8) = 0$

$$x - 2 = 0 \quad x + 8 = 0$$

$$x = 2 \quad x = -8$$

$$\boxed{x = 2, -8}$$

(ii) $\frac{\cancel{x-2}(x+8)}{\cancel{x-2}} = x + 8$

2017 SEC Paper 1

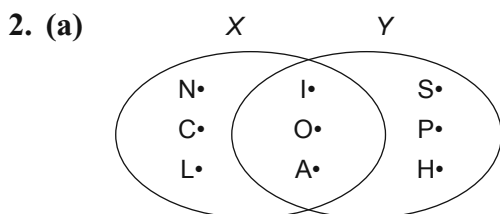
1. (a)

Number	Factors
9	1, 3, 9
10	1, 2, 5, 10
11	1, 11
12	1, 2, 3, 4, 6, 12

(b) Number that is prime: 11
Reason: It is divisible only by itself and 1.

(c) Answer = 3, 7, and 13.

(d) $3 \times 7 \times 13$
 $= 273$



(b) Answer = {I, O}

(c) Answer = {N, C}

(d)

	English	Set Notation
Statement 1	Letters in both X and Y .	$X \cap Y$
Statement 2	Letters in X that are not in Y .	$X \setminus Y$
Statement 3	Letters in X or Y or both.	$X \cup Y$

3. (a) (i) $2 \times 5 = 10$ hours

(ii) €95 for 10 hours

$$\Rightarrow \frac{95}{10} = \text{€}9.50 \text{ per hour}$$

(iii) Spends 30% : 30% of 95
 $= \frac{30}{100} \times 95$
 $= \text{€}28.50$

(b) $20 \times 60\,000 \times 0.7$

$$= 8.4 \times 10^5 \text{ g}$$

4. (a) (i)

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Prize A	€10	€15	€20	€25	€30	€35

(ii) Linear

Reason: Any term minus the previous term is a constant equal to 5.

(iii) Total amount of money = €135

(b) (i)

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Prize	€2	€4	€8	€16	€32	€64

(ii) Exponential

Reason: Any term divided by the previous term is a constant equal to 2.

(c) Alexa should choose: Prize A

Reason: Total for A = €135

Total for B = €126

Total for C = €100

5. (a) (i) 5:00 a.m.

(ii) 5:00 + 11:40 = 16:40

∴ 16:40 or 4:40 p.m.

(b) €1 = R\$ 3.60

$$\text{R\$}1 = \text{€}\frac{1}{3.60}$$

$$\text{R\$} 756 = \text{€}\frac{756}{3.60} = \text{€}210$$

(c) x = Cost of child ticket

$2x$ = Cost of adult ticket

Total cost of 2 adult tickets and 2 child tickets = $2x + 2(2x) = 6x$

$$6x = 756$$

$$x = 126$$

Cost of child ticket = €126

6. (a)

Emma's age, in years	4	5	6	7	10	16
(a)(i) Spot's age, in years	0	1	2	3	6	12
(a)(ii) Spot's age, in dog years	0	7	14	21	42	84

(b) 1 year = 7 dog years

$$1 \text{ dog year} = \frac{1}{7} \text{ year}$$

$$105 \text{ dog years} = \frac{105}{7} \text{ years}$$

$$= 15 \text{ years}$$

$$\text{Emma's age} = 15 + 4 = 19 \text{ years}$$

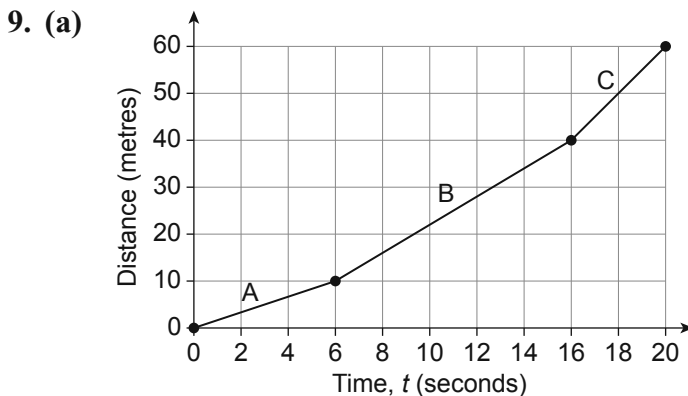
7. (a)

Shape: x	Number of sides: $h(x)$
Pentagon	5
Square	4
Hexagon	6
Triangle	3

(b) Range = {3, 4, 5, 6}

8. (a) $\frac{2(4) + 1}{3(4) - 2}$
 $= \frac{8 + 1}{12 - 2} = \frac{9}{10}$

(b) $w(3w - 2) + 4(3w - 2)$
 $= 3w^2 - 2w + 12w - 8$
 $= 3w^2 + 10w - 8$



(i) Answer = 20 s

(ii) Answer = 40 m

(b) (i) Martin's slowest section: A

(ii) Speed = $\frac{\text{Distance}}{\text{Time}} = \frac{10}{6} = \frac{5}{3}$ m/s

(c) (i) Radius = 35 cm

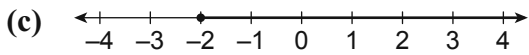
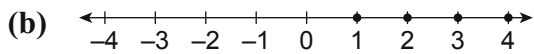
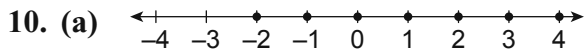
(ii) Circumference = $2 \times \pi \times r$
 $= 2 \times \pi \times 35$
 $= 220$ cm

(d) $60 \text{ m} = 60 \times 100 \text{ cm}$
 $= 6000 \text{ cm}$

Number of turns

$= \frac{6000}{220} = 27\frac{3}{11}$

Ans: 27 Full turns

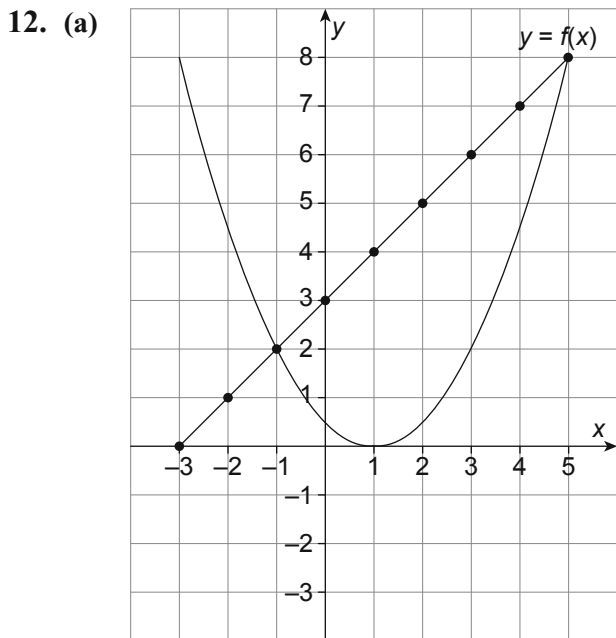


11. (a) $x^2 + 4x - 5 = (x + 5)(x - 1)$

(b) $(x + 5)(x - 1) = 0$

$$\begin{array}{l|l} x + 5 = 0 & x - 1 = 0 \\ x = -5 & x = 1 \end{array}$$

Ans: -5, 1



(i)

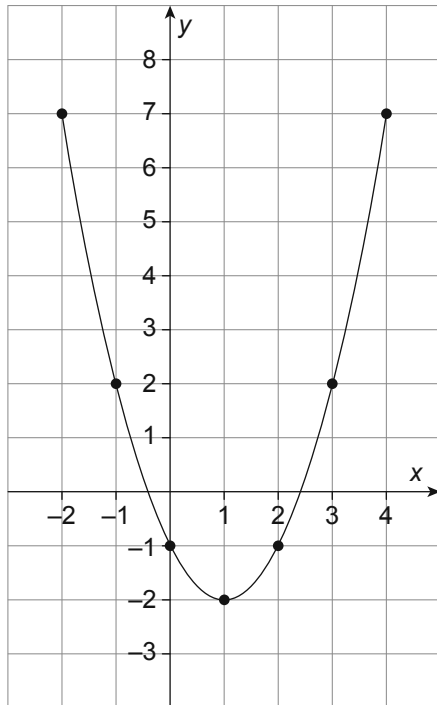
x	-3	-2	-1	0	1	2	3	4	5
$g(x) = x + 3$	0	1	2	3	4	5	6	7	8

(ii) Answer = (-1, 2) and (5, 8)

(b) (i) $k(x) = x^2 - 2x - 1$

$$\begin{aligned} k(3) &= (3)^2 - 2(3) - 1 \\ &= 9 - 6 - 1 \\ &= 2 \end{aligned}$$

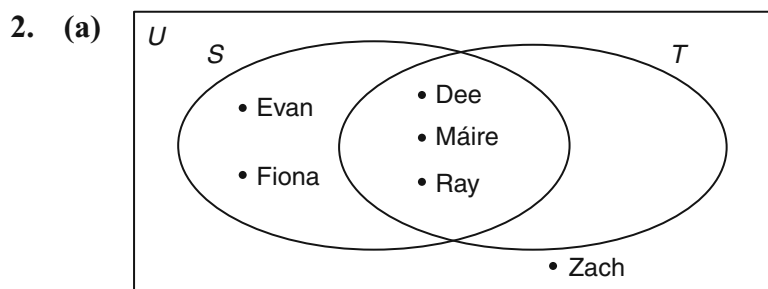
(ii)



x	-2	-1	0	1	2	3	4
x^2	4	1	0	1	4	9	16
$-2x$	4	2	0	-2	-4	-6	-8
-1	-1	-1	-1	-1	-1	-1	-1
$k(x)$	7	2	-1	-2	-1	2	7

2016 SEC Paper 1

1. (a) (i) 999 999
 (ii) 100 000
 (b) (i) 11
 (ii) 25
 (iii) 32
 (iv) 7

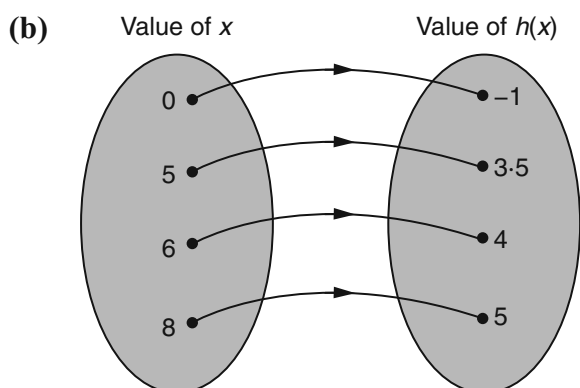


- (b) (i) {Dee, Máire, Ray}
 (ii) {Zach}

(c)

Statement	Tick one only for each statement	
	True	False
$\#S = 3$		✓
$Dee \in T$	✓	
$S \cup T = T \cup S$	✓	
$T \subset S$	✓	
$S \setminus T = \{ \}$		✓

3. (a) (i) $h(4) = 3$
 (ii) $\odot = 2$



4. (a) 20% of 2450
 $= \frac{20}{100} \times 2450$
 $= 490$
 Gross tax = €490
- (b) Net tax = 490 – 275
 $= €215$
 Net income = 2450 – 215
 $= €2235$
5. (a) 2 hrs 45 mins is charged at 3 hours.
 Charge = 3 × 30 = €90
 Call-out = €40
 Total = €130
- (b) €1 = £0.71
 $£1 = € \frac{1}{0.71}$
 $£24.83 = \frac{24.83}{0.71} = €34.97$
- (c) % VAT = $\frac{75.90}{330} \times 100\%$
 $= 23\%$
6. (a) 2 l cost €3.60
 1 l costs = $\frac{3.60}{2} = €1.80$
- (b) B 750 ml cost €1.50
 1 ml costs $\frac{1.50}{750}$
 1 l = 1000 ml cost $\frac{1.50}{750} \times 1000 = €2$
 Cheaper brand, per litre = A
- (c) She cannot buy 5 l of A because it comes in 2 l cartons.
 She has to buy 2 l of A (1 carton) and 3 l of B (4 cartons).
 A: 1 carton = 3.60
 B: 4 cartons = 4 × 1.50
 $= 6.00$
 Total = €9.60
 Lowest price = €9.60
7. (a) 89 270
 (b) 89 000
 (c) 8.93×10^4

8. (a) $(x + 9)(2x - 1)$
 $= x(2x - 1) + 9(2x - 1)$
 $= 2x^2 - x + 18x - 9$
 $= 2x^2 + 17x - 9$

(b) $3ax + ay + 3cx + cy$
 $= a(3x + y) + c(3x + y)$
 $= (3x + y)(a + c)$

9. (a) Ned's distance = 30 m

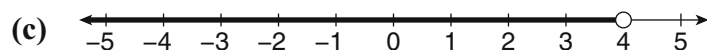
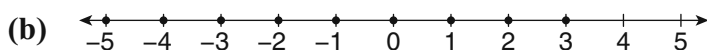
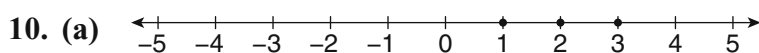
(b) Laurie's distance = 25 m

(c) 10 seconds

(d) $\frac{25}{10} = 2.5$ m/sec

(e) Answer: No

Reason: He started slowly but speeded up during the race.



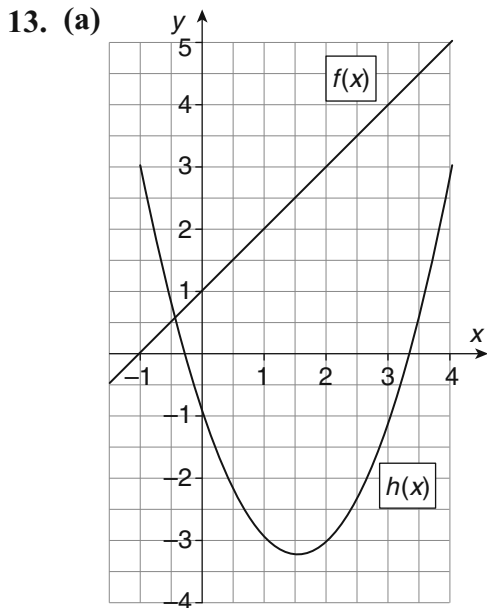
11.

Expression	In the form 2^p , where $p \in \mathcal{N}$
$8 =$	2^3
$32 =$	2^5
$2 \times 2 \times 2 \times 2 \times 2 \times 2 =$	2^6
$2^7 \times 2^{10} =$	2^{17}
$(2^6)^4 =$	2^{24}

12. (a)

Description	Algebraic term
Jake's age now.	J
Jake's age in 2 years' time.	$J + 2$
Jake's age in 5 years' time.	$J + 5$
Jake's age 4 years ago.	$J - 4$
Twice Jake's age.	$2J$
One third of Jake's age.	$\frac{J}{3}$

(b) $5M + 2 = 2M + 35$
 $5M - 2M = 35 - 2$
 $3M = 33$
 $M = \frac{33}{3}$
 $M = 11$



- (b) $f(x)$
 $f(x) = x + 1$ is a straight line because it is a linear function.
- (c) $x = -0.5$
- (d) $h(8) = 8^2 - 3(8) - 1$
 $= 64 - 24 - 1$
 $= 39$

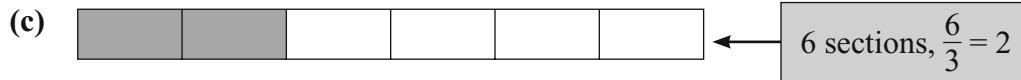
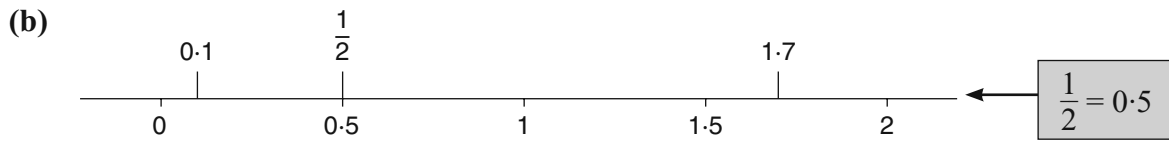
14. (a) (i) $x^2 + 6x - 7 = (x + 7)(x - 1)$
(ii) $(x + 7)(x - 1) = 0$
 $x + 7 = 0$ | $x - 1 = 0$
 $x = -7$ | $x = 1$
Answers: $-7, 1$

(b) $3x + 2y = 39$(1)
 $x + 2y = 25$(2)
 $3x + 2y = 39$(1)
 $-1x - 2y = -25$(2) $\times -1$
 $2x = 14$
 $x = 7$

Into (2): $7 + 2y = 25$
 $2y = 25 - 7$
 $2y = 18$
 $y = 9$
Answers: $x = 7, y = 9$

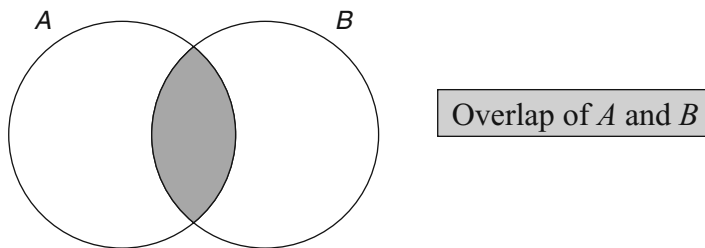
2015 SEC Paper 1

1. (a) (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) $(-2)^3 = -2 \times -2 \times -2 = 4 \times -2 = -8$

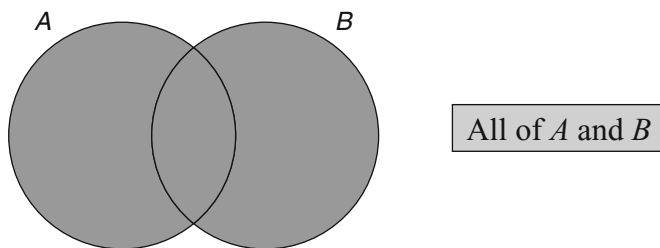


$$\begin{array}{|c|} \hline 1 \\ \hline 3 \\ \hline \end{array} = \begin{array}{|c|} \hline 2 \\ \hline 6 \\ \hline \end{array} = \begin{array}{|c|} \hline 4 \\ \hline 12 \\ \hline \end{array}$$

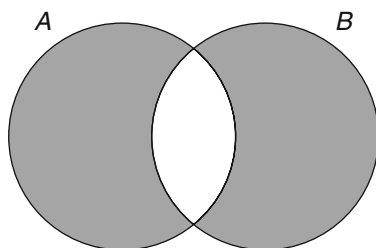
2. (a) $A \cap B$



- (b) $A \cup B$



- (c) $(A \cup B) \setminus (A \cap B)$



- (d) The final box is right: $A \setminus B$

3. (a) $\text{€}320 - \text{€}(320 \times 0.1) = \text{€}320 - \text{€}32 = \text{€}288$

$$10\% = \frac{10}{100} = 0.1$$

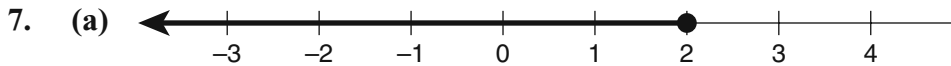
- (b) $\text{€}320 - \text{€}(320 \times 0.25) = \text{€}320 - \text{€}80 = \text{€}240$

$$\frac{1}{4} = 0.25$$

- (c) $\text{€}60 + \text{€}(20 \times 12) = \text{€}60 + \text{€}240 = \text{€}300$

- (d) Offer B is by far the best. It is cheaper than offer A by €48 and offer C by €60.

4. (a) $2:50 + 2 \text{ h } 20 \text{ m}$
 $= 4:50 + 20 \text{ m}$
 $= 5:10 \text{ p.m.}$
- (b) $\text{€}140 \times 1.28 = \text{€}179.20$
- (c) $\frac{60}{80} \times 100 = \frac{3}{4} \times 100 = 75\%$
- (d) 4000 in total
 $3:5 = \text{children} : \text{adults}$
 Number of children $= \frac{3}{8} \times 4000 = 1500$
 1500 children in attendance
5. (a) $S1 = \{b, c, d\}$
 $S2 = \{c, d, e\}$
- (b) w is not an element of S , so it cannot be in any subset of S .
6. (a) $\text{€}2.10 + \text{€}3.60 = \text{€}5.70$
- (b) Small Strawberry Slurp + Small Apple Swirl + Large Banana Boost
 $= \text{€}2.00 + \text{€}1.80 + \text{€}3.00$
 $= \text{€}6.80$
- (c) Large smoothies cost double the price of the small ones.
 $\text{€}1.60$ for a small Orange Twist, $\text{€}3.20$ for a large



(b)

Inequality	Tick
$x \leq 1, x \in \mathbb{N}$	
$x \geq 1, x \in \mathbb{N}$	✓
$x > 1, x \in \mathbb{N}$	
$x < 1, x \in \mathbb{N}$	

8. (a)

Gráinne runs for 20 minutes	C	←	15 mins to 35 mins
Gráinne stops for 15 minutes	D	←	Flat, 35 mins to 50 mins
Gráinne walks for 10 minutes	A	←	0 mins to 10 mins
Gráinne stops for 5 minutes	B	←	Flat, 10 mins to 15 mins

- (b) $4 \text{ k in } 20 \text{ minutes} = 12 \text{ k in } 60 \text{ minutes}$
 12 km/h
- $20 \text{ mins} \times 3 = 60 \text{ mins} = 1 \text{ Hour}$
 $4 \times 3 = 12$

9. (a) $7(x - 3y)$
- (b) $(x + 5)(x - 5)$ ← Difference of two squares
- (c) $(x + 2)(x - 3)$

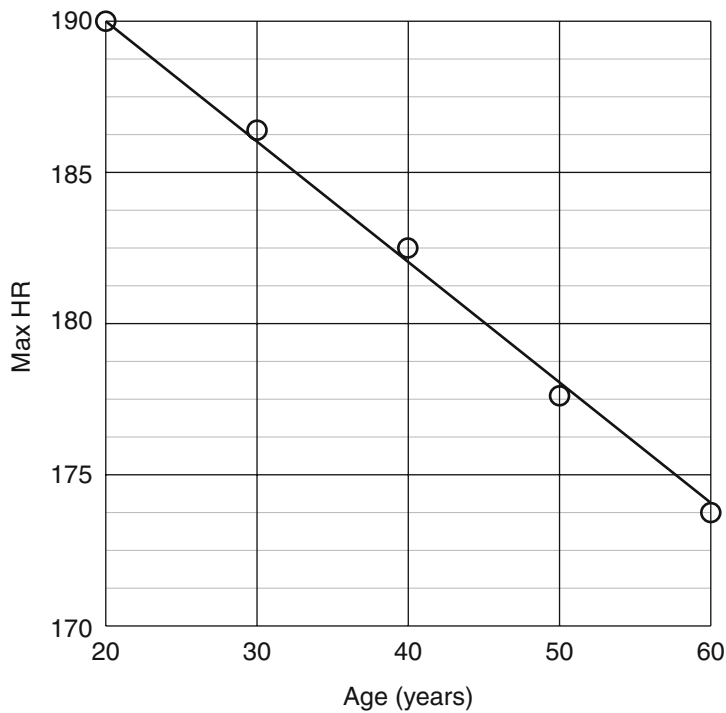
10. (a) Max HR @ 30 years = 190 bpm
 Max HR @ 50 years = 170 bpm
- $190 + 30 = 220$
 $170 + 50 = 220$
- (b) 220 bpm minus your age
- (c) $210 - \left(\frac{60}{2}\right) = 210 - 30 = 180 \text{ bpm}$

(d)

Age	Max HR
20	190
30	186
40	182
50	178
60	174

HR decreases by 4 each time

(e)



11. (a) $5x - 10 = 3x + 2$

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

$$2x = 12$$

$$x = 6$$

(b) $x^2 - 2x - 8 = 0$

$$x = 4: (4)^2 - 2(4) - 8 \leftarrow \text{Check by substituting } x = 4$$

$$= 16 - 8 - 8$$

$$= 0$$

\therefore John is correct.

(c) (1) $x + y = 11$

(2) $+x - y = -5$ \leftarrow Add to eliminate y and find x

$$2x = 6$$

$$x = 3$$

$$3 + y = 11 \leftarrow \text{Substitute into Eq (1) to find } y$$

$$y = 8$$

12. (a)

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) Reverse steps from (a)

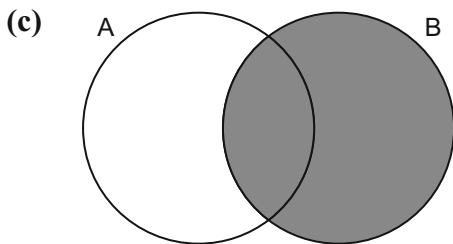
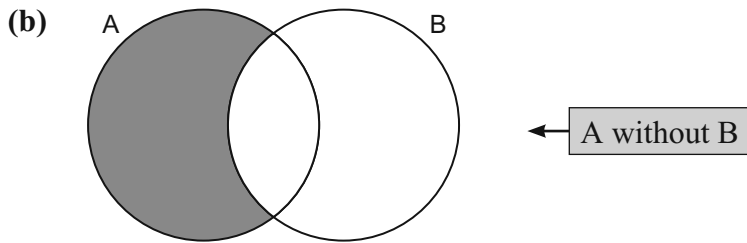
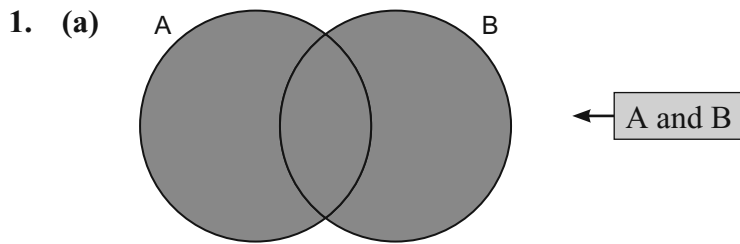
Outcome: 1

Add 5: $1 + 5 = 6$ Divided by 3: $\frac{6}{3} = 2$

Starting number is 2

(c) Starting number k Multiply by 3: $3k$ Subtract 5: $3k - 5$ Outcome = $3k - 5$

2015 SEC Sample Paper 1 (Phase 3)



(d) $A \setminus B$ represents students who like fruit but do not like vegetables.

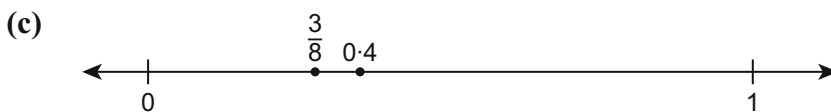
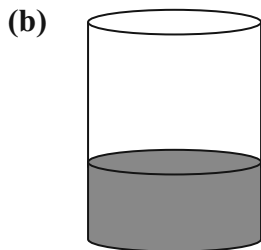
2. (a) $8 + 1 + 5 + 1 + 3 + 1 + 8 = 27$



(c) $16 + 1 + 5 + 1 + 3 + 1 + 16 = 43$

$43 + 50$ (Bonus Points) $= 93$ points

3. (a) 0.375 ← $3 \div 8 = 0.375$



(d) 0.4 is to the right of $\frac{3}{8}$.

4. (a) (i) $\frac{3}{4}$ (ii) $\frac{5}{7}$ (iii) $\frac{3}{4} \times \frac{5}{7} = \frac{15}{28}$

(b) Answer: No

Reason: $\frac{3}{4} \neq \frac{2}{3}$

5. (a) $\text{€}5000 \times 0.04 = \text{€}200$ ← $4\% = 4 \div 100 = 0.04$

(b) $\text{€}200 \times 0.41 = \text{€}82$

(c) $\text{€}5000 + \text{Interest} - \text{Tax}$
 $\text{€}5000 + \text{€}200 - \text{€}82 = \text{€}5118$

(d) $\text{€}5118 + \text{Interest} - \text{Tax}$
 $\text{€}5118 + \text{€}204.72 - \text{€}83.94$
 $= \text{€}5238.78$

6. (a) $50 \times 20 = 1000$ people

(b) $600 \times 2 = 1200$ people

(c) Standing = $1200 \times \text{€}10 = \text{€}12\,000$

Seating = $1000 \times \text{€}15 = \text{€}15\,000$

Total = $\text{€}17\,000$

7. (a) 2^6

(b) $p = 5$ ← $a^p \times a^3 = a^{(p+3)}$ add the powers (indices)

(c) $2^4 = 16$

↑

$$\frac{2^5 \times 2^6}{2^4 \times 2^3} = \frac{2^{11}}{2^7} = 2^{(11-7)} = 2^4$$

8. (a) 5 km (b) 25 minutes (c) She is faster going home.

(d) Olive leaves home to go to the shop. She cycles at a steady rate of 15 km/hour until she reaches the shop. She stays in the shop for 25 minutes and then cycles home at a faster rate of 30 km/hour. Her total journey of 10 km took 45 minutes so her average speed for the journey was $13\frac{1}{3}$ km/hour.

9. (a)

Time	Red Car Distance (m)	Blue Car Distance (m)
0	70	20
1	90	50
2	110	80
3	130	110
4	150	140
5	170	170
6	190	200
7	210	230
8	230	260
9	250	290

(b) 5 seconds

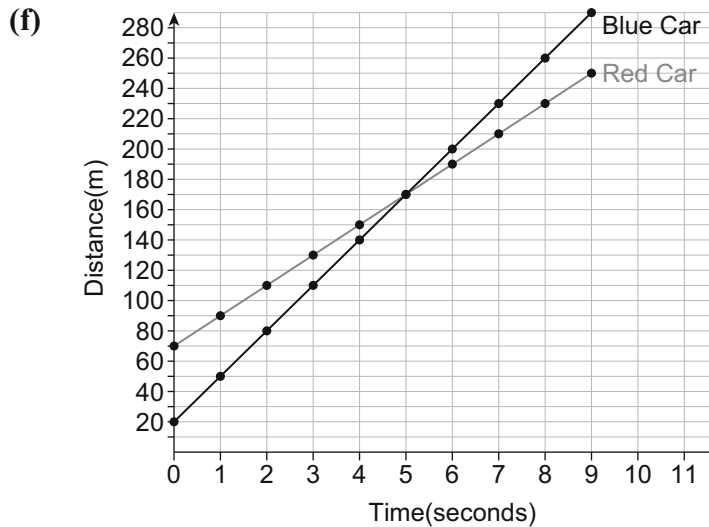
(c) $D = 70 + 20s$ (D is distance in m, s is time in seconds.)

(d) $D = 20 + 30s$ (D is distance in m, s is time in seconds.)

(e) If you put in 5 seconds into both formulas you should get the same answer.

$$D = 20 + 30(5) = 20 + 150 = 170 \text{ m}$$

$$D = 70 + 20(5) = 70 + 100 = 170 \text{ m}$$



(g) This is where the two lines intersect. They intersect at (5,170).

The two cars are both 170 m from Tina and this occurs after 5 seconds.

10. Let x be the number of hours worked in Bob's Bakery.

$16 - x$ will be the number of hours worked in Ciara's Café.

$$11x + 9(16 - x) = 152$$

$$11x + 144 - 9x = 152$$

$$2x + 144 = 152$$

$$2x = 8$$

$$x = 4$$

4 hours worked in Bob's Bakery

12 hours worked in Ciara's Café

11. (a)

$$\frac{2x + 1}{3} + \frac{3x - 5}{2}$$
$$\frac{2(2x + 1) + 3(3x - 5)}{6}$$
$$\frac{4x + 2 + 9x - 15}{6}$$
$$\frac{13x - 13}{6}$$

(b) $\frac{2x+1}{3} + \frac{3x-5}{2} = \frac{13}{2}$
 $\frac{13x-13}{6} = \frac{13}{2}$
 $\frac{13x-13}{6} = \frac{39}{6}$
 $13x-13 = 39$

← Adding fractions:
Get common denominator which is 6.

$13x = 52$ ← Adding 13 to both sides of the equation

$x = 4$ ← Dividing both sides by 13

12. (a) $2x + 4$ or any multiple of $(x + 2)$

(b) $(x + 2)(2x + 3) = 2x^2 + 7x + 6$

(c) $x^2 - k$

$x^2 - 4$ has factors of $(x + 2)$ and $(x - 2)$.

$k = 4$

(d) (i) Division is the reverse of multiplication.
If she divides the expression by $x + 2$, it should divide in evenly with no remainder.

(ii)
$$\begin{array}{r} 3x + 5 \\ x + 2 \overline{) 3x^2 + 11x + 10} \\ \underline{3x^2 + 6x} \\ 5x + 10 \\ \underline{5x + 10} \\ 0 \end{array}$$

← Or use Area Model

	$3x$	$+5$
x	$3x^2$	
2		10

(e) $(x + 2)$ multiplied by any similar expression such as $(x + 2)(x - 1)$

13. (a) $x^2 + 7x + 12 = 0$

$(x + 4)(x + 3) = 0$

$x + 4 = 0$ or $x + 3 = 0$

$x = -4$ or $x = -3$

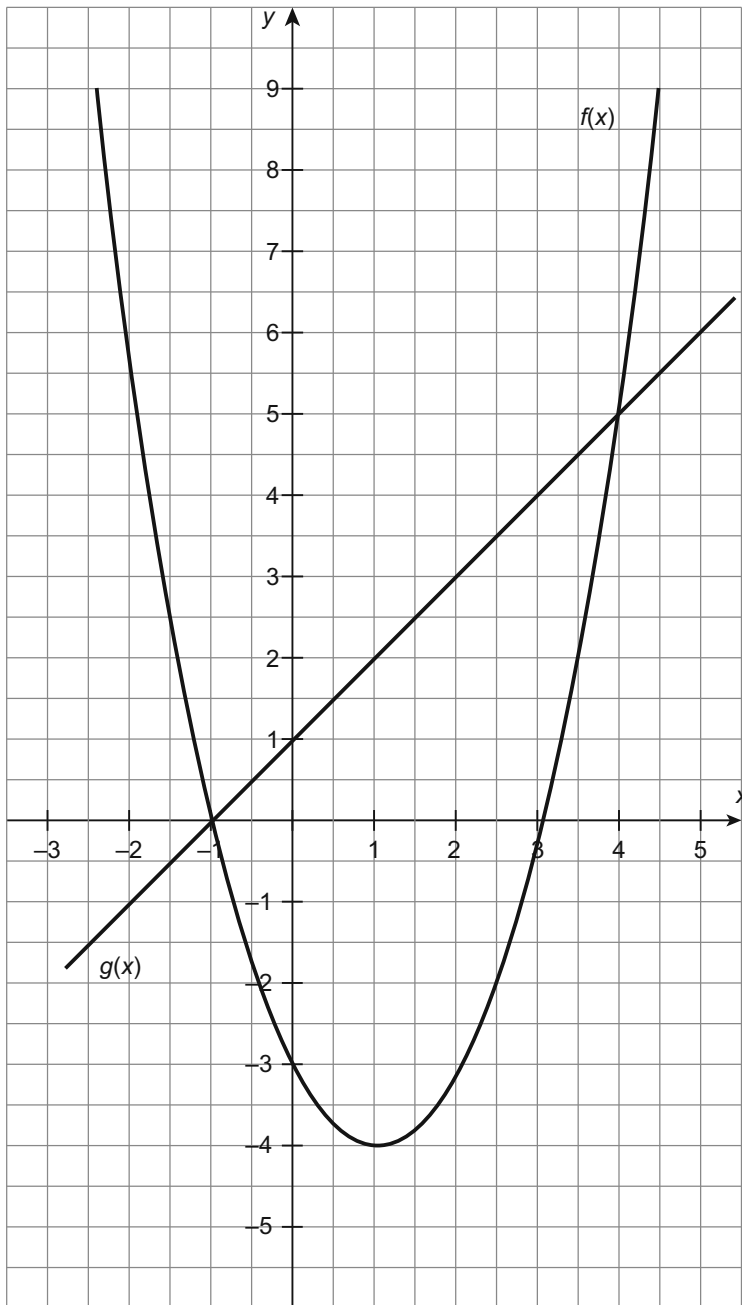
(b) $(-4)^2 + 7(-4) + 12 = 0$ or $(-3)^2 + 7(-3) + 12 = 0$

$16 - 28 + 12 = 0$ $9 - 21 + 12 = 0$

$28 - 28 = 0$ $21 - 21 = 0$

True True

14. (a)



(b) Function: $f(x)$

Explanation: This is an x^2 function and x^2 functions are U shaped or \cap shaped.

OR Function: $g(x)$

Explanation: This is an x function and x functions are linear.

(c) $f(2) = -3$

(d) $f(2) = (2)^2 - 2(2) - 3$

$$f(2) = 4 - 4 - 3 \Rightarrow f(2) = -3$$

(e) $x = 2$

(f) $x = -1$ and $x = 4$

15. Answer: Diagram B is not a function.

Explanation: There are two arrows coming from the same element (diamond).

2014 SEC Paper 1 (Phase 3)

1. (a)

6	2	9	5
9	6	5	2

Other examples are 2659, 2695, 6259, 6295.

(i) 5629 or similar, any number using the 4 digits and ending in 9 or 5.

(ii) 2569

(b) $3 \boxed{+} 2 \boxed{\times} 5 = 13$

← BIMDAS

(i) $3 \boxed{-} 2 \boxed{+} 5 = 6$

(ii) $3 \boxed{\times} 2 \boxed{-} 5 = 1$

2. (a) (i)

Item	Actual Cost	Estimate (nearest euro)
Magazine	€2.80	3
Milk	€1.79	2
Banana	34 cent	0
Bread	€1.23	1
Biscuits	79 cent	1
Total	€6.95	7

(ii) $€7 - 6.95 = €0.05$, or 5 cent

(b)

Number	Rounded number	Rounded to...
851.7	852	the nearest whole number
0.0026	0.003	three decimal places
798.798	798.8	one decimal place
12.342, or similar (incl. 12.34)	12.34	two decimal places

3. (a) (i) $\frac{1}{5} + \frac{1}{2} = \frac{2}{10} + \frac{5}{10} = \frac{7}{10}$

← Adding fractions: Find the common denominator.

(ii) $\frac{3}{10} = €12$

$\frac{1}{10} = €4$

$\frac{10}{10} = €40$

← If she spent $\frac{7}{10}$, she had $\frac{3}{10}$ left.

- (b) $2 + 3 + 4 = 9$ parts
 $45 \div 9 = 5$ sweets per part
 $2 \times 5 = 10$ sweets
 $3 \times 5 = 15$ sweets
 $4 \times 5 = 20$ sweets

The sweets were divided as follows $\frac{2}{9}$, $\frac{3}{9}$ and $\frac{4}{9}$.
 $\frac{1}{9}$ of 45 = 5
 $\frac{2}{9}$ of 5 \times 2 = 10 sweets
 $\frac{3}{9}$ of 5 \times 3 = 15 sweets
 $\frac{4}{9}$ of 5 \times 4 = 20 Sweets



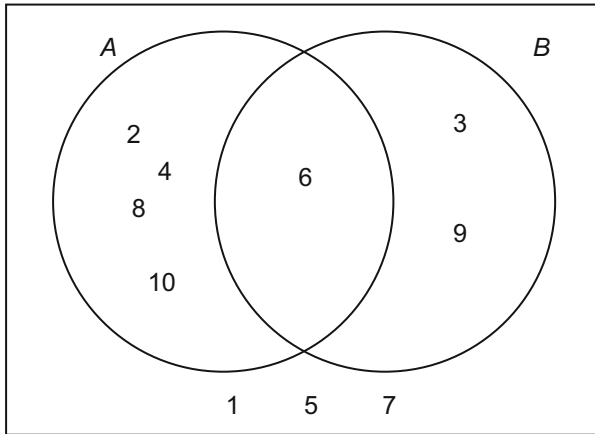
4. (i) Complete the table.

Power of 3	Expanded power of 3	Answer
3^1	3	3
3^2	3×3	9
3^3	$3 \times 3 \times 3$	27
3^4	$3 \times 3 \times 3 \times 3$	81
3^5	$3 \times 3 \times 3 \times 3 \times 3$	243

- (ii) Multiply 6561 by 3 or $3^8 \times 3^1 = 3^9$ or equivalent.

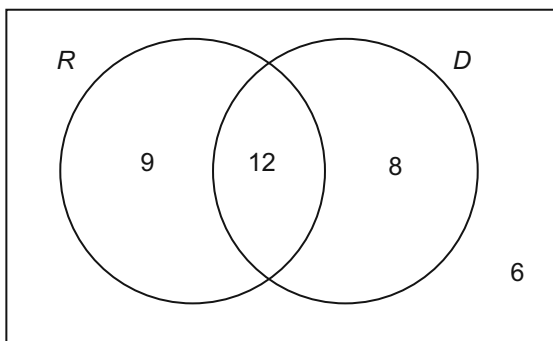
5. (a) You can't say for sure if some websites are good or not, or equivalent.
 Your explanation should include the idea that this is **not well-defined**.

- (b) (i) U



- (ii) 6 ← 6 is common to both sets.

6. U



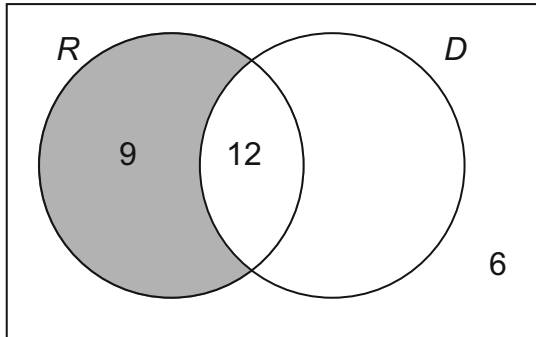
(i) $9 + 12 + 6 = 27$

$35 - 27 = 8$

See diagram.

(ii) $12 + 8 = 20$

(iii) U



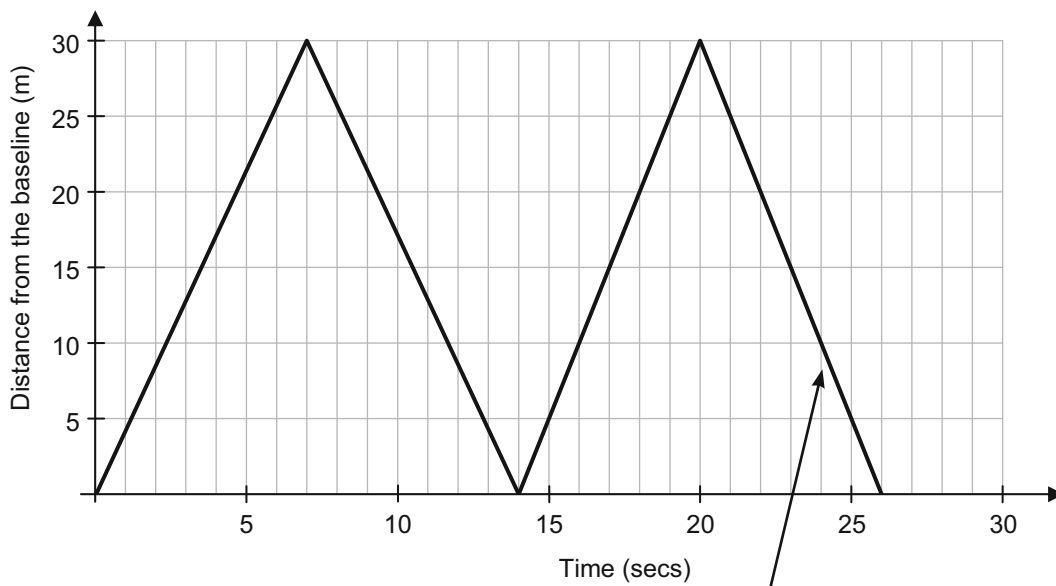
(iv) The students who liked Rihanna but not One Direction, or equivalent.

7. (a) €20 ← $€20 + 0\% \text{ of } €20 = €20$

(b) $4.8\% \text{ of } €1600 = €76.80$ ← $4.8\% \text{ of } €1600 = 1600 \times 0.048 = €76.80$
 $€1600 + €76.80 = €1676.80$

(c) $109\% = €2.18$
 $1\% = €0.02$
 $100\% = €2$

8.



(i) 14 seconds

(ii) 30 m

This part of the graph is the answer to part (iii).

(iii) See diagram.

Or:

$$\begin{aligned} \text{Time} &= \frac{\text{Distance}}{\text{Speed}} \\ &= \frac{30}{5} \\ &= 6 \text{ seconds} \end{aligned}$$

For half the lap, the total time is 12 seconds.

See diagram.

9. (i) **Pattern 1:** 2 4 9 17 28

First difference:
(Change)

2	5	8	11
---	---	---	----

Second difference:
(Change of change)

3	3	3
---	---	---

Pattern 2: -1 2 5 8 11

First difference:
(Change)

3	3	3	3
---	---	---	---

Second difference:
(Change of change)

0	0	0
---	---	---

(ii) Pattern 1: Quadratic

Reason: First difference changes, second difference is constant, or equivalent

Pattern 2: Linear

Reason: First difference is constant, or equivalent

10. (a) (i) $5x + 10$

$5(x + 2)$ ← 5 is a common factor.

(ii) $rc - sc + 2rd - 2sd$

$(c + 2d)(r - s)$

(iii) $x^2 - 16$

$(x + 4)(x - 4)$

Difference of
two squares:
 $x^2 - 4^2$

Group: $rc - sc + 2rd - 2sd$
 $(rc - sc) + (2rd - 2sd)$
 $c(r - s) + 2d(r - s)$
 $(r - s)(c + 2d)$

(b) (i) $x^2 - 5x + 6$

$(x - 3)(x - 2)$ ← Quadratic factors

(ii) Solve the equation $x^2 - 5x + 6 = 0$.

$(x - 3)(x - 2) = 0$

$x = 3 \quad x = 2$

(iii) Verify **one** of your answers.

Either:

$$3^2 - 5(3) + 6 = 0$$

$$9 - 15 + 6 = 0$$

$$0 = 0$$

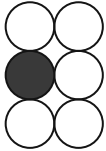
Or:

$$2^2 - 5(2) + 6 = 0$$

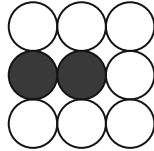
$$4 - 10 + 6 = 0$$

$$0 = 0$$

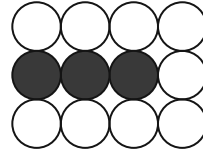
11.



1st Stage

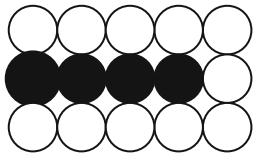


2nd Stage



3rd Stage

(i)



(ii)

Number of Shaded Discs	Number of White Discs
1	5
2	7
3	9
4	11
5	13
6	15

(iii) 9

Continue the pattern	
Number of shaded discs	Number of white discs
7	17
8	19
9	21

(iv) There are 2 extra white discs for each extra shaded disc. There is 1 shaded disc and 5 white discs at the start.

Or:

$$\text{Shaded discs} = n$$

$$\text{White discs} = 3 + 2n$$

Continue the pattern	
Number of shaded discs	Number of white discs
1	$2(1) + 3 = 5$
2	$2(2) + 3 = 7$
3	$2(3) + 3 = 9$
n	$2(n) + 3$

12. (a) Integers are all the whole numbers.

Or:

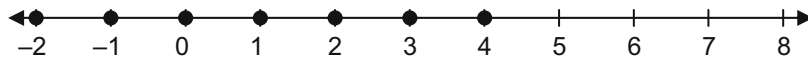
An integer is an element of $\{\dots -3, -2, -1, 0, 1, 2, 3 \dots\}$

(b) (i) $2x \leq 1 + 7$

$$2x \leq 8$$

$$x \leq 4$$

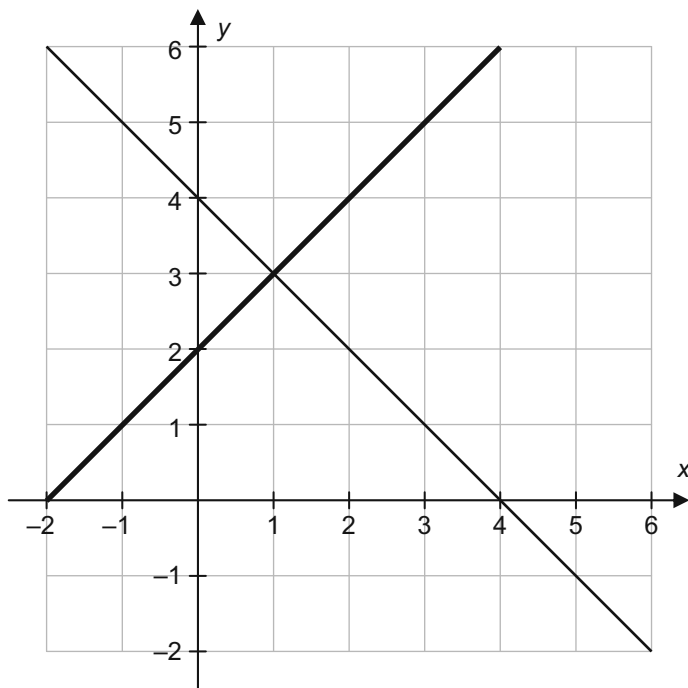
(ii) Graph



13. (i) $€199.95 \div 1.33 = €150.34$ (to the nearest cent)

(ii) $€269.99 - €150.34 = €119.65$

14.



(i) The line cuts the axes at $(0, 2)$ and $(-2, 0)$, or the line cuts the y -axis at 2 and has slope of 1.

(ii) $(1, 3)$

← Reading the point from the graph

(iii) Verify your answer using algebra

Simultaneous equations

$$y = -x + 4$$

$$y = x + 2$$

$$2y = 6$$

$$y = 3$$

$$\Rightarrow x = 1$$

\Rightarrow Point of intersection is (1, 3)

Substitute (1, 3) into the equation of each line:

$$y = -x + 4$$

$$3 = -1 + 4$$

$$3 = 3$$

and:

$$y = x + 2$$

$$3 = 1 + 2$$

$$3 = 3$$

15. (i) $f(-2) = 12$

$$f(-1) = 7$$

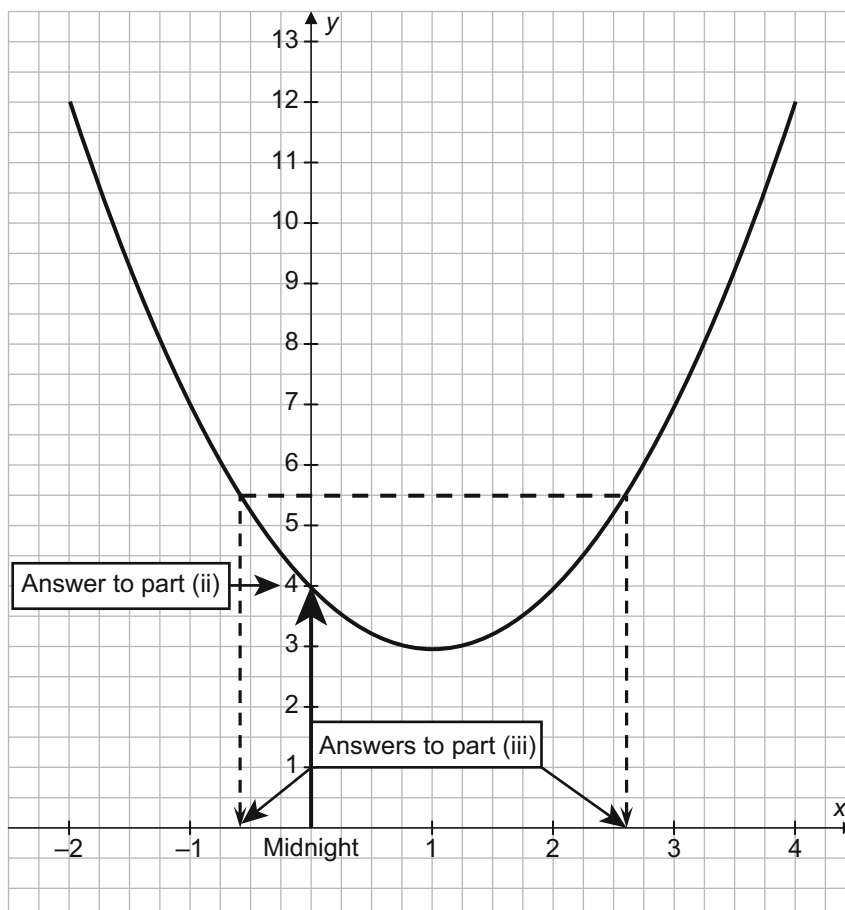
$$f(0) = 4$$

$$f(1) = 3$$

$$f(2) = 4$$

$$f(3) = 7$$

$$f(4) = 12$$



(ii) 4 km/h ← See arrows on the graph.

(iii) See diagram: 11:25 p.m. and 2:35 a.m.

(iv) 3 hours and 10 minutes ← Read from the graph.

2013 SEC Paper 1 (Phase 3)

1. (a) $5000/1000 = 5$ (kg) ← $1,000 = 1$ kg
- (b) $(2.7)100 = 270$ (cm) ← 100 cm = 1 m
- (c) $8000/1000 = 8$ (litres) ← 1000 cm³ = 1 litre
- (d) $(4)(100)(100) = 40\ 000$ (cm²) ← $10\ 000$ cm² = 1 m²

2. (a) John
 $0.7 = 70\%$ $\frac{3}{4} = 75\%$
 Both < 80%

- (b) $0.7 \times 20 = 14$
 $80\% \times 20 = 16$ ← 80% of 20 = $0.8 \times 20 = 16$
 $\frac{3}{4} \times 20 = 15$

- (c) $\frac{14 + 16 + 15}{3} = \frac{45}{3} = 15$ ← To find the mean: Add the numbers and divide by the number of numbers.

3. (a)

GRIDPOWER	€
Standing charge	9.47
18.5 cent per unit	94.35
Sub-total	103.82
13.5% VAT	14.02
Total	117.84

ELECTROLINE	€
No standing charge	
First 50 units free Then 25 cent per unit	115
Sub-total	115
13.5% VAT	15.53
Total	130.53

$510 \times 18.5 = 94.35$

↑
Cost of 510 units

$510 - 50 = 460 \times 0.25 = 115$

↑
Cost of 460 units

- (b) $130.53 - 117.84 = €12.69$

- (c) Electroline ← Which company?

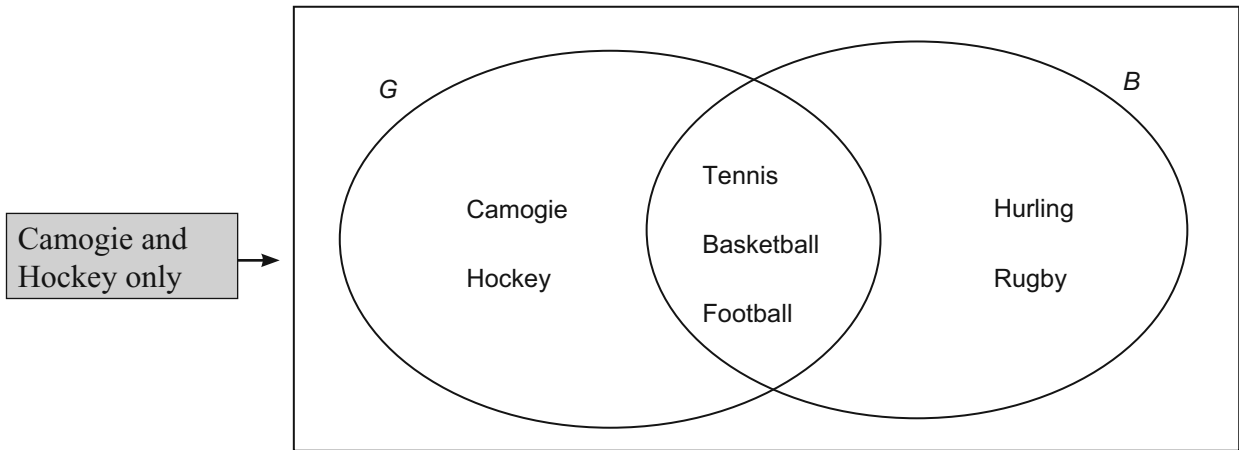
Because it is cheaper. ← Reason

$130.53 - 10\% = 117.48$ ← Cost less 10% off Electroline bill:

$117.84 - 117.48 = 36$ cent difference

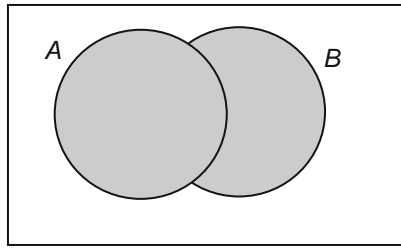
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4.

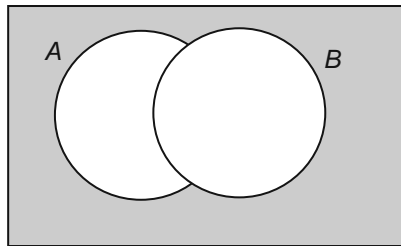


- (a) Girls only or $G \setminus B$ or $U \setminus B$
- (b) Girls and boys both play. or $G \cap B$
- (c) (i) $A \cup B \cup U$

Girls without (less) the boys
OR
Universal set without (less) the boys

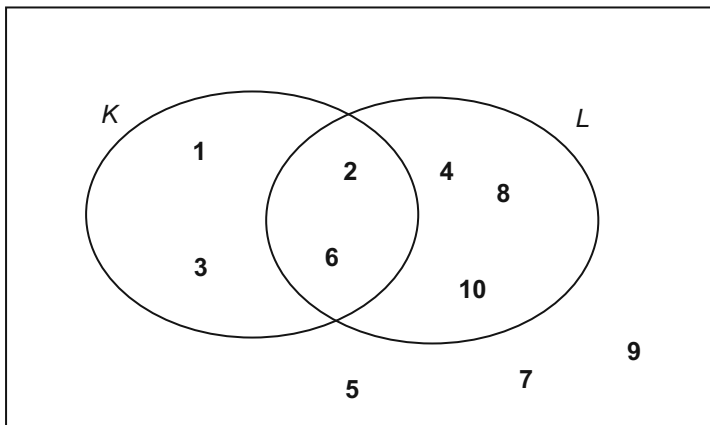


- (ii) $(A \cup B)' \cup U$



5. $U = \{\text{Natural numbers from 1 to 10 inclusive}\}$ $K = \{\text{Factors of 6}\}$ $L = \{\text{Even numbers}\}$

(a) U



(b) (i) $K \cap L = \{\}$ ← $\{\}$ is the null set.

False

$K \cap L = \{2, 6\}$ ← Reason

(ii) $K \neq L$

True

$K = \{1, 2, 3, 6\}$, $L = \{2, 4, 6, 8, 10\}$. These are not equal.

(iii) $K \cup L = U$

False

$K \cup L$ does not include 5, 7, 9.

6. (a) $19 \cdot 50 + 2(4 \cdot 50) = \text{€}28 \cdot 50$

(b) $2(7 \cdot 25) + 4(4 \cdot 50) = \text{€}32 \cdot 50$

$32 \cdot 50 - 28 \cdot 50 = \text{€}4$ extra

← 2 adults @ €7.25 each = €14.50

4 children @ €4.50 each = €18

Total = €32.50

7. $22 \times 8 \cdot 65 = \text{€}190 \cdot 30$

Tips: $235 \cdot 50 - 190 \cdot 30 = \text{€}45 \cdot 20$

← Tips = Total wages – Total for 22 hours

8. (a) $82\,300 \times 40\% = 32\,920$

$= 32\,900$ to nearest 100

← $40\% = 40 \div 100 = 0 \cdot 4$

$40\% \text{ of } 82\,300 = 82\,300 \times 0 \cdot 4 = 32\,920$

(b) (i) No

OR

Bill: $128 + 10\% = \text{€}140 \cdot 80$

Cost each: $140 \cdot 80 \div 8 = \text{€}17 \cdot 60$

So, €15 each is not enough.

Bill: $128 + 10\% = \text{€}140 \cdot 80$

$15 \times 8 = \text{€}120$

← Reason

So, €15 each is not enough.

(ii) €18 (or an amount $\geq \text{€}17 \cdot 60$)

← Estimate

Cost each: €17.60

Or

$20 \cdot 80 \div 8 = \text{€}2 \cdot 60$

← Reason

So, at least this much extra each is needed.

9. (a) (i) 2, 5, 8, 11, 14, 17

← Add 3 each time to get the next term.

(ii) 16, 12, 8, 4, 0, -4

← Subtract 4 each time to get the next term.

(iii) 1, 4, 9, 16, 25, 36, 49

← $1^2, 2^2, 3^2, 4^2, 5^2, 6^2, 7^2 \dots \dots \dots$

(b) 0, 1, 1, 2, 3, 5, 8, 13, 21,

34,

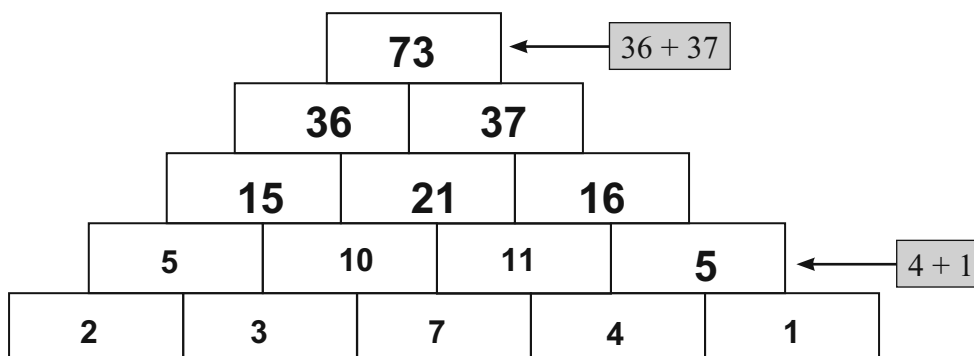
55

← $8 + 13$

← $13 + 21$

← $21 + 34$

(c)



10. (a) (i) $5x + 4y$

$5(3) + 4(5) = 15 + 20 = 35$ ← Use brackets when filling in.

(ii) $x^2 + y^2$

$(3)^2 + (5)^2 = 9 + 25 = 34$ ← Use brackets when filling in.

(b) (i) Multiply $5(3a - 4b)$

$15a - 20b$

(ii) Multiply $x(x - y) + y(x + y)$

$x^2 - xy + xy + y^2$

$= x^2 + y^2$

(c) (i) $4xy - 6x^2y^2$

$= 2xy(2 - 3xy)$ ← $2xy$ is a common factor.

(ii) $2ax - ay + 2bx - by$

$a(2x - y) + b(2x - y) = (a + b)(2x - y)$ ←

Grouping:

Group $2ax - ay$: a is common.

Group $2bx - by$: b is common.

11. (a) Factorise $x^2 - x - 12$
 $(x + 3)(x - 4)$

(b) Solve the equation $x^2 - x - 12 = 0$

$(x + 3)(x - 4) = 0$

$x + 3 = 0$ $x - 4 = 0$

$x = -3$ $x = 4$

12. (a) Lauren

17 and 18 are consecutive numbers. ← Reason

(b) $8 + 3x = 47$ $47 - 8 = 39$

$3x = 39$ OR $39 \div 3 = 13$

$x = 13$

(c) $5x + 2y = 30$

$3x - 2y = 2$

$8x = 32$

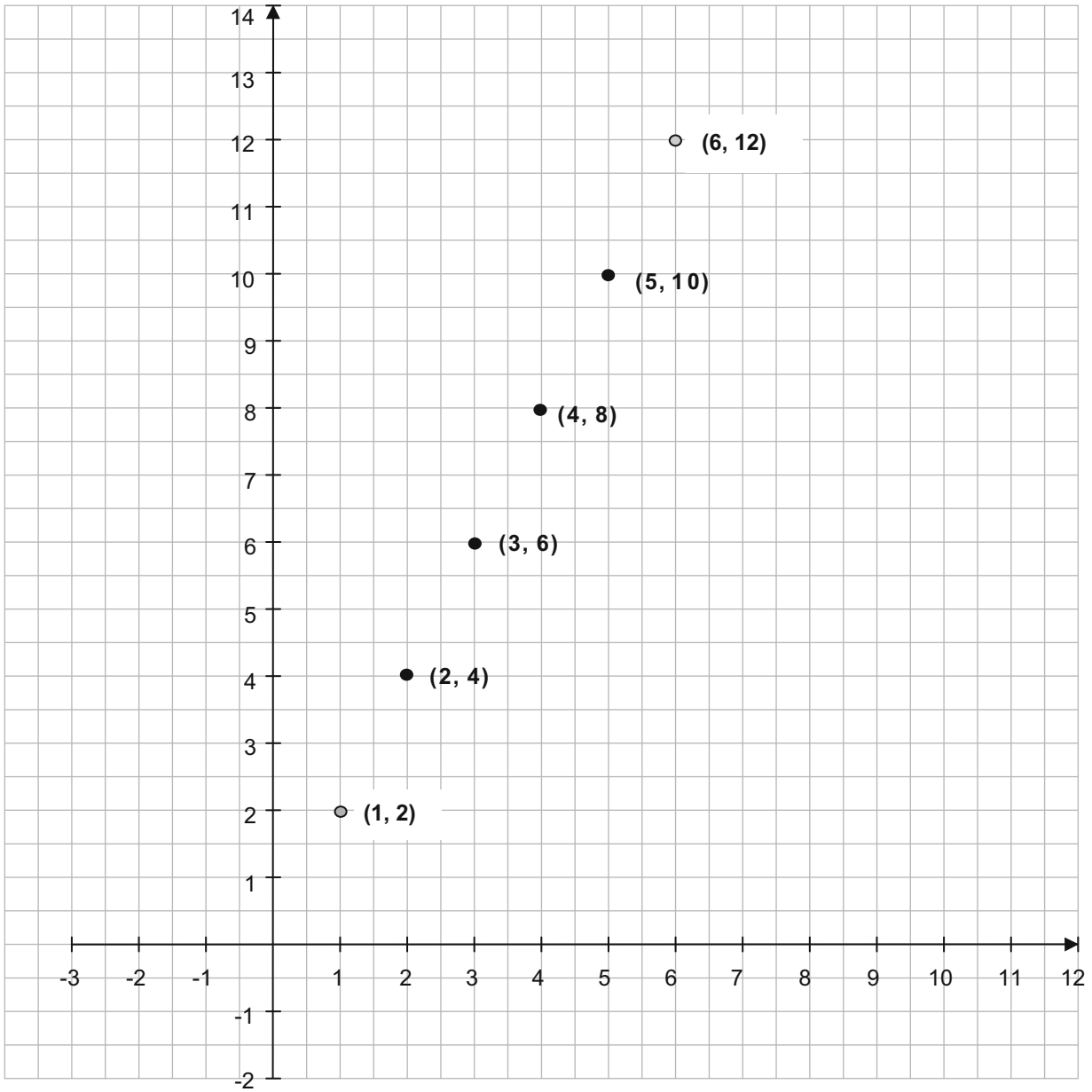
$x = 4$

$5(4) + 2y = 30$

$2y = 30 - 20 = 10$

$y = 5$

13. (a)



(b) $x \rightarrow 2x$

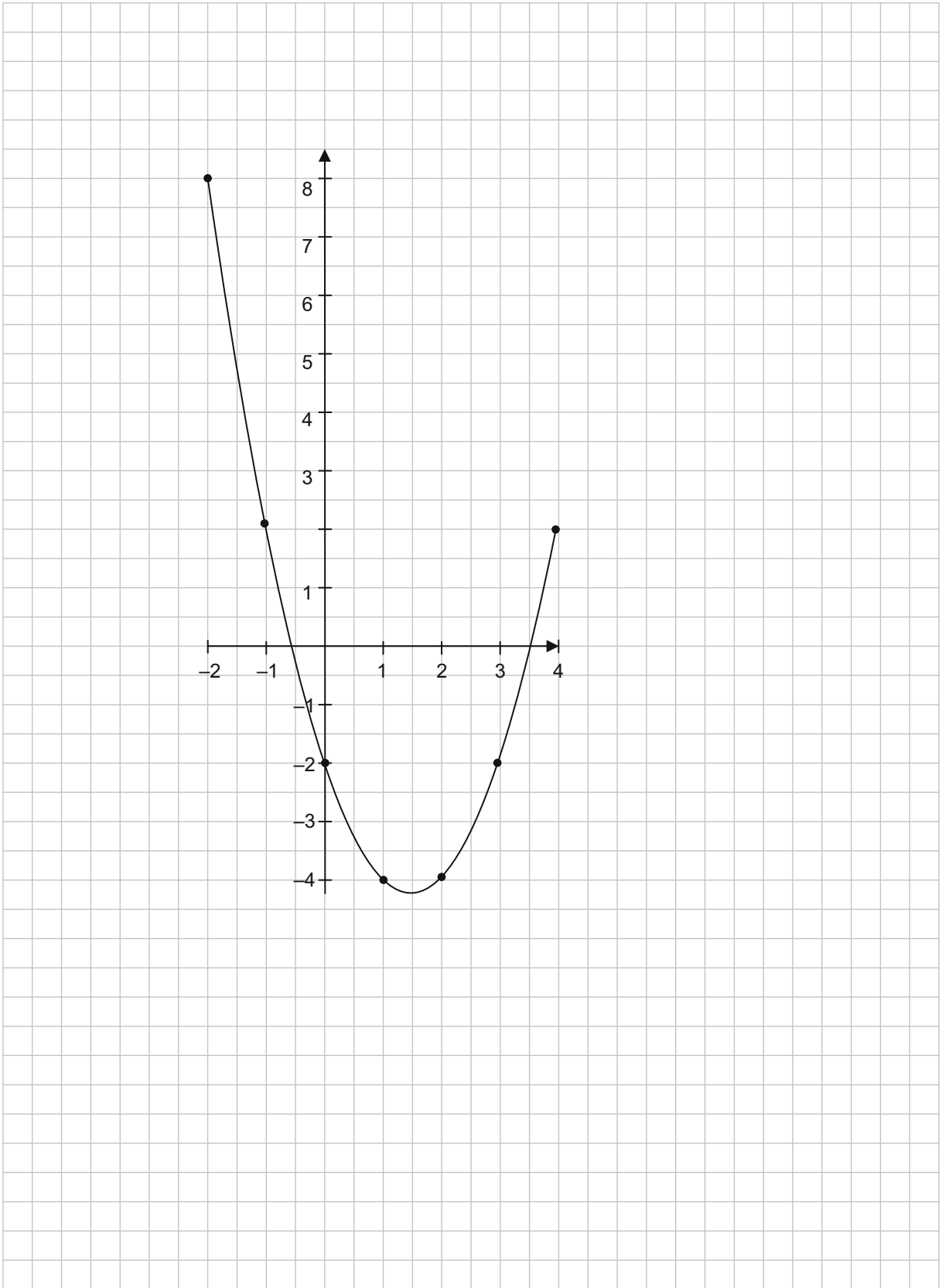
x value is $\frac{1}{2}$ the y value for each couple.

(c) (1, 2) (6, 12) ← See the diagram above.

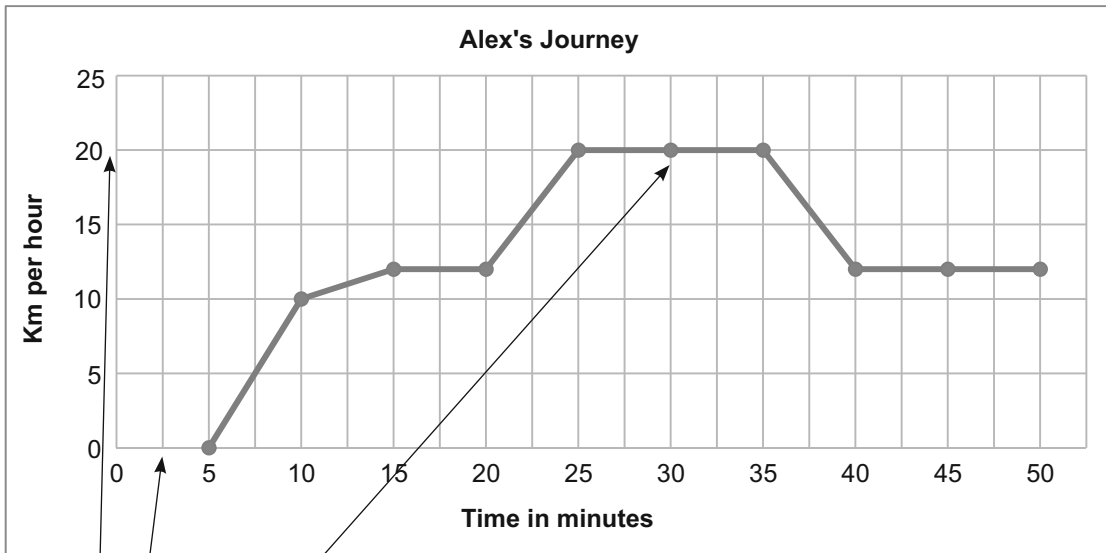
14. (a)

x	$f(x)$	$(x, f(x))$
-2	8	$(-2, 8)$
-1	2	$(-1, 2)$
0	-2	$(0, -2)$
1	-4	$(1, -4)$
2	-4	$(2, -4)$
3	-2	$(3, -2)$
4	2	$(4, 2)$

(b)



15.



- (a) 5 minutes
- (b) 20 km/h
- (c) 10 minutes
- (d) $10 \text{ mins} = \frac{1}{6} \text{ hour}$
 $20 \times \frac{1}{6} = 3 \frac{1}{2} \text{ km}$

Speed = Distance \div Time

$20 \text{ km/h} = \text{Distance} \div 10 \text{ min} \left(\frac{1}{6} \text{ of an hour} \right)$

Distance = $20 \times \frac{1}{6}$

Distance = $\frac{10}{3} \text{ km} = 3.3333 \text{ km}$

2012 SEC Paper 1 (Phase 2)

1. (a) $\frac{2}{6} = \frac{1}{3}$ ← Always write the answer in its simplest form.

(b) $\frac{2}{5}$

(c) $\frac{2}{5} - \frac{2}{6} = \frac{12 - 10}{30} = \frac{2}{30} = \frac{1}{15}$

2. (a) $€8.65 \times 40$
 $= €346.00$

(b) $€346 \times 20\%$ ← $20\% = 20 \div 100 = 0.2$
 $= €69.20$ $20\% \text{ of } €346 = 346 \times 0.2 = €69.20$

(c) $€69.20 - €20$ ← Net Tax = Gross Tax – Tax Credit
 $= €49.20$

(d) $€346.00 - €49.20$ ← Net Pay = Gross Pay – Net Tax
 $= €296.80$

(e) $€1650 \times 0.045$ ← $4.5\% = \frac{4.5}{100} = 0.045$
 $€74.25$

(f) $250 \times 0.20 = €50$
 $€50 + €30 = €80$

(g) No, because she only has €74.25 and would need €5.75 more to pay the bill.

3. (a)

Power of 2	Expanded power of 2	Answer
2^1	2	2
2^2	2×2	4
2^3	$2 \times 2 \times 2$	8
2^4	$2 \times 2 \times 2 \times 2$	16
2^5	$2 \times 2 \times 2 \times 2 \times 2$	32
2^6	$2 \times 2 \times 2 \times 2 \times 2 \times 2$	64
2^7	$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$	128
2^8	$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$	256
2^9	$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$	512

(b) Option: B

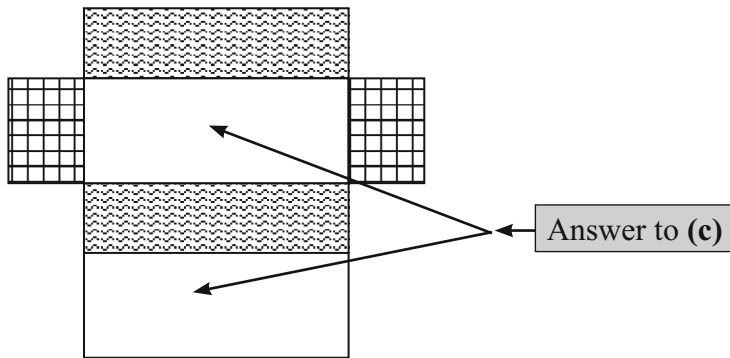
Reason: With Option B she would get €1022 which is €22 extra.

4.

Itemised bill for service	Cost	
5 litres of oil at €4.20 per litre	€21	← €4.20 × 5 = €21
2 windscreen wiper blades at €4.50 per blade	€9.00	← €4.50 × 2 = €9
2 brake shoes at €28 each	€56.00	← €28 × 2 = €56
2 hours of labour at €60 per hour	€120	← €60 × 2 = €120
Sub-total (before VAT added)	€206	
VAT @ 13.5%	€27.81	← €206 × 0.135 = €27.81
Total bill	€233.81	

5. (a) 6

(b) and (c)

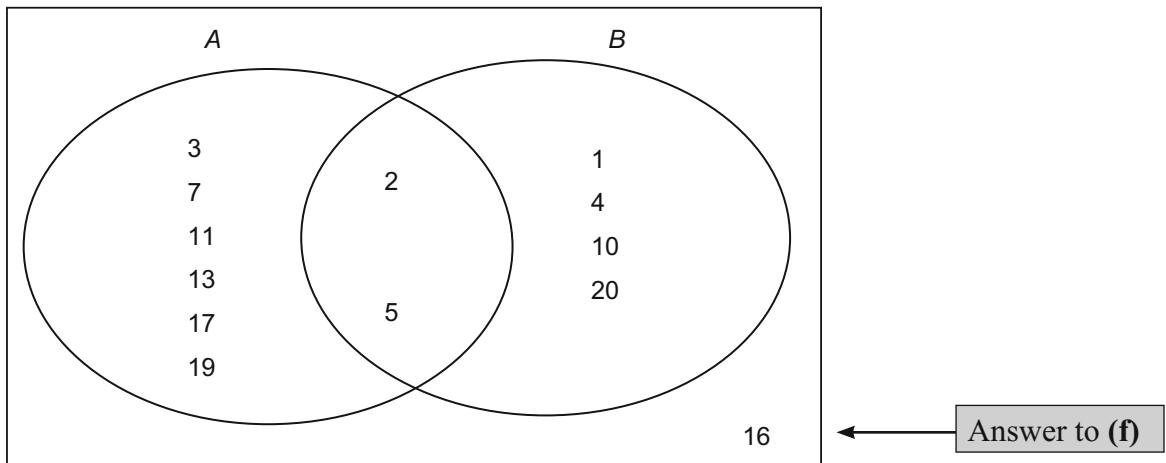


(d) $2(40 \times 30 + 40 \times 10 + 30 \times 10)$
 $= 2(1200 + 400 + 300)$
 $= 2(1900)$
 $= 3800 \text{ cm}^2$

6. (a) $A = \{2, 3, 5, 7, 11, 13, 17, 19\}$ ← These are prime numbers.

(b) $B = \{1, 2, 4, 5, 10, 20\}$ ← These are factors of 20.

(c) U



(d) $A \cap B = \{2, 5\}$ ← Factors of 20 which is also a prime number

(e) Factor of 20

(f) It is in U but is not prime and is not a factor of 20.

7. (a) Write the following numbers correct to the nearest ten.

$$121 - 120$$

$$195 - 200$$

$$504 - 500$$

(b) Write the following numbers correct to 3 decimal places.

$$105.5555 - 105.556$$

$$2.173 - 2.173$$

$$0.0264 - 0.026$$

(c) Write the following numbers correct to two significant figures.

$$2920 - 2900$$

$$159 - 160$$

$$0.0336 - 0.034$$

(d) $€2 + €2 + €4 + €2 + €1$
 $= €11$

(e) No

(f) $€1.95 + €1.99 + €3.59 + €1.40 + €0.99$
 $= €9.92$

(g) Method:
Round to the nearest whole number.

Reason:
This should give a more accurate estimate because some will round up and some will round down.

8. (a) €5

	Week 1	Week 2	Week 3	Week 4	Week 5
€20	€25	€30	€35	€40	€45

(c) $€5(\text{week number}) + €20$

OR

$$5n + 20$$

(d) $5n + 20 = 100$

$$5n = 100 - 20$$

$$5n = 80$$

$$n = \frac{80}{5}$$

$$n = 16$$

(e) €7

(f) Yes, because after 13 weeks, he will have saved €101.

9. (a) (i) $2a + 3b - 2$ ← Keep brackets when filling in values.

$$2(4) + 3(-1) - 2$$

$$= 8 - 3 - 2$$

$$= 3$$

(ii) $a^2 + b^2 + 4$

$$(4)^2 + (-1)^2 + 4$$

$$= 16 + 1 + 4$$

$$= 21$$

(iii) $\frac{a + 2b}{2} =$

$$\frac{(4) + 2(-1)}{2} = 1 \quad \leftarrow \quad \frac{4 - 2}{2} = \frac{2}{2} = 1$$

(b) Multiply $x + 4$ by $x - 6$

$$(x + 4)(x - 6) =$$

$$x(x - 6) + 4(x - 6) \quad \text{or} \quad \begin{array}{r|l} x & +4 \\ \hline x^2 & +4x \\ -6x & -24 \end{array}$$

$$= x^2 - 6x + 4x - 24$$

$$= x^2 - 2x - 24$$

10. (a) There are four terms given below. Three of them have a common factor other than 1.

$3xy$
 $6ay$
 $11ax$
 $9y$

$3y$

(b) (i) $4x + 8y - 12z$ \leftarrow 4 is a common factor.

$$= 4(x + 2y - 3z)$$

(ii) $ab - 2a + 3b - 6$ \leftarrow

$$= a(b - 2) + 3(b - 2)$$

$$= (a + 3)(b - 2)$$

Group: $ab - 2a + 3b - 6$

$(ab - 2a) + (3b - 6)$

$a(b - 2) + 3(b - 2)$

$(b - 2)(a + 3)$

(iii) $x^2 + 5x + 6$ \leftarrow Quadratic factors

$$(x + 3)(x + 2)$$

(iv) $b^2 - 16$ \leftarrow Difference of two squares $b^2 - 4^2$

$$(b - 4)(b + 4)$$

11. (a) $7x + 4 = 3x - 8$ $7x + 4 = 3x - 8$

$$7x - 3x = -8 - 4$$

$$4x = -12$$

$$x = -\frac{12}{4} \quad \leftarrow \quad \text{Divide both sides by 4}$$

$$x = -3$$

(b) Solve the equation $x^2 - 3x - 10 = 0$ \leftarrow Quadratic equation

$$(x - 5)(x + 2) = 0$$

$$x = 5 \quad \text{or} \quad x = -2$$

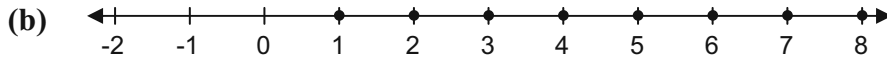
12. (a) $3x - 5 \geq -2, x \in \mathbb{N}$

$3x \geq -2 + 5$ ← Add 5 to both sides.

$3x \geq 3$

$x \geq \frac{3}{3}$ ← Divide both sides by 3.

$x \geq 1$



(c) (i) Make an equation to represent Gemma's score.

$5x - 5y = 20$

(ii) $2x - 3y = 7$

$5x - 5y = 20$

$-10x + 15y = -35$

$10x - 10y = 40$

$5y = 5$

$y = \frac{5}{5}$

$y = 1$

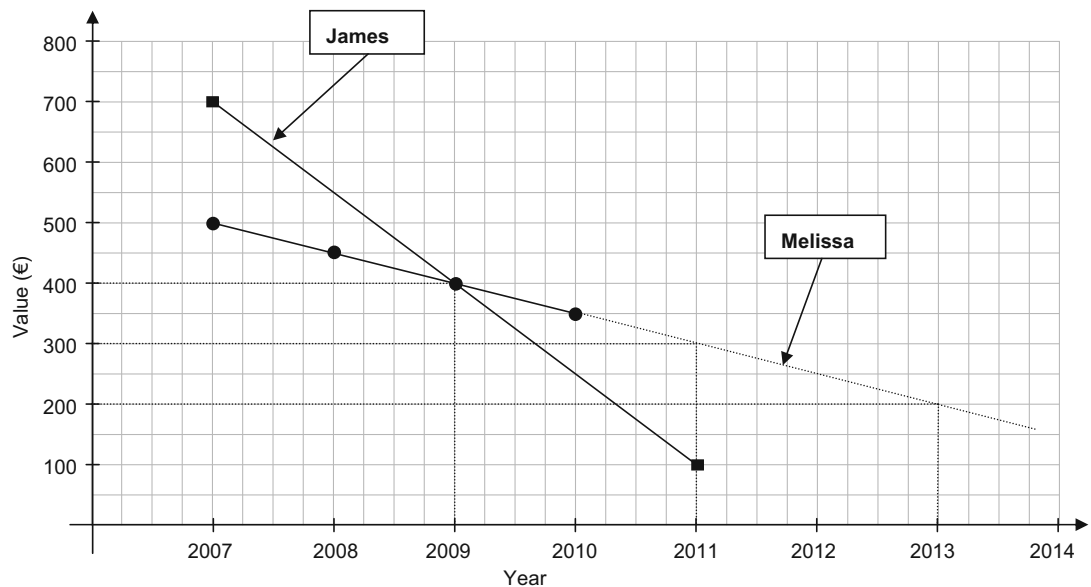
$x = 5$

(iii) $2(5) - 3(1) = 7$ $5(5) - 5(1) = 20$

$10 - 3 = 7$ $25 - 5 = 20$

$7 = 7$ $20 = 20$

13. (a) and (e)



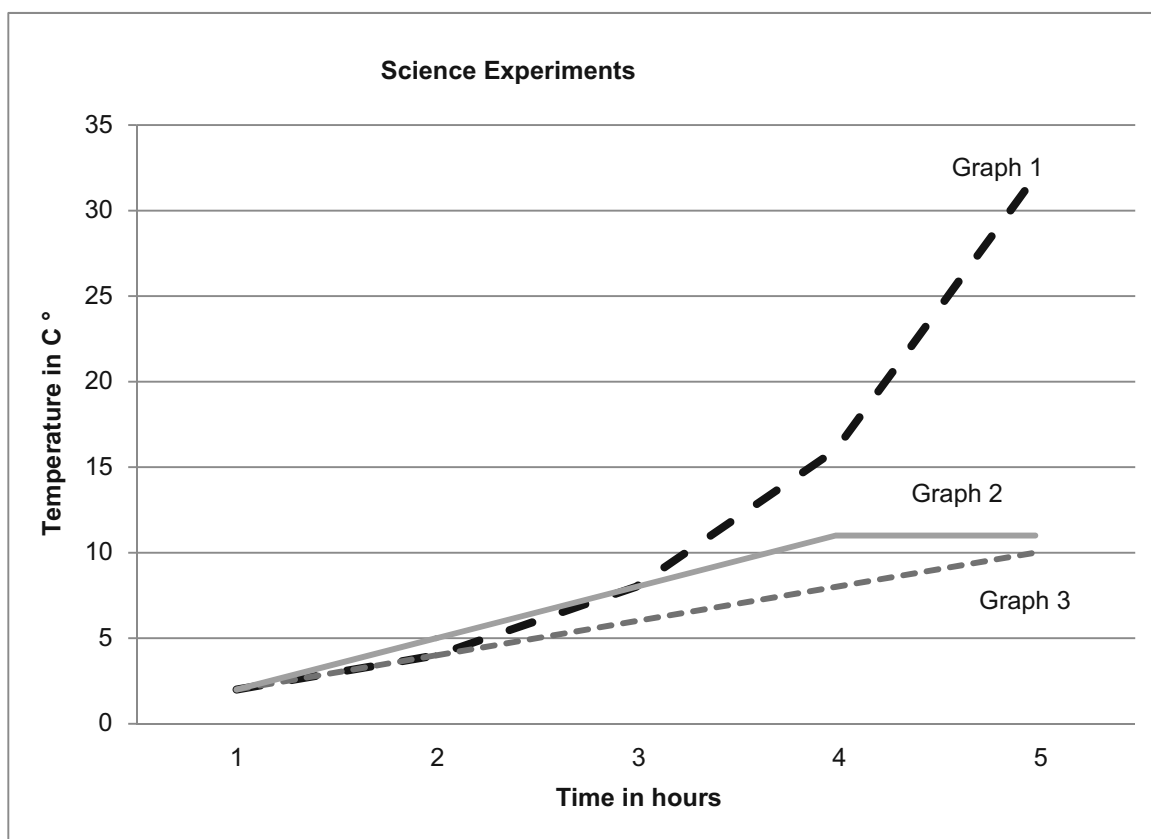
(b) €300

(c) €50

(d) 2013

- (f) Year: 2009
Value: €400
- (g) The line with the steepest slope

14.



Experiment	Graph number
A	1
B	3
C	2

15. (a) Domain = {1, 2, 3, 4}
Range = {a, b, c}

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

$$f(-2) = 5 + 2(-2) - (-2)^2 = 5 - 4 - 4 = -3 \Rightarrow (-2, -3)$$

$$f(-1) = 5 + 2(-1) - (-1)^2 = 5 - 2 - 1 = 2 \Rightarrow (-1, 2)$$

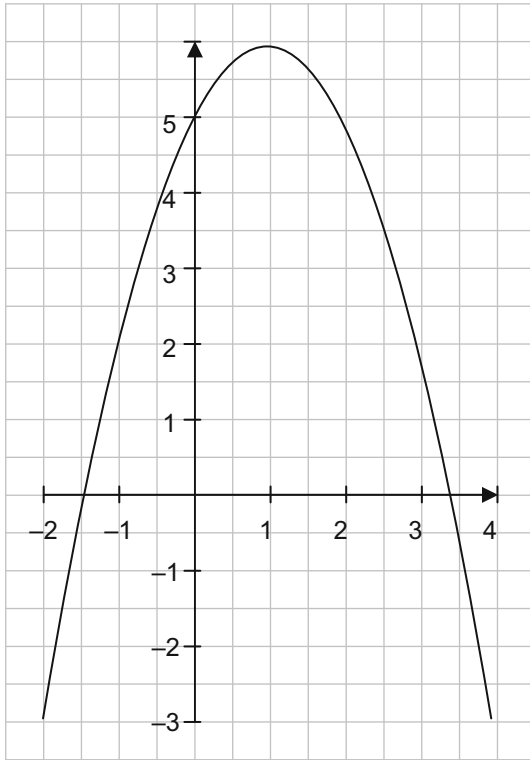
$$f(0) = 5 + 2(0) - (0)^2 = 5 + 0 - 0 = 5 \Rightarrow (0, 5)$$

$$f(1) = 5 + 2(1) - (1)^2 = 5 + 2 - 1 = 6 \Rightarrow (1, 6)$$

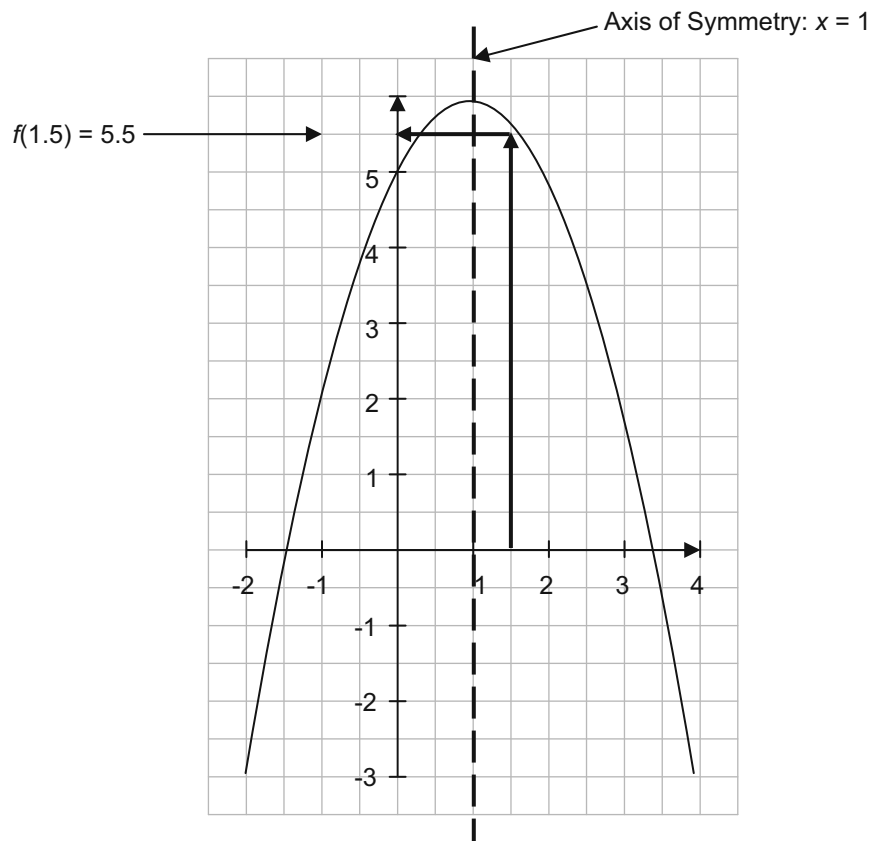
$$f(2) = 5 + 2(2) - (2)^2 = 5 + 4 - 4 = 5 \Rightarrow (2, 5)$$

$$f(3) = 5 + 2(3) - (3)^2 = 5 + 6 - 9 = 2 \Rightarrow (3, 2)$$

$$f(4) = 5 + 2(4) - (4)^2 = 5 + 8 - 16 = -3 \Rightarrow (4, -3)$$



(c) (i)



(ii) 5.5

Educate.ie Sample 1

Paper 1

1.

Percentages	50%	75%	25%	$33\frac{1}{3}\%$	30%	20%
Fractions	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{3}{10}$	$\frac{1}{5}$
Decimal	0.5	0.75	0.25	0.33	0.3	0.2

2. (a) (i) $(A \cap B)$ ← This is A intersection B i.e. the elements in A and B.
 $\{4, 2\}$

(ii) $(A \cup B)^c$ ← This is the complement of A union B, the elements outside A and B.
 $\{12\}$
 This can also be written as $(A \cup B)'$

(iii) $(A \setminus B)$ ← This is A less B i.e. the elements in A without the elements in B.
 $\{1, 3, 5\}$

(b) (i) $\#(A \cup B)$ ← The # symbol means you count the elements in that section.
 7

(ii) $\#(B \setminus A)$
 2

(iii) $\#B$
 4

3. (a) Principal year 1 = €10 000
 Interest year 1 = €150 ← $10\,000 \times 0.015$

Principal year 2 = €10 150
 Interest year 2 = €203 ← $10\,150 \times 0.02$

Principal year 3 = €10 353
 Interest year 3 = €207.06 ← $10\,353 \times 0.02$

After 3 years = €10 560.06

Total after 3 years = €10 560.06

(b) Total dividend = Total – €10 000
 After 3 years = €10 560.06 – €10 000 ← Interest = Total – Principal

Total dividend = €560.06

4. (a) Gross income tax = 20% of €650 = €130

Net income tax = Gross income tax – tax credits

Net income tax = €130 – €60

Net income tax = €70

(b) 2% of €193 + 4% of €115 + 7% of €342

€3·86 + €4·60 + €23·94

€32·40

(c) 4% of €650

€26

(d) €650 – (€70 + €32·40 + €26) ←

Net income = Gross income – All deductions

€521·60

5. (a)

	2x	5
3x	6x ²	15x
4	8x	20

Area = Length × Breadth

Get area of each small rectangle and add all to find the total area.

Total area = 6x² + 15x + 8x + 20

= 6x² + 23x + 20

= (2x + 5)(3x + 4) ←

Verifying answer by multiplying brackets

= 6x² + 8x + 15x + 20

= 6x² + 23x + 20

(b)

$$\begin{array}{r}
 4x - 7 \\
 2x - 3 \overline{) 8x^2 - 26x + 21} \\
 \underline{8x^2 - 12x} \\
 -14x + 21 \\
 \underline{-14x + 21} \\
 0
 \end{array}$$

Method 2

	4x	-7
2x	8x ²	-14x
-3	-12x	21

-26x

Answer 4x - 7

6. (a) 2a²b

2($\frac{1}{2}$)²($\frac{1}{4}$) ←

Use brackets to help in substitution.

2($\frac{1}{4}$)($\frac{1}{4}$)

$\frac{2}{16} = \frac{1}{8} = 0.125$

(b) (i) x² - 81 ←

Difference of two squares

(x + 9)(x - 9)

(ii) x² - 8x - 9 ←

Quadratic factors

(x - 9)(x + 1)

$$(c) \frac{x^2 - 8x - 9}{x^2 - 81} \Rightarrow \frac{(x-9)(x+1)}{(x+9)(x-9)} \therefore \frac{x+1}{x+9}$$

Use (b) parts (i) and (ii).

for $x = 3$

$$\frac{3+1}{3+9} = \frac{4}{12} = \frac{1}{3}$$

7. (a)

Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
2	4	6	8	10	12

Adding 2 to each term to get the next

(b)

Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
2	4	16	256	65 536	4 294 967 296

$$16 \times 16 = 256$$

$$65\,536 \times 65\,536$$

(c)

Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
2	6	38	1446	2 090 918	4.37×10^{12}

$$6^2 + 2 = 38$$

$$1446^2 + 2 = 2\,090\,918$$

(d)

Term 1	Term 2	Term 3	Term 4	Term 5
2	16	324	106 276	1.1295×10^{10}

$$\begin{aligned} 2 + 2 &= 4 \\ 4^2 &= 16 \end{aligned}$$

$$\begin{aligned} 324 + 2 &= 326 \\ 326^2 &= 106\,276 \end{aligned}$$

8. (a) Yes

$$6(x-2) = 4(x-1)$$

$$6(4-2) = 4(4-1)$$

$$12 = 12$$

or solve equation

$$6(x-2) = 4(x-1)$$

$$6x - 12 = 4x - 4$$

$$2x = 8$$

$$x = 4$$

(b) Yes

$$x^2 - 16 = 0$$

$$4^2 - 16 = 0$$

$$16 - 16 = 0$$

$$0 = 0$$

or solve equation

$$x^2 - 16 = 0$$

$$(x+4)(x-4)$$

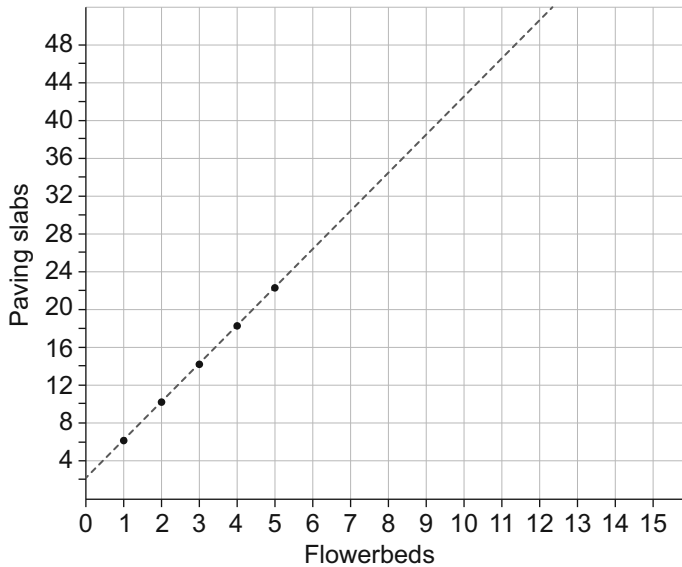
$$x = -4 \text{ or } x = 4$$

9. (a)

No. of flowerbeds	No. of paving slabs
1	6
2	10
3	14
4	18
5	22

← Adding 4 each time

(b)



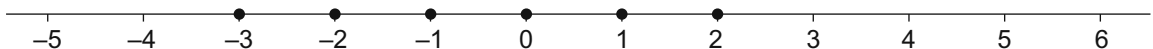
(c) Yes

Reason: All couples are on a line or there is a constant difference between the number of paving slabs.

10. (a)



(b)



11. $x + y = 4$ and $2x + y = 2$

$$\Rightarrow y = 4 - x$$

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

$$\Rightarrow 2x + 4 - x = 2$$

$$\Rightarrow x = -2$$

$$\Rightarrow y = 4 - (-2)$$

$$\Rightarrow y = 6$$

or

$$x + y = 4$$

$$\underline{2x + y = 2}$$

$$-x = 2$$

$$\Rightarrow x = -2$$

$$\Rightarrow (-2) + y = 4$$

$$\Rightarrow y = 6$$

12. (a)

Country	Population
China	1.4×10^9
India	1.2×10^9
United States	3.2×10^8
Germany	8.1×10^7
United Kingdom	6.3×10^7
Romania	2.1×10^7
Republic of Ireland	4.6×10^6
New Zealand	4.5×10^6
Lithuania	3.0×10^6

(b) $\frac{3.2 \times 10^8}{9.1 \times 10^6} = \frac{3.2 \times 10^2}{9.1} = 35.16 \text{ people/km}^2$

(c) $\frac{1.4 \times 10^9}{7.1 \times 10^9} \times \frac{100}{1} = 19.7\%$

13. (a) **Solution 1:**

Number	5 times the number	3 added to 5 times the number
1	$1 \times 5 = 5$	$5 + 3 = 8$
2	$2 \times 5 = 10$	$10 + 3 = 13$
3	$3 \times 5 = 15$	$15 + 3 = 18$
4	$4 \times 5 = 20$	$20 + 3 = 23$

(b) **Solution 2:**

$$23 - 3 = 20$$

$$20 \div 5 = 4$$

(c) **Solution 3:**

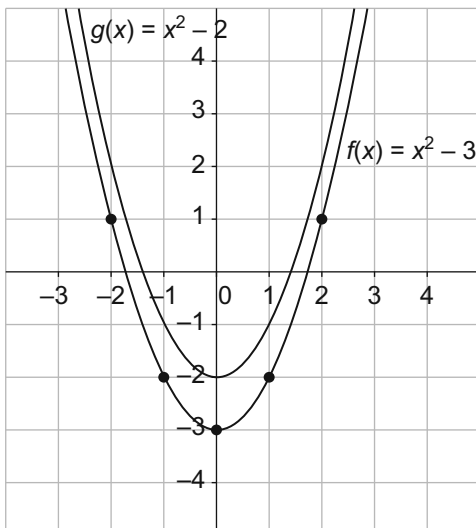
$$5x + 3 = 23$$

$$5x = 20$$

$$x = 4$$

14. (a) (i) $f(-2) = (-2)^2 - 3 = 1$ (ii) $f(2) = (2)^2 - 3 = 1$

(b)



(c) Shown on the diagram above

Educate.ie Sample 2

Paper 1

1. (a) $34 \times 10 = 340$ mm

← $10 \text{ mm} = 1 \text{ cm}$

(b) $12 \times 1000 = 12\,000$ grams

← $1000 \text{ grams} = 1 \text{ kg}$

(c) $2.4 \times 1000 = 2400 \text{ cm}^3$

← $1000 \text{ cm}^3 = 1 \text{ litre}$

(d) $3\,000\,000 \div 1\,000\,000 = 3$ tonnes

← $1\,000\,000 \text{ cm}^3 = 1 \text{ tonne}$

2. (a) $\frac{1}{4} \frac{1}{3} \frac{3}{8} \frac{3}{5} \frac{3}{4} \frac{5}{6}$

← It might be best to change all to the same common denominator.

(b) $\frac{1}{5} + \frac{1}{6} = \frac{11}{30}$ $\frac{11}{30} \div 2 = \frac{11}{60}$

(c) 1:5 That is $\frac{1}{6}$ of orange juice and $\frac{5}{6}$ of water.

Orange juice needed to make 3 litres = $\frac{1}{6}$ of 2 = $\frac{1}{3}$ litre

3. (a) $28\% = 18\,312$

$1\% = \frac{18\,312}{28}$

← This is called the unitary method.
Work back through 1%.

$100\% = \frac{18\,312}{28} \times 100 = 65\,400$

(b) $65\,400 \times 0.005 = 327$: Population in 2012 = $65\,400 - 327 = 65\,073$

↑ $0.5\% = 0.5 \div 100 = 0.005$



4. (a) (i) $12 \boxed{\div} 3 \boxed{+} 4 = 8$

(ii) $12 \boxed{\div} 6 \boxed{-} 2 = 0$

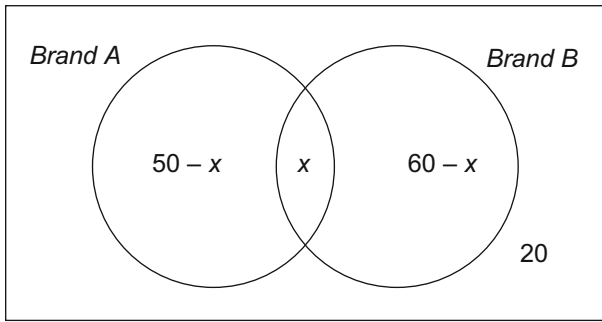
(b) List: 1, 2, 3, 4, 6, 8, 12, 24

(c)
$$\begin{array}{r} 3 \overline{) 63} \\ \underline{21} \\ 7 \end{array}$$

Prime factors = $3 \times 3 \times 7$

← If you have a Casio calculator (NATURAL – V.P.A.M) to find the prime factors of 63: Type in 63 and press the equals button. Then press   and the prime factors will show up as $3^2 \times 7$.

5.



(a) $50 - x + x + 60 - x + 20 = 100 \Rightarrow x = 30$

(b) $60 - 30 = 30$

6. (a) $25 \in B$ True False
- (b) $B \subset A$ True False
- (c) $\# A = 6$ True False
- (d) $\{8, 10\} \subset B$ True False
- (e) $\emptyset \subset A$ True False
- (f) $A \cap B = \{10\}$ True False

$\emptyset \subset A$: This means that the null set is a subset of A. This is true because the null set is a subset of all sets.

7. (a) €3·213 ← 0.1071×30
- €5·082 ← 0.2541×20
- €15·603 ← 0.5201×30
- €0·406 ← 0.0203×20

(b) Total cost: €24·30

(c) Credit at beginning of week = €25·25: Credit at end of week = €25·25 - €24·30 = €0·95

8. Gross tax: 20% of €25 250 = €5050 ← $0.2 \times 25\ 250$
- Net tax: €5050 - €1530 = €3520

Statement	True	False	Reason
If a set $A = \{x \mid -4 < x \leq 3, x \in \mathbb{Z}\}$, then $-4 \in A$		✓	x is greater than -4 . The inequality sign does not include an equal sign.
If a set $A = \{x \mid -4 < x \leq 3, x \in \mathbb{N}\}$, then $-3 \in A$		✓	-3 is not a natural number.
If a set $A = \{x \mid -4 < x \leq 3, x \in \mathbb{R}\}$, then $2.5 \in A$	✓		2.5 is a real number greater than -4 and less than or equal to 3 .
If a set $A = \{x \mid -4 < x \leq 3, x \in \mathbb{Z}\}$, then $3 \in A$	✓		3 is an integer greater than -4 and less than or equal to 3 .

10. (a) $x^2 - 10x + 9$
 $(x - 9)(x - 1)$ ← Quadratic factors

(b) $x^2 - 10x + 9 = 0$
 $(x - 9)(x - 1) = 0$
 $x - 9 = 0$ or $x - 1 = 0$
 $x = 9$ or $x = 1$

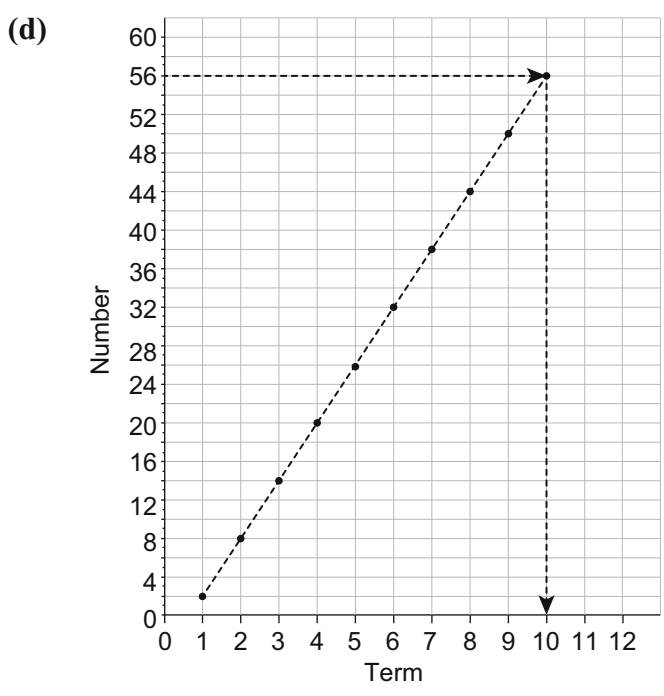
(c) $x = 9$ or $x = 1$
 $(9)^2 - 10(9) + 9 = 0$ $(1)^2 - 10(1) + 9 = 0$
 $81 - 90 + 9 = 0$ $1 - 10 + 9 = 0$
 $0 = 0$ $0 = 0$
 $\therefore x = 9$ is a solution $\therefore x = 1$ is a solution

11. (a) (i) 3, 6, 9, 12, 15, 18, ← Adding 3 to get the next term
(ii) 7, 4, 1, -2, -5, -8, ← Adding -3 to get the next term
(iii) 1, 8, 27, 64, 125, 216, ← $1^3, 2^3, 3^3, 4^3, 5^3, 6^3$

(b)

Term	Sequence	Pattern	Couple
1	2	$6(1) - 4$	(1, 2)
2	8	$6(2) - 4$	(2, 8)
3	14	$6(3) - 4$	(3, 14)
4	20	$6(4) - 4$	(4, 20)
5	26	$6(5) - 4$	(5, 26)
6	32	$6(6) - 4$	(6, 32)

(c) 8th term: $6(8) - 4 = 44$



(e) See lines on diagram above. 10th term

12. (a)

Cylinder	A	B	C	D
Graph	4	2	1	3

(b) 8 cm

(c) 6 cm

(d) Cylinder A: $\frac{\text{Rise}}{\text{Run}} = \frac{8}{20} = 0.4 \text{ cm/sec}$

Cylinder B: $\frac{\text{Rise}}{\text{Run}} = \frac{8}{5} = 1.6 \text{ cm/sec}$

Cylinder C: $\frac{\text{Rise}}{\text{Run}} = \frac{8}{3} = 2\frac{2}{3} \text{ cm/sec}$

Cylinder D: $\frac{\text{Rise}}{\text{Run}} = \frac{8}{10} = 0.8 \text{ cm/sec}$

13. (a) $ab - 2b$ ← Common factor: b is common.
 $b(a - 2)$

(b) $3m - 9mn$ ← Common factor: $3m$ is common.
 $3m(1 - 3n)$

(c) $t^2 - 25$ ← Difference of two squares
 $(t + 5)(t - 5)$

14. (a)

Name	Statement	Age (A)
Alan	Three years older than Tommy	$A = y + 3$
Donnacha	Four years younger than Tommy	$A = y - 4$
Cillian	Double Alan's age	$A = 2(y + 3)$
Oliver	Half Donnacha's age	$A = (y - 4) \div 2$
Shane	Two years older than Oliver	$A = [(y - 4) \div 2] + 2$

(b) Oliver: $A = (y - 4) \div 2$: $A = (14 - 4) \div 2$: $A = (10) \div 2$: $A = 5$ years
 Shane: $A = [(y - 4) \div 2] + 2$: $A = [(14 - 4) \div 2] + 2$: $A = 5 + 2$: $A = 7$ years

15. (a) (i) (2, 4) (2, 6), (2, 8) (2, 10) Not a Function
 Reason: The first elements of the couples are repeated.

(ii) (1, 4) (2, 6), (3, 8) (4, 10) Function
 Reason: No first element of the couples is repeated.

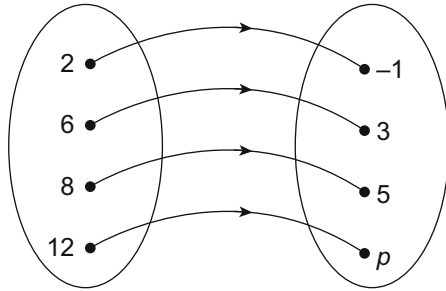
(iii) (1, 4) (2, 4), (3, 4) (4, 4) Function
 Reason: No first element of the couples is repeated.

(b) Domain: $\{1, 2, 3, 4, 5\}$

Range: $\{2, 3, 4, 5, 6\}$

(c) If you add 1 to each element in the domain you get the corresponding element in the range.

(d)



Couples: $(2, -1)$ $(6, 3)$ $(8, 5)$ $(12, p)$.

(e) $p = 12 - 3 = 9$

Educate.ie Sample 3

Paper 1

1. (a) 0.224 0.24 0.244 0.245 0.254 0.42

(b) (i) $\frac{2}{3}(250) = \text{€}166.67$

(ii) $250 \times 0.15 = \text{€}37.50$
 $250 - 37.50 = \text{€}212.50$ ← $15\% = 15 \div 100 = 0.15$

(iii) $250 \times 0.23 = \text{€}57.50$
 $250 - 57.50 = \text{€}192.50$ ← $23\% = 23 \div 100 = 0.23$

2. (a) $5:4 = \frac{5}{9}$ and $\frac{4}{9}$




$\frac{5}{9}$ of €3600 = €2000 ← $(\text{€}3600 \div 9) \times 5 = \text{€}2000$

$\frac{4}{9}$ of €3600 = €1600 ← $(\text{€}3600 \div 9) \times 4 = \text{€}1600$

(b) $\frac{a^2 \times a^8}{a^3 \times a^7} = \frac{a^{10}}{a^{10}} = 1$ ← Add indices for multiplication.

3. (a)

Shape	Shape 1	Shape 2	Shape 3	Shape 4
Fraction	$\frac{2}{9}$	$\frac{3}{7}$	$\frac{320}{360} = \frac{8}{9}$	$\frac{3}{9} = \frac{1}{3}$

(b)  +  = 
 $5 \text{ parts } \left(\frac{5}{10}\right) + 4 \text{ parts } \left(\frac{4}{10}\right) = 9 \text{ parts } \left(\frac{9}{10}\right) = 0.9$

(c) $\frac{1}{2} + \frac{2}{5} = 0.5 + 0.4 = 0.9$

4.

Region	$A \cap B$	$A \cup B$	$B \setminus A$	$A \setminus B$	A^c	$(A \cap B)^c$
Diagram no.	2	1	4	3	6	5

5. (a) 20% of €530 = €106
 $\text{€}106 - \text{€}31.70 = \text{€}74.30$

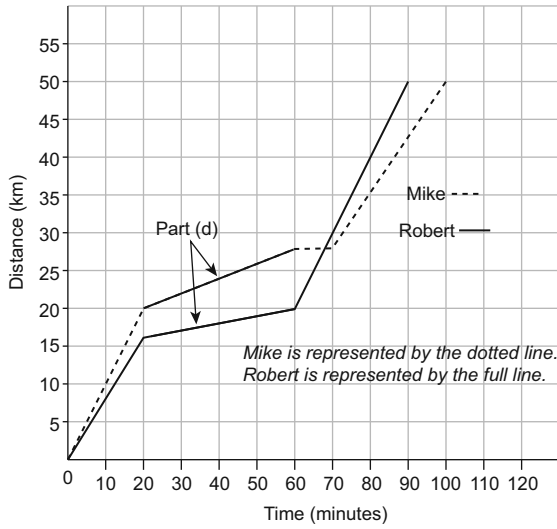
This is the complement of A i.e. the elements outside A.

(b) 4% of €530 = €21.20 PRSI

(c)

Carmel's payslip	
Gross pay	Deductions
€530	Net tax €74.30
	PRSI €21.20
	USC €24
	Total deductions €119.50
	Net pay = Gross pay – Total deductions
	Net pay = €530 – €119.50 = €410.50

6.



(a) Mike

(b) Mike: He stopped for 10 minutes.

(c) Robert

(d) See arrows on graph.

(e) $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$

$$\text{Speed} = \frac{30 \text{ km}}{30 \text{ min}}$$

$$= 60 \text{ km/h}$$

30 mins = 0.5 hours. $30 \div 0.5 = 60 \text{ km/hr}$.
Be sure to include units in your answer.

7. (a)

Rate	Number of Years		
	One	Two	Three
1%	€1.01	€1.02	€1.03
1.5%	€1.02	€1.03	€1.05
2%	€1.02	€1.04	€1.06
2.5%	€1.03	€1.05	€1.08
3%	€1.03	€1.06	€1.09
3.5%	€1.04	€1.07	€1.11
4%	€1.04	€1.08	€1.12

$1.11 \times 10\ 000 = \text{€}11\ 100$

(b)

Rate	Number of Years		
	One	Two	Three
1%	€1.01	€1.02	€1.03
1.5%	€1.02	€1.03	€1.05
2%	€1.02	€1.04	€1.06
2.5%	€1.03	€1.05	€1.08
3%	€1.03	€1.06	€1.09
3.5%	€1.04	€1.07	€1.11
4%	€1.04	€1.08	€1.12

$1.04 \times 20\ 000 = \text{€}20\ 800$

Interest = €800 ← Interest = Total Amount – Principal

(c) €1 = €1.09 ← Unitary Method

€x = €16 350

$x = \frac{16\ 350}{1.09} = \text{€}15\ 000$

8. (a) (i) $y^2 - 5y$
 $y(y - 5)$ ← Common factor: y is common.

(ii) $y(y - 5) = 0 \Rightarrow y = 0$ or $y = 5$

(b) (i) $y^2 - 2y - 8$
 $(y - 4)(y + 2)$ ← Quadratic factors

(ii) $(y - 4)(y + 2) = 0 \Rightarrow y = 4$ or $y = -2$

(c) (i) $y^2 - 9$
 $(y + 3)(y - 3)$ ← Difference of two squares

(ii) $(y + 3)(y - 3) = 0 \Rightarrow y = -3$ or $y = 3$

9. (a) (i) $k_1 \quad y = x + 3$
 $k_2 \quad y = -x + 1$

(ii) The co-ordinates of B . $(-1, 2)$

(b) $y = x + 3$

$y = -x + 1$

$\Rightarrow x + 3 = -x + 1$

$\therefore 2x = -2$

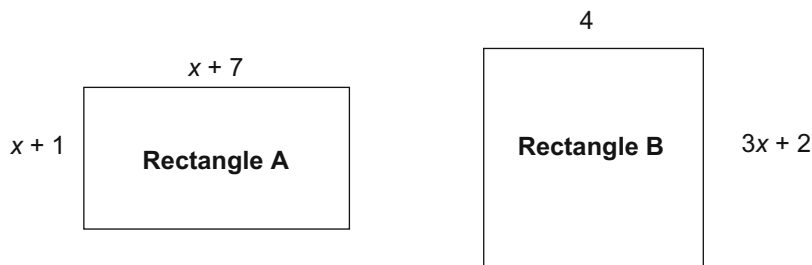
$x = -1$

$y = -1 + 3$

$y = 2$

Co-ordinates of B are $(-1, 2)$

10.



$2(x + 7 + x + 1) = 2(4 + 3x + 2)$

$2x + 8 = 3x + 6$

$x = 2$

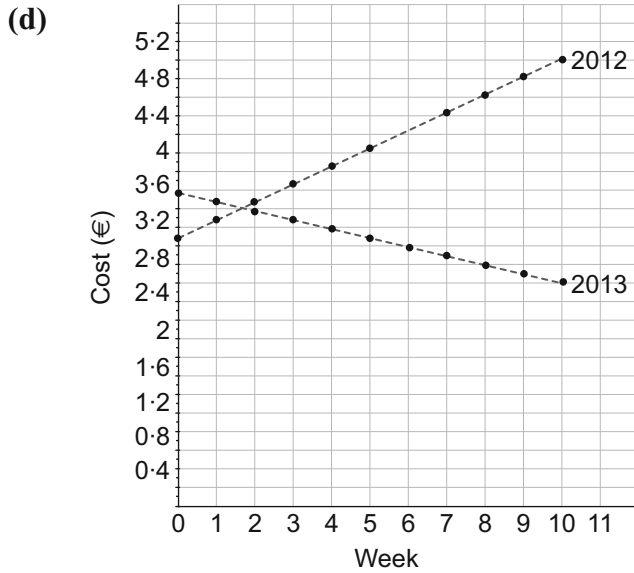
Add €0.20 each time.

11. (a)

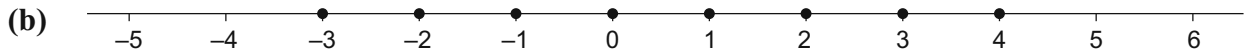
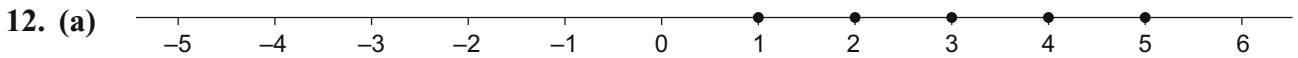
Week	0	1	2	3	4	5	6	7	8	9	10
2012	€3.00	€3.20	€3.40	€3.60	€3.80	€4.00	€4.20	€4.40	€4.60	€4.80	€5.00
2013	€3.50	€3.40	€3.30	€3.20	€3.10	€3.00	€2.90	€2.80	€2.70	€2.60	€2.50

(b) €5.00 Subtract €0.10 each time.

(c) Cost equals the week number by 20 cent plus three euro.



(e) €2.50



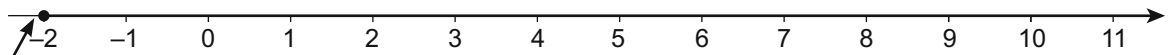
(c) $3x - 5 \geq 4$
 $3x \geq 9$
 $x \geq 3$



(d) $2(-x - 5) \leq -6$

3 is included in the answer.

$-2x - 10 \leq -6$
 $-2x \leq 4$
 $2x \geq -4$
 $x \geq -2$



-2 is included in the answer.

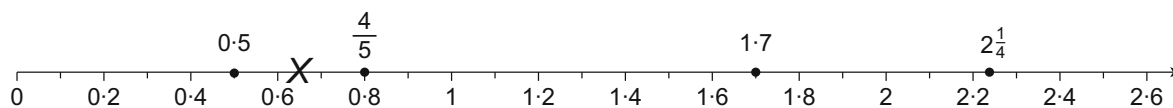
13. (a)

Graph	Function
Graph A	5
Graph B	4
Graph C	6
Graph D	3
Graph E	2
Graph F	1

Educate.ie Sample 4

Paper 1

1. (a)



(b) Shown on number line above.

$$2\frac{1}{4} - \frac{4}{5} \div 0.5 = 0.65$$

When working this out be careful of the order of operations (BIMDAS).

2. €810 = 90%

€900 = 112.5%

€9 = 1%

Séan sold the computer for €900.

€8 = 1%

€900 = 100%

Séan bought the computer for €800.

€800 = 100%

3. (a) (i) $\{1, 2, 3\} \subset \{1, 2, 3\}$

True

(ii) # of $\{1, 2, 3\} = 2$

False

(iii) $4 \in \{1, 2, 3\}$

False

(iv) $\{1, 2, 3\} = \{3, 2, 1\}$

True

(v) $\emptyset \subset \{1, 2, 3\}$

True

(b) $\{\}, \{0\}, \{3\}, \{6\}, \{0, 3\}, \{0, 6\}, \{3, 6\}, \{0, 3, 6\}$

The null set

(c) (i) $\{1, 2, 3, 4, 6, 12\}$

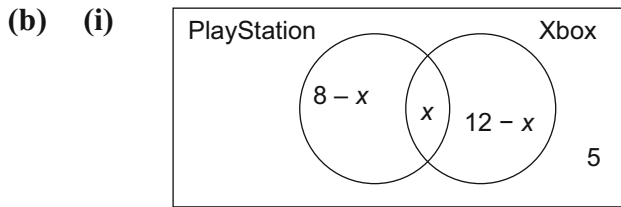
(ii) $\{2, 3, 5, 7\}$

(iii) $\{3, 4, 5, 6\}$

(iv) $\{-2, -1, 0, 1, 2, 3\}$

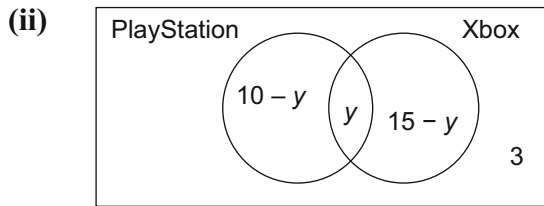
4. (a)

	PlayStation	Xbox	Neither
Female	8	12	5
Male	10	15	3
Total	18	27	8



$$8 - x + x + 12 - x + 5 = 23$$

$$25 - x = 23 \quad x = 2$$



$$10 - y + y + 15 - y + 3 = 22$$

$$28 - y = 22 \quad y = 6$$

(iii) $2 + 6 = 8$

5.

Loan	€5000
Interest for 1 st year	€200
Repayment	€1000
Loan	€4200
Interest for 2 nd year	€168
Repayment	€2000
Loan	€2368
Interest for 3 rd year	€94.72
Balance to be paid	€2462.72

6.

Story	A	B	C	D	E	F
Graph	4	6	1	2	5	3

7. Two years ago: $3x + 9y = 120$
 Last year: $5x + 5y = 90$

$$\begin{array}{r} 15x + 45y = 600 \\ 15x + 15y = 270 \\ \hline 30y = 330 \quad \Rightarrow y = 11 \\ 3x + 99 = 120 \\ 3x = 21 \quad \Rightarrow x = 7 \\ 5x + 7y \\ 5(7) + 7(11) \\ \text{This year: } 35 + 77 \\ 112 \text{ minutes} \end{array}$$

8. (a) (i) $12x^2 + 6x$ ← Multiply both terms in brackets by 6.

(ii) $12x^2 + 6x$
 $12(-2)^2 + 6(-2)$ ← Use brackets to help in substitution.
 $12(4) - 12$
 $48 - 12$
 36

(b) $x^2 - 9$ ← Difference of two squares
 $(x + 3)(x - 3)$

(c) $x^2 + 2x - 35$ ← Quadratic factors
 $(x + 7)(x - 5)$

(d) $x^3 + 5x^2 - 6x$ ← Common factor x
 $x(x^2 + 5x - 6)$ ← Quadratic factors also
 $x(x + 6)(x - 1)$

9. (a) $3.4 \times 10^7 - 3.1 \times 10^7 = 3.0 \times 10^6$ metres ← Calculator: Remember units.

(b) $3.4 \times 10^7 + 3.1 \times 10^7 + 6.4 \times 10^6 = 7.78 \times 10^7$ metres ← Calculator: Remember units.

10. (a) (i) D
(ii) E
(iii) C (Accept E also)
(iv) F
(v) A
(vi) B

(b) $A = (2, 0)$ $B = (-2, 0)$ $C = (0, -4)$

11. (a) $a = \frac{2b + c}{5}$
 $\frac{2(12.5) + 2\frac{3}{4}}{5}$
 $a = 5.55$

(b) $a = \frac{2b + c}{5}$
 $5a = 2b + c$

$$5a - c = 2b$$

$$\frac{5a - c}{2} = b$$

$$b = \frac{5a - c}{2}$$

12. (a) Method 1

	$3x$	2
$2x$	$6x^2$	$4x$
1	$3x$	2

$$3x + 2$$

Method 2

$$\begin{array}{r}
 \overline{) 6x^2 + 7x + 2} \\
 \underline{6x^2 + 3x} \\
 4x + 2 \\
 \underline{4x + 2} \\
 0
 \end{array}$$

(b)

	x	4
x	x^2	$4x$
2	$2x$	8

$$\text{Perimeter} = 2(x + 4 + x + 2) = 2(2x + 6) = 4x + 12$$

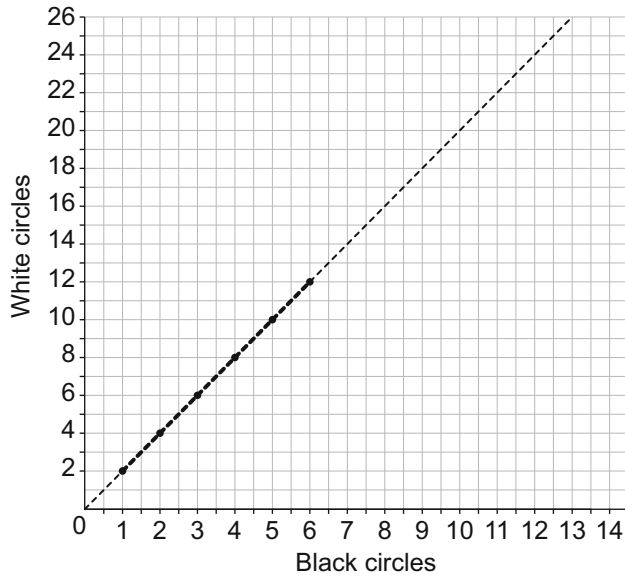
13. (a) 5

(b)

Pattern	Black circles	White circles
1	1	2
2	2	4
3	3	6
4	4	8
5	5	10
6	6	12
7	7	14

(c) The number of white circles is always double the number of black circles in each pattern.

(d)

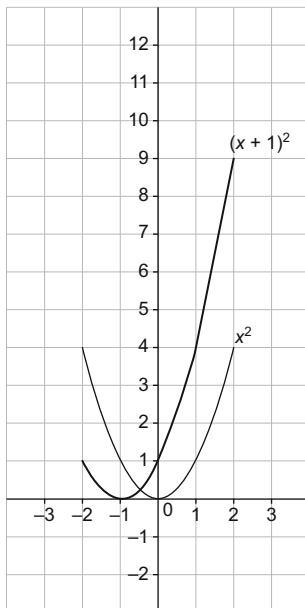


(e) 12

(f) $2n$

14. (a)

x	x^2	$(x + 1)^2$
-2	$(-2)^2 = 4$	$(-2 + 1)^2 = 1$
-1	$(-1)^2 = 1$	$(-1 + 1)^2 = 0$
0	$(0)^2 = 0$	$(0 + 1)^2 = 1$
1	$(1)^2 = 1$	$(1 + 1)^2 = 4$
2	$(2)^2 = 4$	$(2 + 1)^2 = 9$



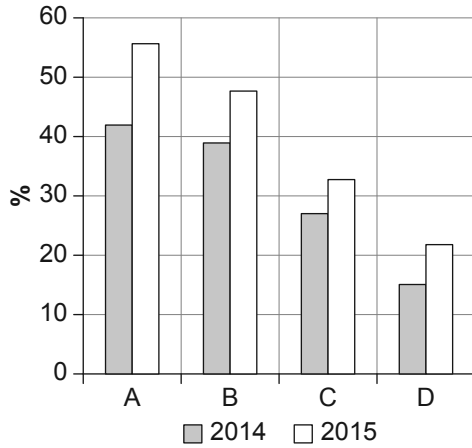
(b) You would have to move g one place to the right (positive direction) along the x axis so that it lies exactly on the graph of f .

(c) $\frac{42 + 39 + 27 + 5}{4} = \frac{123}{4} = 30.75\%$

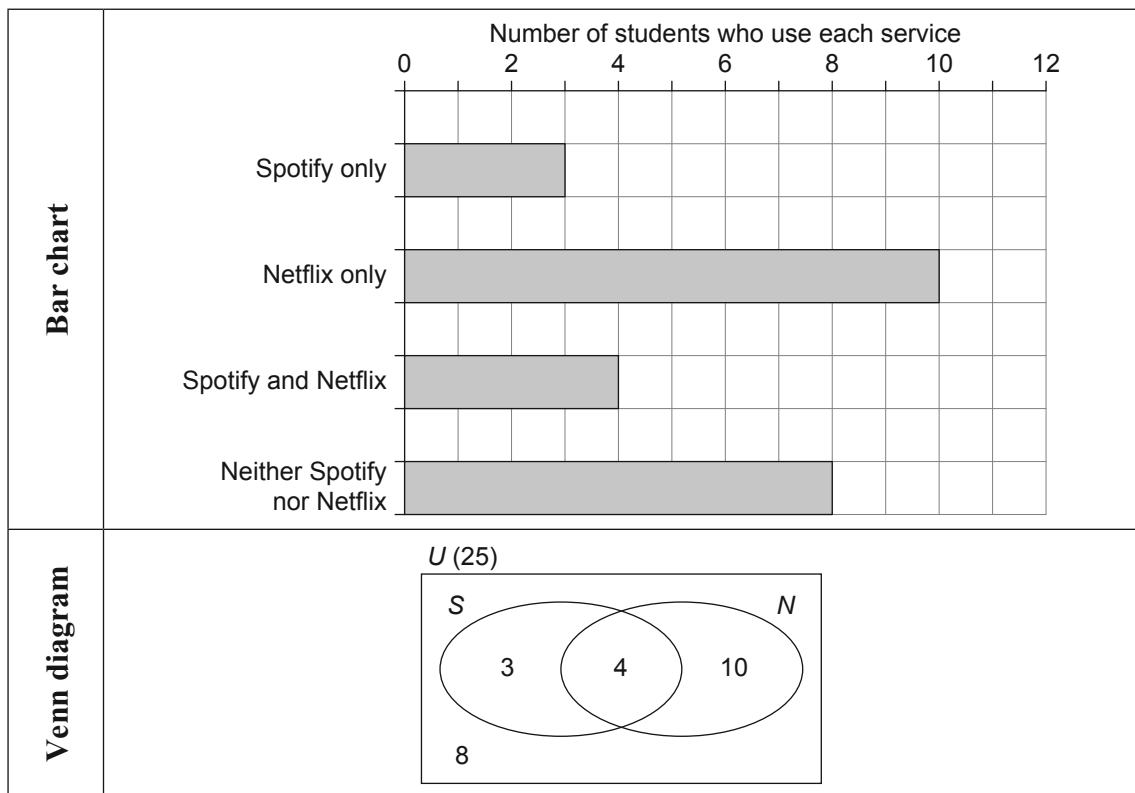
(d) Older people are less likely to use the internet to store files.

(e)

Age group	A	B	C	D
Percentage in 2014 (%)	42	39	27	15
Percentage in 2015 (%)	56	48	33	22



4. (a)



From chart: Spotify only = 3

Both $S \cap N = 4$

$3 + 4 + 10 = 17$

$25 - 17 = 8 =$ Number who watch neither

(b) $3 + 4 = 7$

(c) $\#(N \setminus S) = 10$

10 students watch Netflix only.

5.

Grey	Black	Grey	Red	Black
Grey	Grey	Red	Black	Red
Red	Grey	White	Grey	Black

(a) Mean Median Mode

(b) Grey 6
 Red 4 Mode is Grey
 Black 4
 White 1

6. (a)

		Game 2		
		W	D	L
Game 1	W	WW	WD	WL
	D	DW	DD	DL
	L	LW	LD	LL

(b) 3 possible outcomes for each game

$$\begin{aligned} \text{Total for 3 games} &= 3 \times 3 \times 3 \\ &= 27 \end{aligned}$$

7. (a) Answer: (2, 2), (5, 2), and (5, 4).

(b) Area of shape C:

$$2 \times 2 = 4$$

Area of shape D:

$$\text{Base} = 3$$

$$\text{Height} = 2$$

$$\begin{aligned} A &= \frac{1}{2} \times 3 \times 2 \\ &= 3 \end{aligned}$$

(c) 12

(d) (i) Shape C has exactly 4 axes of symmetry.

(ii) Shape G is the image of shape F under axial symmetry.

(iii) Shape A is the image of shape D under a translation.

(e) Slope = $\frac{2}{3}$

8. (a)

Line	Slope	Point where the line crosses the y-axis	Equation
<i>l</i>	3	(0, 4)	$y = 3x + 4$
<i>k</i>	2	(0, -1)	$y = 2x - 1$
<i>r</i>	-5	(0, 8)	$y = -5x + 8$
<i>t</i>	7	(0, -6)	$y = 7x - 6$

$$y = mx + c$$

$$r: \quad c = +8 \quad \text{pt } (0, 8)$$

$$t \quad m = 7$$

$$c = -6 \quad y = 7x - 6$$

(b) *l* *k* *r* *t*

Reason: Highest value for slope

(c)

The point (2, 10):	is on <i>l</i>	is not on <i>l</i>
(tick (<input type="checkbox"/>) one box only)	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Justification:

$$y = 3x + 4$$

$$x = 2 \quad y = 3(2) + 4$$

$$= 6 + 4$$

$$= 10$$

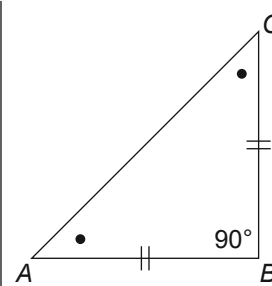
(2, 10) is on line

9. (a) (i) All angles are 60°

$$|\angle W| = 60^\circ$$

$$|\angle X| = 90^\circ$$

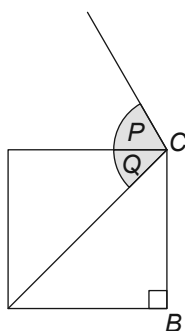
$$|\angle Y| = 45^\circ$$



$$\frac{90}{2} = 45$$

Z is the obtuse angle *ACE*.

(ii)



$$Z = P + Q$$

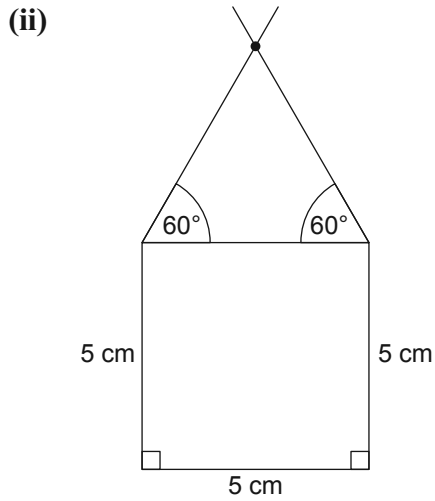
$$= 60^\circ + 45^\circ$$

$$Z = 105^\circ$$

$$P = 60^\circ$$

$$Q = 45^\circ$$

(b) (i) $x^2 = 5^2 + 5^2$
 $= 25 + 25$
 $= 50$
 $x = \sqrt{50}$
 $x = 7.07 \text{ cm}$



10. (a) $y^2 + 3^2 = 5^2$
 $y^2 + 9 = 25$
 $y^2 = 25 - 9$
 $y^2 = 16$
 $y = 4 \text{ m}$

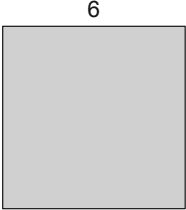
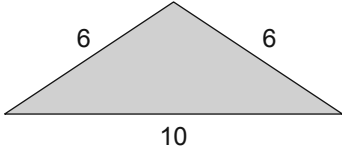

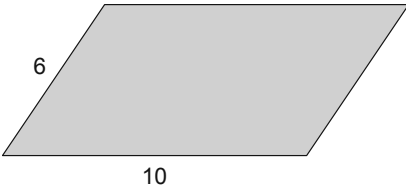
(b) (i) $\cos B = \frac{3}{5}$ $\sin B = \frac{3}{5}$ $\tan B = \frac{3}{5}$

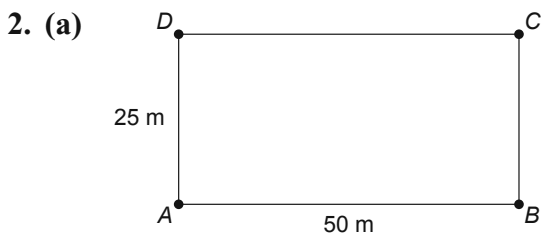
(ii) $B = 53.1^\circ$ (calculator)

(c) $\frac{x}{5.8} = \frac{9}{6} = 1.5$
 $x = 5.8 \times 1.5$
 $x = 8.7 \text{ m}$

2017 SEC

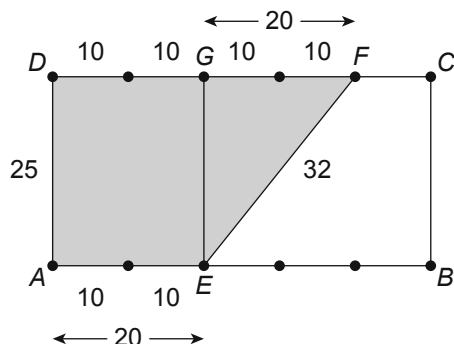
Paper 2

1.	Shape	Diagram	Number of axes of symmetry
	Square		Tick (✓) one box only: 0 1 2 4 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>
	Isosceles Triangle		Tick (✓) one box only: 0 1 2 4 <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
	Rectangle		Tick (✓) one box only: 0 1 2 4 <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
	Parallelogram (angles are not 90°)		Tick (✓) one box only: 0 1 2 4 <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>



Area of $ABCD$
 $= 25 \times 50 = 1250 \text{ m}^2$

(b) Length of the perimeter of $ABCD = 25 + 50 + 25 + 50 = 150 \text{ m}$



- (c) Area of rectangle $AEGD = 20 \times 25 = 500$
 Area of triangle $EFG = \frac{1}{2} \times 25 \times 20 = 250$
 Area of quadrilateral $AEFD = 500 + 250$
 $= 750 \text{ m}^2$

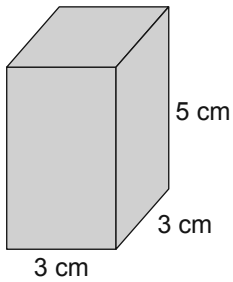
(d) (i) $|EF|^2 = 25^2 + 20^2$
 $= 625 + 400$
 $= 1025$

$|EF| = \sqrt{1025}$

$|EF| = 32 \text{ m}$

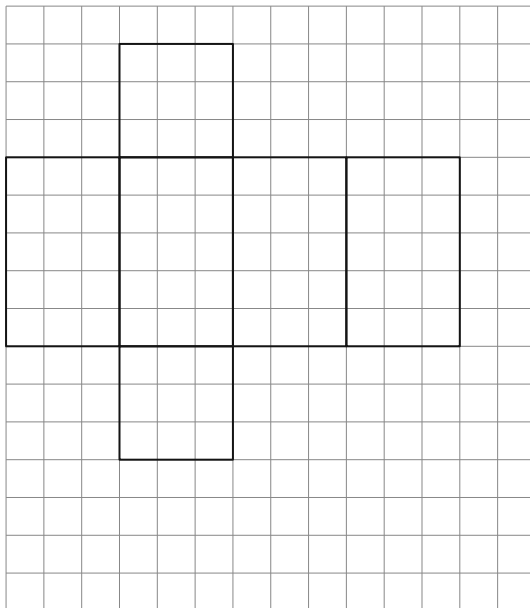
- (ii) Length of perimeter of $AEFD$
 $= 25 + 40 + 32 + 20$
 $= 117 \text{ m}$

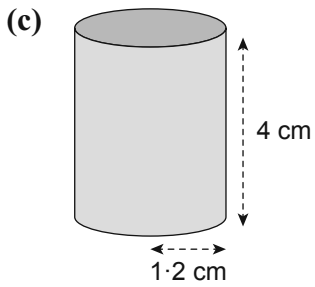
3. (a)



Volume $= 3 \times 3 \times 5$
 $= 45 \text{ cm}^3$

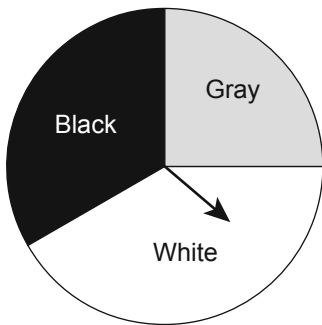
(b)





$$\begin{aligned}
 V &= \pi(r)^2h \\
 &= \pi \times (1.2)^2 \times 4 \\
 &= 18 \text{ cm}^3
 \end{aligned}$$

4. (a)



(i)

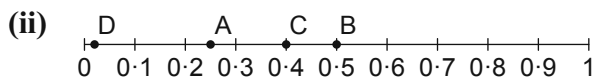
Sector	Grey	Black	White
Size of angle (degrees)	90°	120°	150°

(ii) Number of times it lands on grey

$$\begin{aligned}
 &= \frac{90^\circ}{360^\circ} \times 60 \\
 &= 15
 \end{aligned}$$

(b) (i)

Event	Probability		
	Fraction	Percentage	Decimal
A	$\frac{1}{4}$	25%	0.25
B	$\frac{1}{2}$	50%	0.5
C	$\frac{2}{5}$	40%	0.4
D	$\frac{1}{50}$	2%	0.02



5.

47	49	49	50	56
57	58	65	67	68
69	69	69	75	79

(a) (i)

4	7	9	9			
5	0	6	7	8		
6	5	7	8	9	9	9
7	5	9				

Key: $\boxed{5|6} = \boxed{56}$

(ii) Median = 8th value beginning at the lowest value = 65 kg

(iii) Range = Highest value – Lowest value

= 79 – 47 = 32 kg

(b) (i) Mean weight $\frac{927}{15} = 61.8$ kg

(ii) New mean weight

= 60.8 kg

(iii) New sum of boxer's weights

= New mean \times Number of boxers

= 60.8 \times 15 = 912 kg

6. (a) How many minutes do you spend on social media each day?

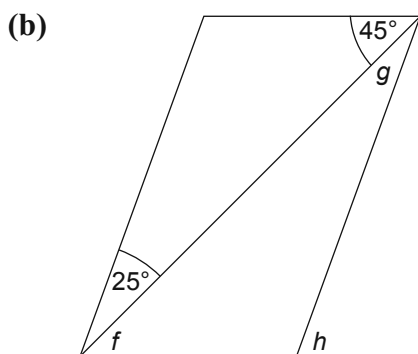
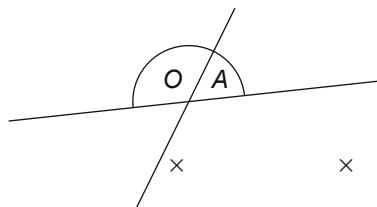
(b) (i)

8, B	8, W	8, S
16, B	16, W	16, S
32, B	32, W	32, S

(ii) Memory size Colour Screen Size

$\boxed{} \times \boxed{} \times \boxed{}$
 3 \times 2 \times 2
 = 18

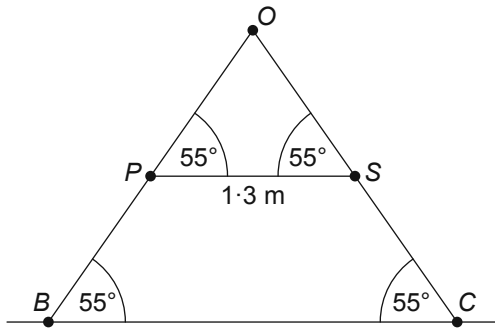
7. (a) (i) (ii)



$|\angle f| = 45^\circ, |\angle g| = 25^\circ, |\angle h| = 70^\circ$

$|\angle h| = 45^\circ + 25^\circ = 70^\circ$

8.



(a) Type of triangle: Isosceles

Reason: Two equal angles means two sides of equal length

(b) $55^\circ + 55^\circ = 110^\circ$

$180^\circ - 110^\circ = 70^\circ$

Answer = 70°

(c) Since $[PS] \parallel [BC]$ angle at $P =$ angle at $B = 55^\circ$ and angle at $S =$ angle at $C = 55^\circ$. The angle at $O = 70^\circ$ is in both $\triangle OPS$ and $\triangle OBC$. Since the angles in both triangles are the same the triangles are similar.

(d) Since $\triangle OPS$ and $\triangle OBC$ are similar

$$|BO| = 2|PO|$$

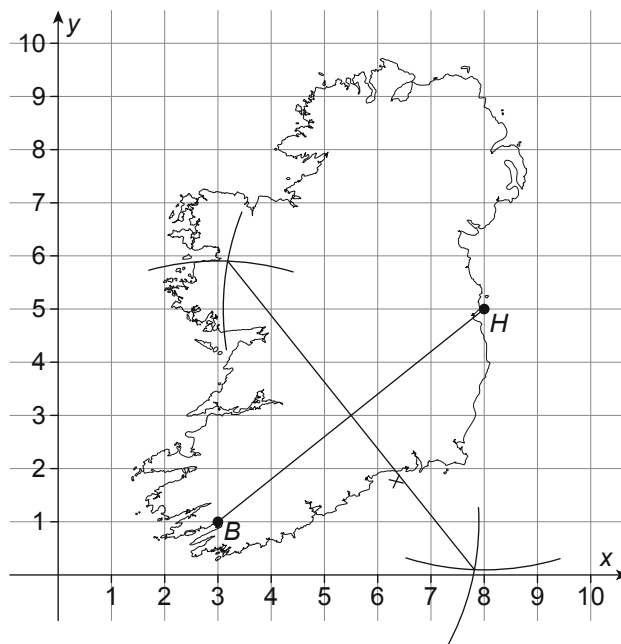
$$\Rightarrow |BC| = 2|PS|$$

$$= 2 \times 1.3$$

$$= 2.6 \text{ m}$$

9. (a) (i) $B = (3, 1), H = (8, 5)$

(ii) (iii)



(iv) $(5\frac{1}{2}, 3)$

(b) Distance from Wicklow to Westport

$$\begin{aligned} &= \sqrt{(3-8)^2 + (6-4)^2} \\ &= \sqrt{(-5)^2 + (2)^2} \\ &= \sqrt{25+4} \\ &= \sqrt{29} \text{ cm} \end{aligned}$$

(c) 4 cm = 180 km

$$\begin{aligned} 1 \text{ cm} &= \frac{180}{4} \text{ km} \\ &= 45 \text{ km} \end{aligned}$$

10. (a) The point that is on $y = 3x + 8$ is (0, 8)

Justification:

$$\begin{aligned} (0, 8): y &= 3x + 8 \\ 8 &= 3(0) + 8 \\ 8 &= 0 + 8 \\ 8 &= 8 \end{aligned}$$

(b) $5x - 11 = 2x + 7$

$$5x - 2x = 7 + 11$$

$$3x = 18$$

$$x = \frac{18}{3} = 6$$

$$x = 6$$

$$x = 6: y = 2x + 7$$

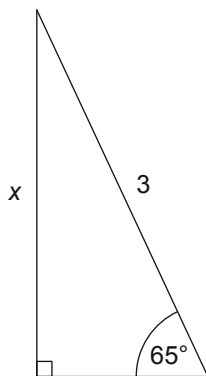
$$y = 2 \times 6 + 7$$

$$y = 19$$

$$\therefore y = 19$$

Point of intersection: (6, 19)

11.



(a) $\sin 65^\circ = \frac{x}{3}$

(b) $\sin 65^\circ = 0.9$

(c) $\frac{x}{3} = 0.9$

$$x = 3 \times 0.9$$

$$x = 2.7$$

2016 SEC

Paper 2

1. (a) Total = 18

(b)

Shirt size	S	M	L	XL
Frequency	3	7	6	2

(c) $\frac{6}{18} = \frac{1}{3}$

(d) $\frac{3}{17}$

2. (a) All numbers are different

(b) Sample = 3, 7, 19, 23, 31.

(c) Sample = 2, 5, 17, 29, 37.

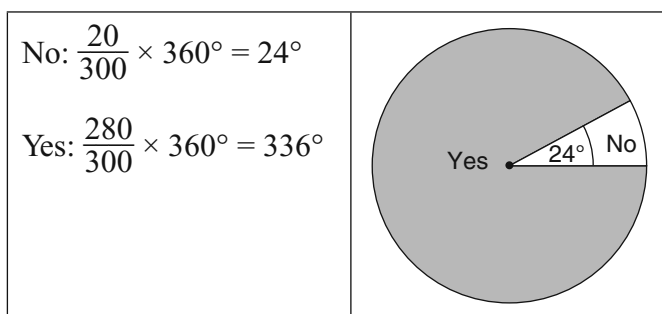
Range = 35

(d) Sample = 2, 3, 5, 7, 11.

Total = 28

Mean = $\frac{28}{5} = 5.6$

3. (a)



(b) Categorical

Numerical



Reason: Results apply to two categories and the answers are non-numerical.

(c) (i) Size of **No** angle = 50°

Size of **Yes** angle = 310°

(ii) $\frac{50}{360} \times 72$
= 10

$72 - 10$
= 62

Number **No** = 10

Number **Yes** = 62

(d) **Company A**

Company B



Reason: More people took part in the survey of company A.

4. (a) $9 \times 14 = 126 \text{ cm}^2$

(b) Answer: Not correct

Justification: Area of front = 16×11
 $= 176 \text{ cm}^2$

$$\begin{aligned} \text{Percentage of eReader covered by screen} &= \frac{\text{Area of Screen}}{\text{Area of eReader}} \times 100\% \\ &= \frac{126}{176} \times 100\% \\ &= 71.6\% \end{aligned}$$

5. (a)

	Measurement in centimetres	Measurement in metres
Length (L)	150	1.5
Width (W)	55	0.55
Depth (D)	40	0.4

(b) Volume $150 \times 55 \times 40 = 330\,000 \text{ cm}^3$

OR

Volume $1.5 \times 0.55 \times 0.4 = 0.33 \text{ m}^3$

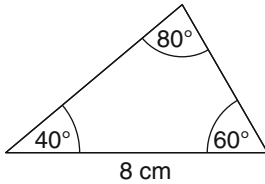
(c) The bath is probably not an exact rectangular box shape – curved edges etc.

6. (a) $40^\circ + 60^\circ = 100^\circ$

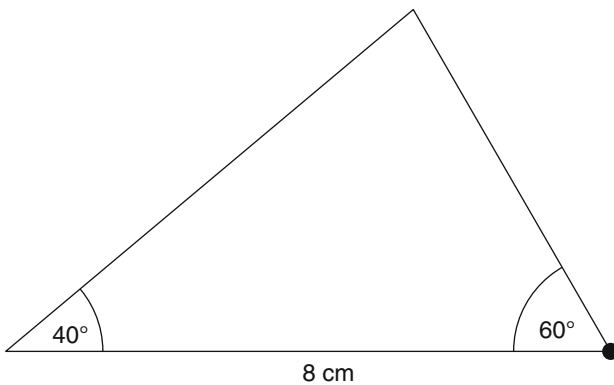
$180^\circ - 100^\circ = 80^\circ$

Third angle = 80°

(b)



(c)



7. (a) $r = 3 \text{ m}$

(b) Perimeter = $2\pi r = 2 \times \pi \times 3$
 $= 19 \text{ m}$

(c) $\text{Area} = \pi r^2 = \pi \times 3^2$
 $= \pi \times 9$
 $= 28.3 \text{ m}^2$

(d) 25 km in 15 mins ($\frac{1}{4}$ hr)
 100 km in 1 hr
 Speed = 100 km per hr

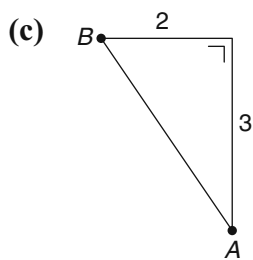
8. (a)

Slope	Line <i>k, t, or p</i>
0	<i>t</i>
1	<i>p</i>
-1	<i>k</i>

(b) $m = 3$
 $c = 5$
 $y = 3x + 5$

9. (a) $A = (5, 1), B = (3, 4)$

(b) $x: \frac{3+5}{2} = \frac{8}{2} = 4$
 $y: \frac{1+4}{2} = \frac{5}{2}$
 Midpoint = $(4, \frac{5}{2})$



$$|AB|^2 = 2^2 + 3^2$$

$$= 4 + 9$$

$$= 13$$

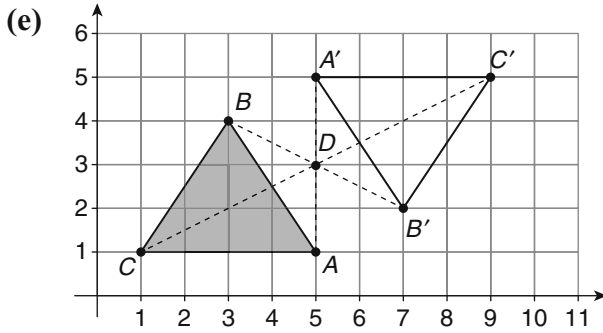
$$|AB| = \sqrt{13}$$

(d) Base = $|CA| = 4$

Height = 3

$$\text{Area} = \frac{1}{2} \times 4 \times 3$$

$$= 6$$



10. (a) $|\angle K| = 110^\circ$ $|\angle L| = 30^\circ$

(b) (i)

Statement	Tick one box for each statement		
	Always true	Sometimes true	Never true
1. In a rectangle, the opposite sides are equal.	✓		
2. The sum of the four angles in a rectangle is 180° .			✓
3. A square has 4 axes of symmetry.	✓		
4. Each of the angles in a parallelogram is 90° .		✓	

(ii) Four right angles
 $4 \times 90^\circ = 360^\circ$

11. (a) (i) Adjacent = 260 cm

(ii) $\tan A = \frac{20}{260} = \frac{1}{13}$

(iii) $\tan A = \frac{1}{13}$
 $A = 4^\circ$

(iv) Yes No

Reason: The angle is clearly less than 5° .

(b) $x^2 + 224^2 = 226^2$

$x^2 + 50\,176 = 51\,076$

$x^2 = 51\,076 - 50\,176$

$x^2 = 900$

$x = 30 \text{ cm}$

2015 SEC Paper 2

1. (a) $30 - (15 + 4 + 3) = 30 - 22 = 8$
8 Usher songs

(b) 3 of 30 songs are by Hozier.
 $\frac{1}{10}$ probability of selecting one

$P = \frac{3}{30} = \frac{1}{10}$

(c) $\frac{15}{30} + \frac{4}{30} = \frac{19}{30}$

15 songs for Pharrell, 4 songs for Ed Sheeran

(d) $4 \times 3 = 12$ ways to play songs

2. (a) GAA: $90 \times 145 = 13\,050 \text{ m}^2$
Rugby: $70 \times 120 = 8400 \text{ m}^2$

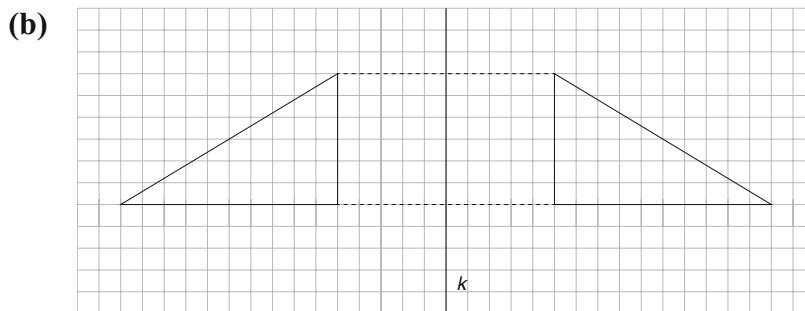
(b) $13\,050 - 8400 = 4650 \text{ m}^2$

3. (a) $90 + 22 + P = 180$

$112 + P = 180$

$P = 180 - 112$

$P = 68^\circ$



(c) (i) 12 m

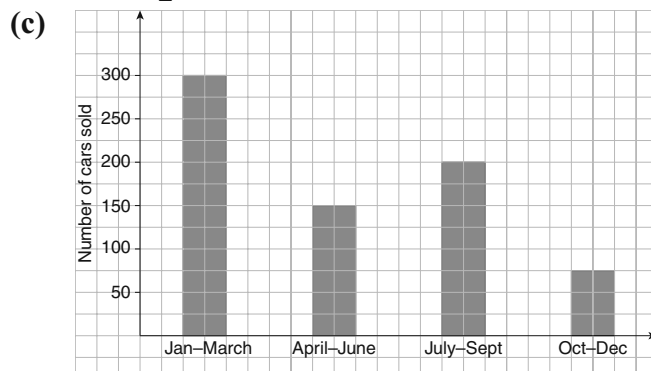
(ii) $5^2 + 12^2 = h^2$

$25 + 144 = 169 = h^2$

$h = 13 \text{ m}$

4. (a) 150

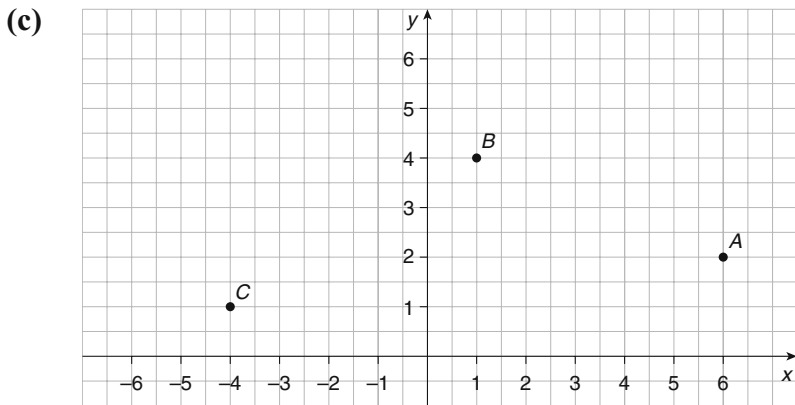
(b) $75 = \frac{150}{2}$



- (d) January–March
- (e) 725
- (f) $\frac{725}{12} = 60.4$ cars sold per month

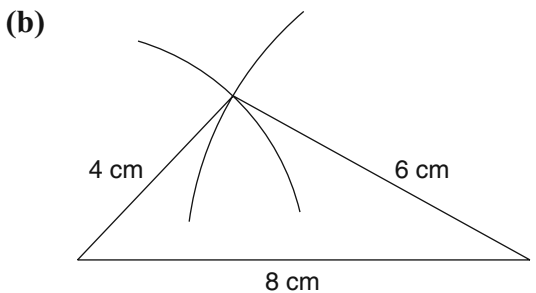
5. (a) The mode is most common value in a list.
 (b) List: 4, 5, 5, 5, 6, 7, 7, 8, 9
 Mode: 5 (because it appears more often than any other value. It is the most common)

6. (a) $A = (1, 4)$
 (b) $|AB| = \sqrt{(6 - 1)^2 + (2 - 4)^2}$
 $|AB| = \sqrt{(5)^2 + (-2)^2}$
 $|AB| = \sqrt{25 + 4}$
 $|AB| = \sqrt{29}$



- (d) Slope equals change in height/over change in distance
 Slope increases along x and y : \oplus
 $C(-4, 1)$
 $A(1, 4)$
 Change in $y = 3$
 Change in $x = 5$
 $m = \frac{3}{5}$

7. (a) Íde has sketched a scalene triangle (all edges are different lengths)



- (c) Biggest angle is opposite the longest side = 104° .

8. (a) 13 15 16 18 20 23 23 26 30

(b) 20 is the median (the middle data unit).

(c) 17 is the range. $\leftarrow 30 - 13 = \text{range}$

(d) 17 (range will remain the same if all values change by the same value)

15 17 18 20 22 25 25 28 32

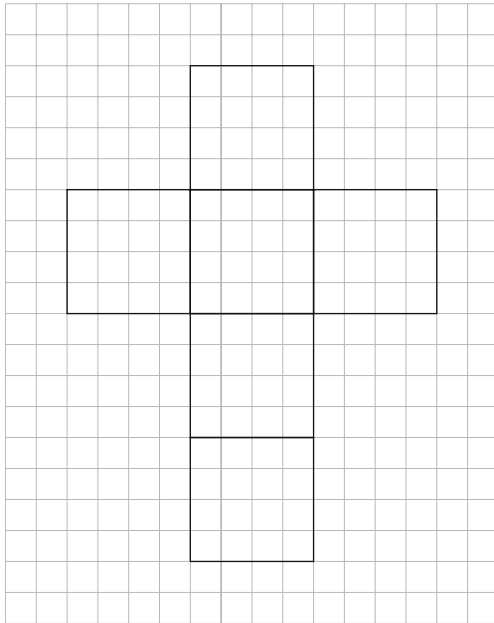
$$\text{Range} = 32 - 15$$

$$= 17$$

9. (a) $2 \times 2 \times 2 = 8 \text{ cm}^3$

(b) 6 faces

(c)



Net of cube of side 2 cm

10. (a) $h = 2 \text{ cm}, d = 6 \text{ cm}$

Actual height = 1 m

$$1 \text{ m} = 100 \text{ cm}$$

$$= 2 \times 50 \text{ cm}$$

Multiply h and d values by 50 to get actual measurements

$$\text{Actual diameter} = 6 \times 50$$

$$= 300 \text{ cm}$$

$$= 3 \text{ m}$$

$$\text{Actual radius} = 1.5 \text{ m}$$

(b) $d = 3 \text{ m}, r = 1.5 \text{ m}$

(c) Volume = $\pi r^2 h = \pi \times r \times r \times h$

$$= \pi \times 2.1 \times 2.1 \times 1.4$$

$$= \pi \times 6.174$$

$$= 19.4 \text{ m}^3$$

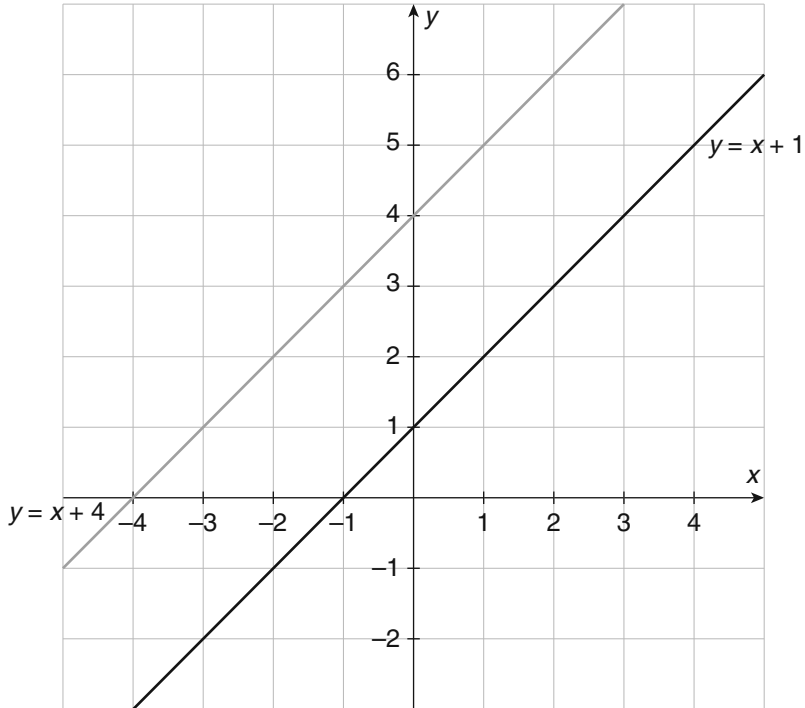
11. (a) (i) 0.34, 0.34
 (ii) 0.77, 0.77
 (b) 80° , ($\sin A = \cos (90^\circ - A)$)

12. (a) (0, 1)

(b) (0, 4)

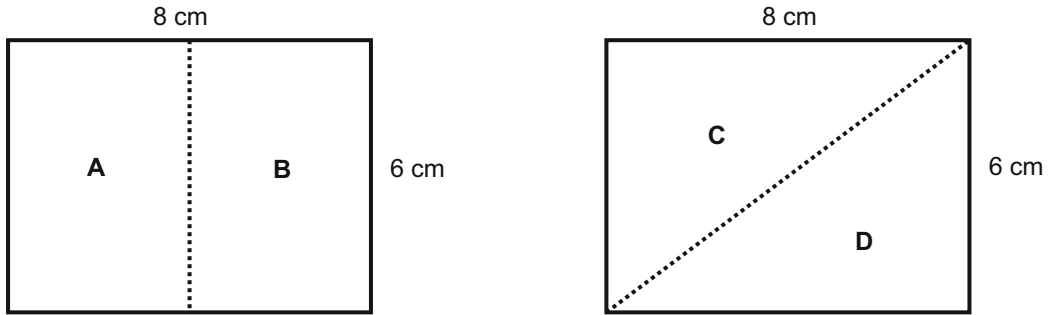
← Let $x = 0$ in equation of line

(c)



2014 SEC Paper 2 (Phase 3)

1. (a)



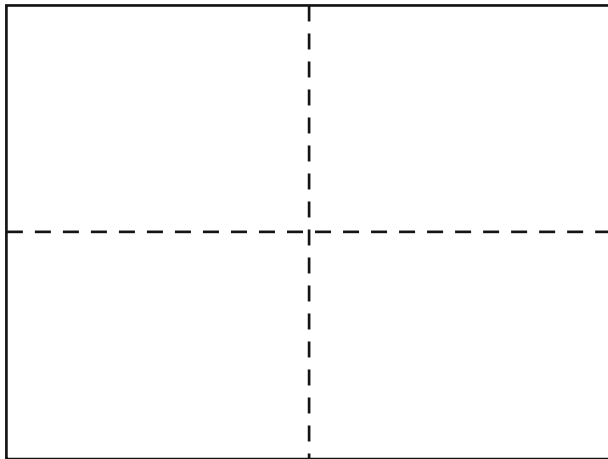
Answer: Yes, because each is half of the same rectangle.

Or:

The area of A = $\frac{1}{2} \times (8 \times 6) = 24 \text{ cm}^2$ and the area of D = $\frac{1}{2} (8 \times 6) = 24 \text{ cm}^2$

Area of rectangle = Length \times Breadth
 Area of triangle = $\frac{1}{2}$ (Base) (Height)

(b)



2. (a) Explanation: The ages overlap in this question

Suitable form: Put a tick (\checkmark) in one box below to indicate your age, in years.

40 – 44	45 – 49	50 – 54	55 – 60
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

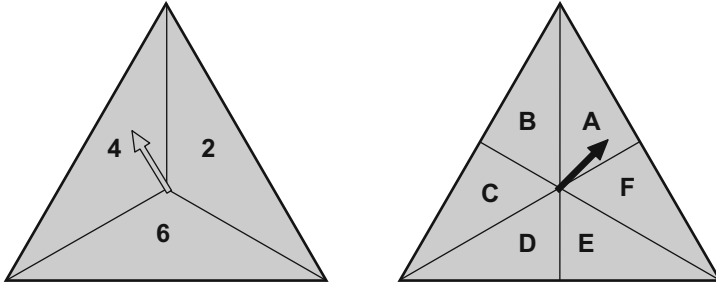
(b) Explanation: The question encourages people to say that they sleep eight hours a night.

Suitable form: How many hours a night do you sleep?

Or:

Do you sleep eight hours (or more) a night?

3.



(i)

	A	B	C	D	E	F
2	(2, A)	(2, B)	(2, C)	(2, D)	(2, E)	(2, F)
4	(4, A)	(4, B)	(4, C)	(4, D)	(4, E)	(4, F)
6	(6, A)	(6, B)	(6, C)	(6, D)	(6, E)	(6, F)

(ii) 3 outcomes

(iii) $\frac{3}{18}$ or $\frac{1}{6}$ ← Probability = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{3}{18} = \frac{1}{6}$

(iv) $\frac{6}{18}$ or $\frac{1}{3}$ ← Probability = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{6}{18} = \frac{1}{3}$

(v) $\frac{8}{18}$ or $\frac{4}{9}$ ← Probability = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{8}{18} = \frac{4}{9}$

Do not count (6, E) twice.

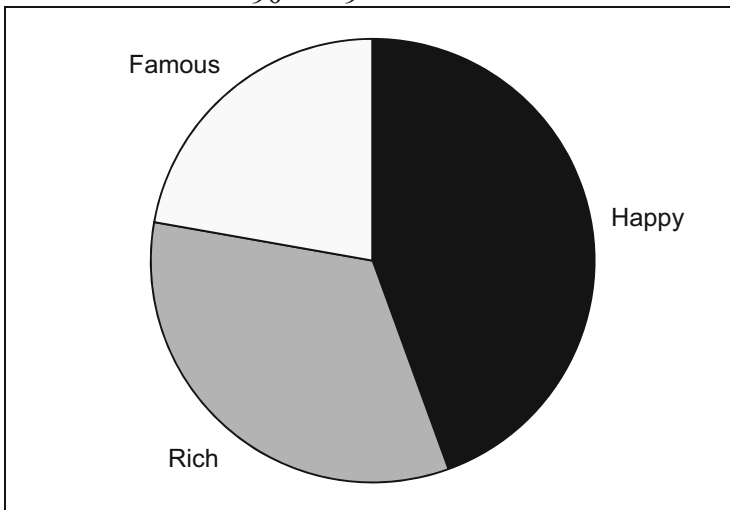
4. (i) $40 + 30 + 20 = 90$

(ii) $50 + 15 = 65$

$90 - 65 = 25$

See graph

(iii) 12 – 15 year olds: $\frac{40}{90}$ or $\frac{4}{9}$ 16 – 19 year olds: $\frac{50}{90}$ or $\frac{5}{9}$



(iv) 12 – 15 year olds, because **Happy** is less than half of the pie chart.

5. 15 22 17 49 12 24 15 23 8 21
16 15 20 9 26 32 8 19 18 30

(i)

0	8	8	9					
1	2	5	5	5	6	7	8	9
2	0	1	2	3	4	6		
3	0	2						
4	9							

Key: 1|6 = 16 seconds

(ii) Range = $8 - 49 = 41$ seconds

Range: The difference between the longest time and the shortest time.
 $49 - 8 = 41$ seconds

(iii) Mode = 15 seconds

The mode is the most common data item.

(iv) Mean = $\frac{(8 + 8 + 9 + 12 + 15 + 15 + 15 + 16 + 17 + 18 + 19 + 20 + 21 + 22 + 23 + 24 + 26 + 30 + 32 + 49)}{20}$

= $\frac{399}{20}$

Mean: sum of all values divided by total number of values

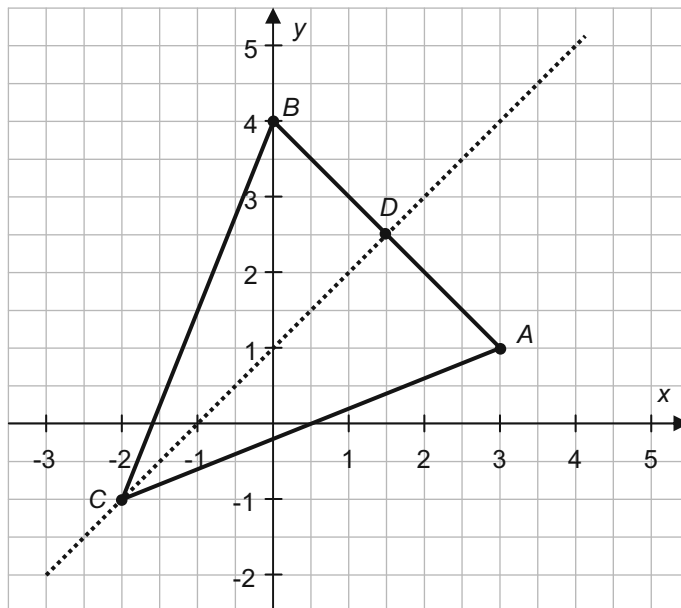
= 19.95

= 20 seconds (correct to the nearest second)

(v) 49 seconds

(vi) Smaller, because 49 is a large number; or $(399 - 49)/19 = 18.42$

6. (i)



(ii) $|AC| = \sqrt{2^2 + 5^2} = \sqrt{29}$ $|BC| = \sqrt{2^2 + 5^2} = \sqrt{29}$

Use the grid to find distances or use the Distance formula: $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
See page 18 of *Formulae and Tables*.

(iii) Isosceles

(iv) $D = \left(\frac{3}{2}, \frac{5}{2}\right)$ or $(1.5, 2.5)$ ← See page 18 of *Formulae and Tables*.

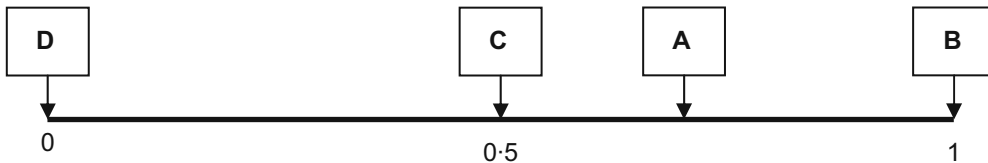
(v) Draw the line CD on the diagram. ← See diagram.

<p>(vi)</p> <p>SSS:</p> <p>$\triangle ADC \quad \triangle BDC$</p> <p>$AC = BC$ From (ii)</p> <p>$BD = DA$ D is midpoint of $[AB]$</p> <p>$CD = CD$ Common</p>	<p>SAS:</p> <p>$\triangle ADC \quad \triangle BDC$</p> <p>$AC = BC$ From (ii)</p> <p>$BD = DA$ D is midpoint of $[AB]$</p> <p>$\angle CBD = \angle CAD$ Isosceles triangle</p>
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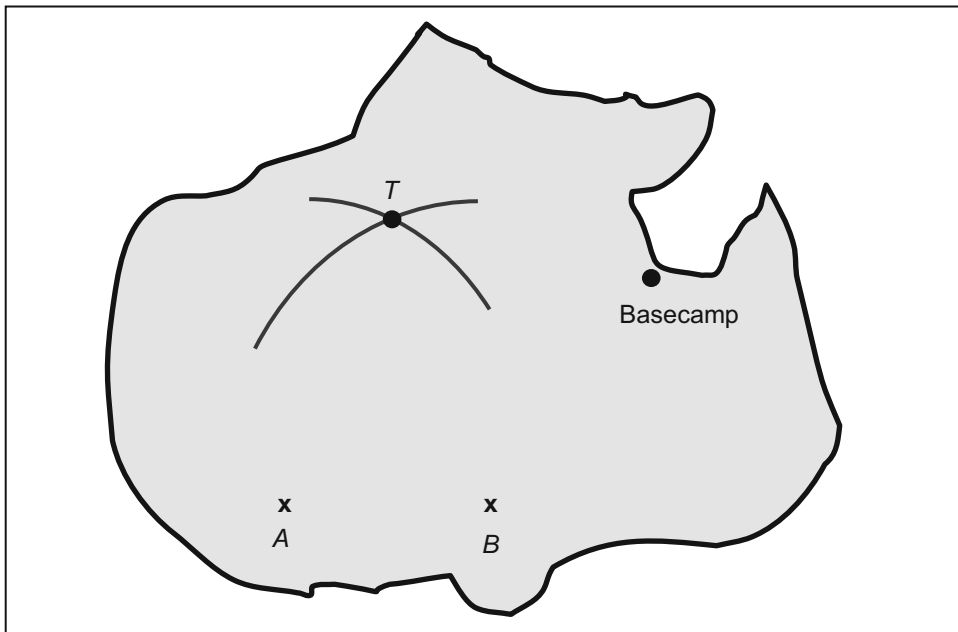
7. (a)

Event	Probability
When a fair coin is tossed you get a head.	50:50
If you buy a lottery ticket for next Saturday's draw, you will win the jackpot.	Unlikely
The 1 st of January will be New Year's Day.	Certain

- (b) A: You pick a red ball from a bag containing 3 black and 7 red balls.
 B: You get a natural number less than 7 when you roll a regular six-sided die.
 C: You pick a red card from a deck of playing cards.
 D: You pick a yellow ball from a bag containing 4 red balls and 2 white balls.



8.



(i) $20 \div 5 = 4 \text{ cm}$

(ii) Using a compass, construct the point T .

(iii) On map: 3.5 cm

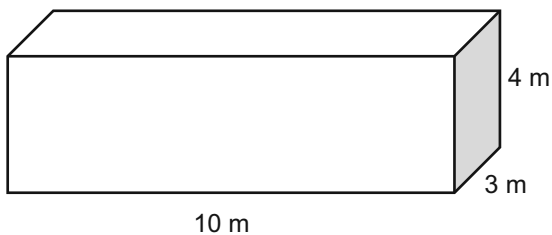
Actual distance = $3.5 \times 5 = 17.5 \text{ km}$

- Steps:
1. Place the compass point on A with the radius of the compass set at 4 cm . Draw an arc.
 2. Place the compass point on A with the radius of the compass set at 4 cm . Draw an arc.
 3. Label as T the point where the arcs intersect.

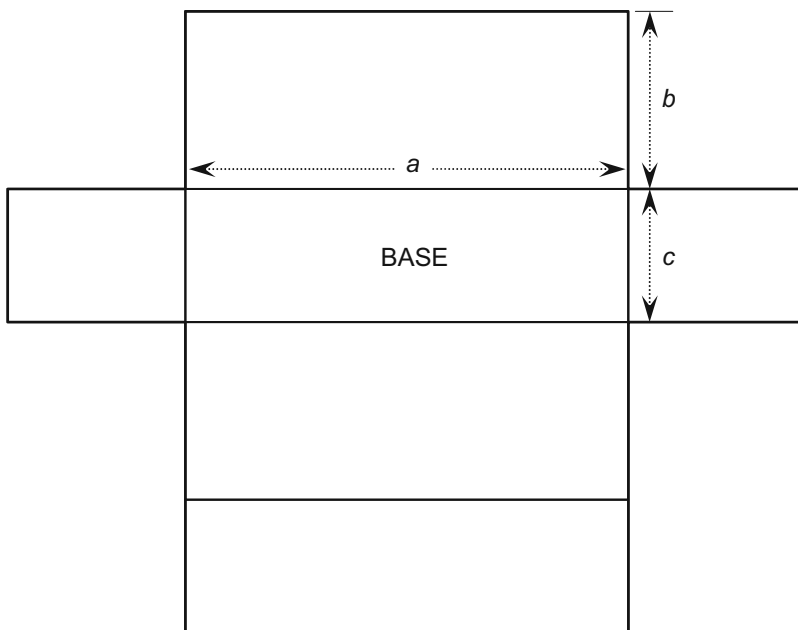
(iv) $\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{17.5}{6} = 2\frac{11}{12} \text{ hours, i.e. 2 hours and 55 minutes}$

15:55

9.



A diagram of the net of this tank is shown below.



(i) $a = \boxed{10 \text{ m}} \quad b = \boxed{4 \text{ m}} \quad c = \boxed{3 \text{ m}}$

(ii) $2 \times [(10 \times 4) + (10 \times 3) + (4 \times 3)] = 164 \text{ m}^2$

(iii) $\text{Volume} = 10 \times 4 \times 3 = 120 \text{ m}^3$ ← Volume of a tank = Length \times Breadth \times Height
 In litres = $120 \times 1000 = 120\,000 \text{ litres}$

(iv) Either:

$10 \times 0.5 \times 3 = 15 \text{ m}^3$

In litres = $15 \times 1000 = 15\,000 \text{ litres}$ $\frac{1}{8} \times 120\,000 = 15\,000 \text{ litres.}$

Or:

50 cm is $\frac{1}{8}$ th of the height, so it will be $\frac{1}{8}$ th of the volume.

10. (i) $1.2 \div 2 = 0.6 \text{ m}$

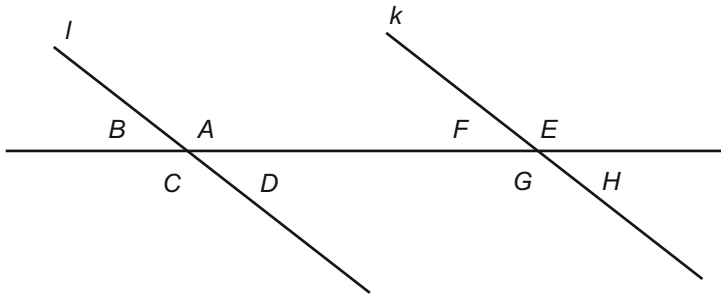
Length of radius = $\frac{1}{2}$ the length of the diameter

(ii) Half of $2\pi r = 0.5 \times (2 \times \pi \times 0.6)$
 $= 1.88 \text{ m}$

Length of semicircle = $\frac{1}{2}$ the length circle = $\frac{1}{2}(2\pi r)$

(iii) $1.88 + 1.5 + 1.2 + 1.5 = 6.08 \text{ m}$

11.



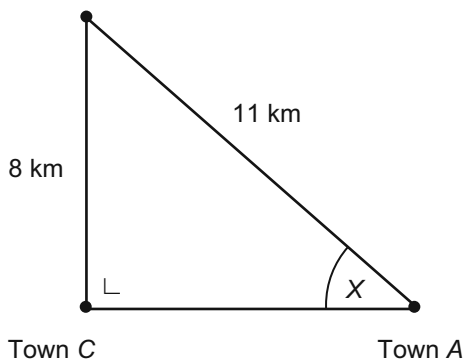
(i) B and D ,
 or A and C ,
 or F and H ,
 or E and G are vertically opposite angles.

(ii) B and F ,
 or A and E ,
 or C and G ,
 or D and H are corresponding angles.

(iii) A and G ,
 or D and F .
 or B and H ,
 or C and E are alternate angles.

(iv) $|\angle G| = |\angle A| = 137^\circ$ $|\angle H| = 180^\circ - |\angle A| = 43^\circ$

12. Town B



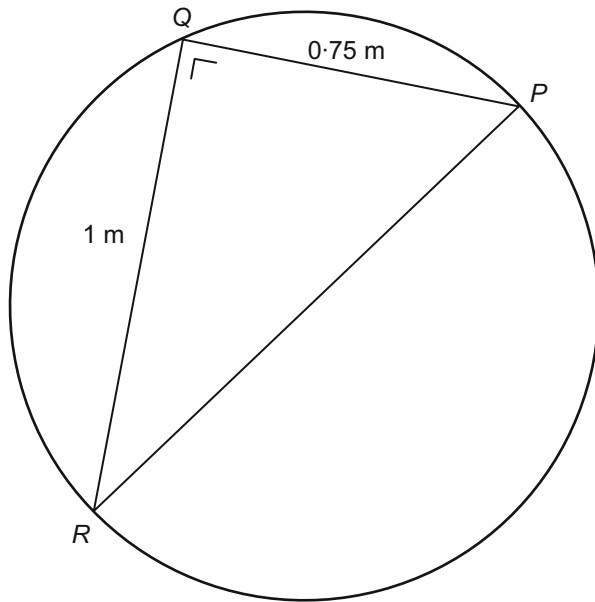
(i) Hypotenuse = 11 km

(ii) Opposite = 8 km

(iii) $\sin X = \frac{8}{11}$ ← $\sin = \frac{\text{Opposite}}{\text{Hypotenuse}}$

(iv) $X = \sin^{-1}\left(\frac{8}{11}\right) = 47^\circ$ (correct to the nearest degree)

13.



(i) $|\angle PQR| = 90^\circ$, so $[PR]$ is a diameter.

(ii) Working in cm:

$$|PR|^2 = 100^2 + 75^2 = 15\,625$$

$$|PR| = \sqrt{15\,625} = 125 \text{ cm}$$

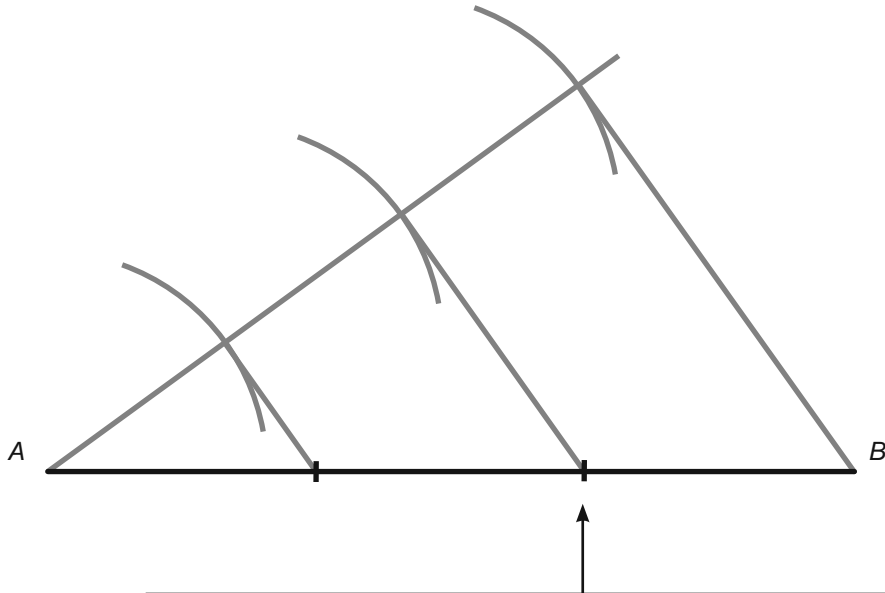
Working in m:

$$|PR|^2 = 1^2 + 0.75^2 = 1.5625$$

$$|PR| = \sqrt{1.5625} = 1.25 \text{ m} = 125 \text{ cm}$$

(iii) $125 \div 2 = 62.5 \text{ cm}$

14.



- Steps:
1. Draw another line at an angle to the line segment AB .
 2. With a compass draw three arcs of equal length to cut the line which is at an angle to $[AB]$.
 3. Join the point where the outside arc cuts the line to B .
 4. Draw two more parallel lines from the intersection of the arcs to $[AB]$.

2014 SEC Sample Paper 2 (Phase 2)

1. Each face has area $2 \times 2 = 4 \text{ cm}^2$.

\therefore Six faces will have area $6 \times 4 = 24 \text{ cm}^2$. Make sure to include units in your answer.

2. (i) $V = \pi r^2 h = \pi(3)^2(10 \cdot 6)$ Volume of a Cylinder formula ($\pi r^2 h$): See page 10 of *Formulae and Tables*.
 $= 299 \cdot 707 \text{ cm}^3$
 $= 300 \text{ cm}^3$

(ii) $5 \times 5 \times h = 300$

$$25h = 300$$

$$h = 12 \text{ cm}$$

Volume of Carton B = 300 cm^3

Length \times Breadth \times Height = 300 cm^3

$5 \times 5 \times \text{height} = 300 \text{ cm}^3$

Height = 12 cm

(iii) Container A

It uses less material to make it. ($256 \cdot 35 \text{ cm}^2$ as opposed to 290 cm^2)

3. (a) (i) 08:50 Read the answer from the timetable given.

(ii) $10:15 - 08:50 = 1 \text{ hr } 25 \text{ mins}$

(iii) $08:50 - 1 \text{ hr } 15 \text{ mins} = 07:35$

(b) $\text{€}133 \cdot 88 - (\text{€}74 \cdot 99 + \text{€}25 \cdot 00) = \text{€}33 \cdot 89$ $\text{€}133 \cdot 88 - (\text{€}74 \cdot 99 + \text{€}25) = \text{€}33 \cdot 89$

(c) $S = \frac{D}{T} = \frac{464}{1\frac{5}{12}} = 327 \cdot 53 \text{ km/hr}$ (25 mins = $\frac{5}{12}$ of an hour) Speed = Distance \div Time
 $= 464 \div 1\frac{25}{60}$ (Use your calculator.)
 $= 327 \cdot 53 \text{ km/h}$

4. (i) What colour is your hair?

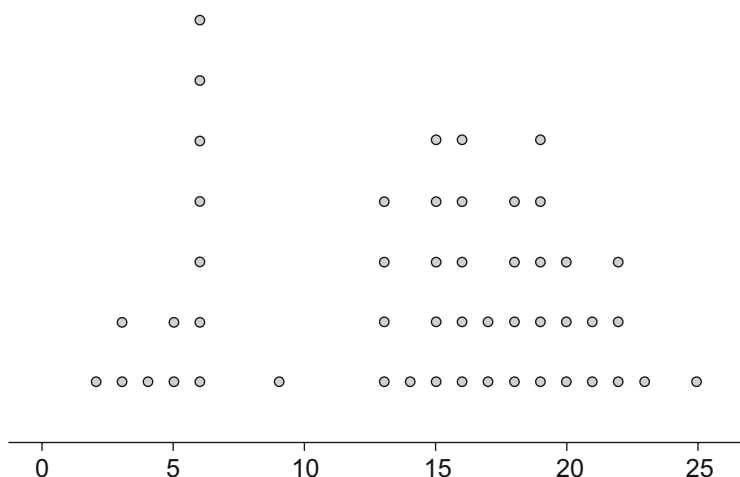
(ii) Do you read books for pleasure – never, sometimes or always?

(iii) How many times have you visited the doctor this year?

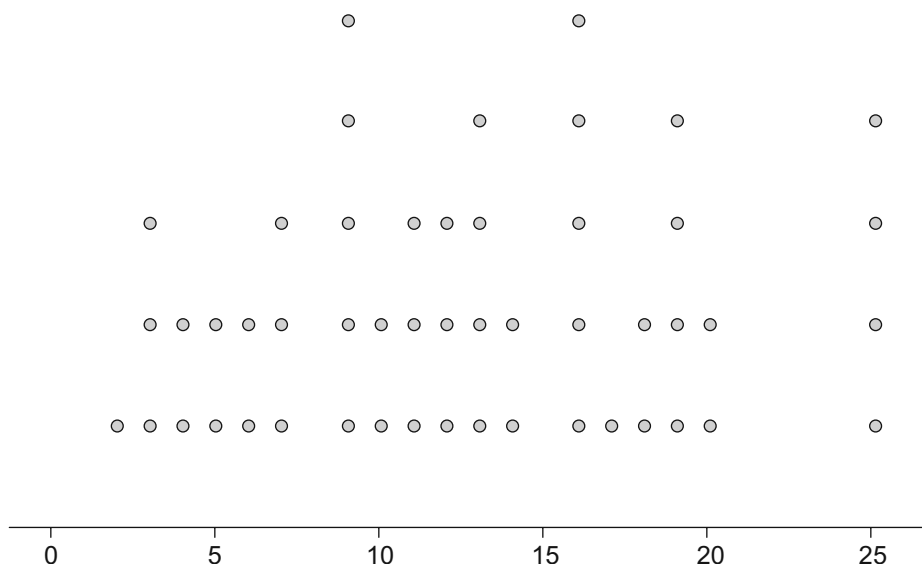
(iv) What is your height, correct to two decimal places?

5. (i) 50; 50 Count the numbers of students in each country.

(ii) **UK Students**



Irish Students



(iii) Similarity: The range is the same for both.

Difference: More UK students spend in excess of 20 hours on the sites.

(iv) Yes. The Irish shape is more uniform. Very few UK students spend between 7 and 12 hours on the sites i.e. there are more extremes in the UK data.

6. (i) There are probably more red discs in the bag.

(ii)

Colour	Red	Blue	White	Total
Frequency	123	78	39	240
Relative frequency ($\frac{\text{Frequency}}{\text{Total}}$)	$\frac{123}{240}$	$\frac{78}{240}$	$\frac{39}{240}$	
% of total (Relative frequency \times 100)	51.25%	32.5%	16.25%	

(iii)

Colour	Red	Blue	White
Probability	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{6}$

(iv) Yes

10 discs could generate these probabilities.

(v) 5 red, 3 blue and 2 white

The figures are close to 50%, 33.33% and 16.66%.

↑

Probability of red = $\frac{\text{No. of red cars}}{\text{Total no. of cars}}$

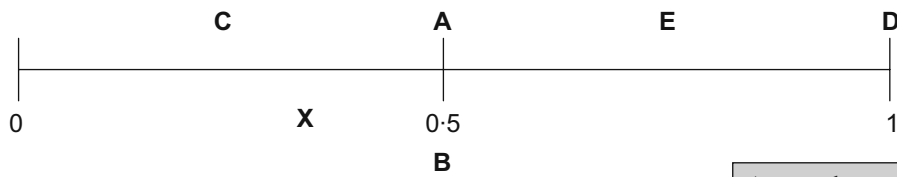
Probability of blue = $\frac{\text{No. of blue cars}}{\text{Total no. of cars}}$

Probability of white = $\frac{\text{No. of white cars}}{\text{Total no. of cars}}$

7. (i)

	Probability
A name is picked at random from a list of 50 girls and 50 boys. A = A girl's name is picked.	$\frac{1}{2}$
A fair coin is tossed once. B = A head is the outcome.	$\frac{1}{2}$
One card is drawn at random from a pack of playing cards. C = The card is a diamond.	$\frac{1}{4}$
A day is chosen at random from a list of the days of the week. D = The name of the day contains the letter a.	1
One number is picked at random from the set $\{1, 2, 3, 4, 5, 7, 11, 13\}$. E = The number chosen is a prime number.	$\frac{3}{4}$

(ii), (v)



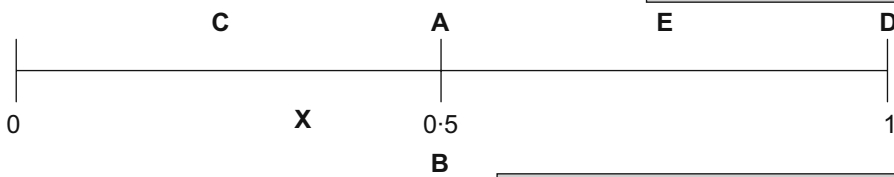
(iii) Drawing a Club from a pack of playing cards.

(iv) Drawing an even number from the set $\{2, 4, 6, 8, 10\}$

Any other event that has a 1 in 4 chance of occurring (probability of 0.25)

Any other event that is certain to occur (probability of 1)

(v)



8. (a) 4, 6, 6, 10, 14 and 8, 8, 8, 8, 8

(b) 1, 2, 3, 4, 7, 7 and 7, 7, 7, 7, 5, 5

Mean: sum of all values divided by total number of values

Mode: the number that occurs most often.

9. (a) 50° ; 134°

(b) O, N, M, P

10. (i) $A + B + C = 180^\circ$

(ii) $C + D = 180^\circ$

(iii) They are equal.

(iv) $x^\circ + 47^\circ = 112^\circ$

$$x = 65^\circ$$

Three angles of a triangle add to 180° .

A straight angle equals 180° .

Both 180°

11. (i) 72°
 (ii) Construction
 (iii) Construction
 (iv) $36^\circ, 72^\circ, 72^\circ$
 (v) Yes, two of the three angles are equal.
 (vi) 9.3 cm; 5.8 cm
 (vii) 1.603

$180^\circ - 36^\circ = 144^\circ$ (three angles add to 180°)
 $144^\circ \div 2$ (this is an isosceles triangle)
 72°

Steps:
 1. Place a compass point on B and draw an arc which cuts AB and BC .
 2. Place the compass on the point of intersection of the arc and $[AB]$. Draw an arc to the right of B .
 3. Place the compass on the point of intersection of the arc and $[BC]$. Draw an arc to the right of B to cut the previous arc.
 4. Label as P the point where these arcs intersect.
 5. Join B to P and extend.

12. (i)

$\sin 25^\circ = 0.423$	$\cos 25^\circ = 0.906$	$\tan 25^\circ = 0.466$
$\sin 50^\circ = 0.766$	$\cos 50^\circ = 0.643$	$\tan 50^\circ = 1.192$

- (ii) No. $\tan 50^\circ > 1$
 (iii) No. $\sin 50^\circ \neq 2\sin 25^\circ$
 (iv) No. $\cos 50^\circ < \cos 25^\circ$

Use your calculator.

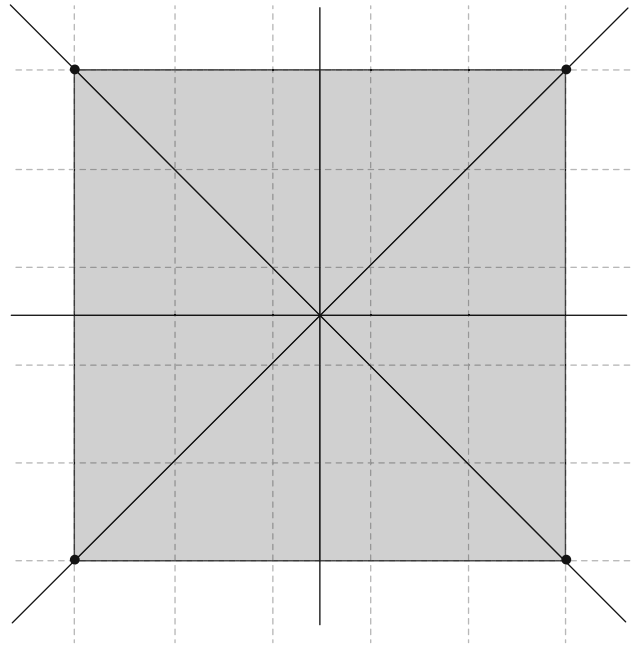
13. (a) (i) $\tan \beta = \frac{6}{12} = \frac{1}{2}$

$\tan = \frac{\text{Opposite}}{\text{Adjacent}}$

(ii) $\tan^{-1}\left(\frac{1}{2}\right) = 26.565^\circ$
 $\therefore \beta = 27^\circ$

(b) $l^2 = 6^2 + 12^2$
 $l^2 = 36 + 144 = 180$
 $l = \sqrt{180} = 13.4164$
 $l = 13.42 \text{ m}$

14.



15. (i) $A(0, 3) B(4, 0)$

(ii) $\sqrt{(4-0)^2 + (0-3)^2} = \sqrt{16+9} = \sqrt{25} = 5$

See Length formula on page 18 of *Formulae and Tables*.

(iii) $|OA| = 3; |OB| = 4$

(iv) $3^2 + 4^2 = |AB|^2$

← Pythagoras's Theorem

$$9 + 16 = |AB|^2$$

$$25 = |AB|^2$$

$$5 = |AB|$$

16. (i) Midpoint = $\left(\frac{1+5}{2}, \frac{2+6}{2}\right) = (3, 4)$

See the Mid-Point formula on page 18 of *Formulae and Tables*.

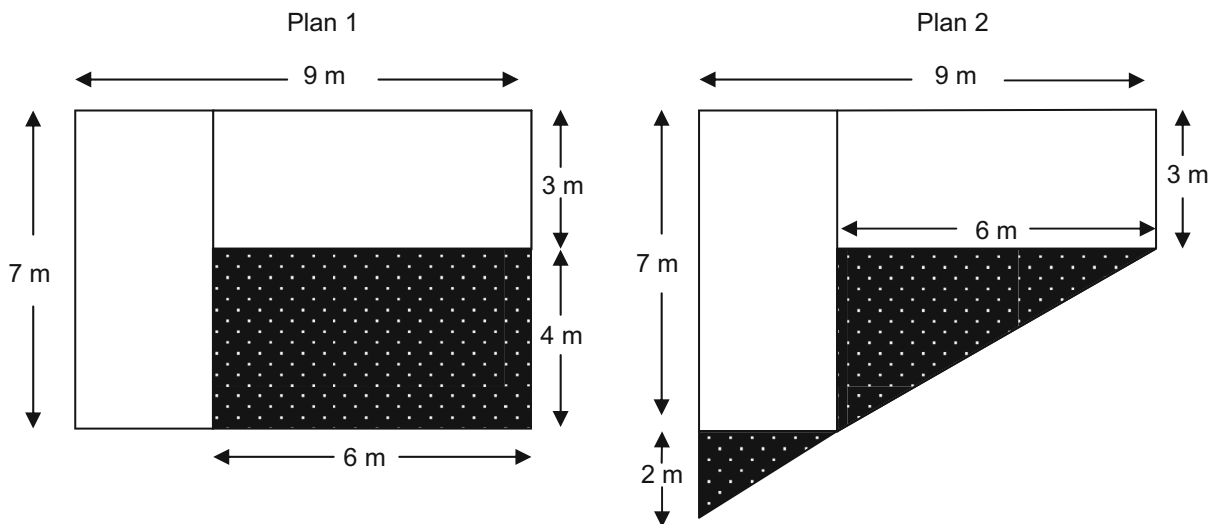
(ii) Moving in an anti-clockwise direction gives E = (6, 7).

(iii) Bee 2

$$8 \cdot 246 < 10$$

2013 SEC Paper 2 (Phase 3)

1.



(a) Plan 1

$$4 \times 6 = 24 \text{ m}^2$$

Area of rectangle = Length \times Breadth

Plan 2

$$\frac{1}{2}(2 \times 3) + \frac{1}{2}(6 \times 4) =$$

Area of triangle = $\frac{1}{2}$ Base \times Height

$$3 + 12 = 15 \text{ m}^2$$

(b) Plan 1

(c) $24 - 15 = 9 \text{ m}^2$

2.

Student	Gender	Age	Year	Location	Cans Bought	Cans Recycled
A	Female	12	1 st Year	Dublin	6	2
B	Male	13	1 st Year	Tipperary	0	0
C	Male	14	2 nd Year	Cork	1	1
D	Female	15	5 th Year	Cavan	0	0
E	Male	15	4 th Year	Cork	2	1
F	Male	13	1 st Year	Offaly	5	2
G	Female	17	5 th Year	Westmeath	1	1
H	Male	17	5 th Year	Westmeath	2	0
I	Male	13	1 st Year	Mayo	1	1
J	Male	13	2 nd Year	Galway	2	2
K	Male	17	5 th Year	Kilkenny	5	5
L	Female	12	1 st Year	Dublin	3	1
M	Female	17	6 th Year	Kerry	2	1
N	Female	17	5 th Year	Dublin	3	1

(a) 14

(b)

Student	A	B	C	F	I	J	L
Cans Bought	6	0	1	5	1	2	3
Cans Recycled	2	0	1	2	1	2	1

(c) $6 + 0 + 1 + 5 + 1 + 2 + 3 = 18$

(d) $2 + 0 + 1 + 2 + 1 + 2 + 1 = 9$

(e) No ← Answer

Student	D	E	G	H	K	M	N	Total
Cans Bought	0	2	1	2	5	2	3	15
Cans Recycled	0	1	1	0	5	1	1	9

Seniors recycled $\frac{9}{15} = 60\%$

← Reason

Juniors recycled $\frac{9}{18} = 50\%$

Probability of a point = 0.6
Probability of a goal = 0.1

3. (a) Fiachra is more likely to score a point. ←

(b) $1 - 0.6 = 0.4$ or $\left(\frac{2}{5}\right)$ ←

Probability of not scoring a point: 1
The probability of scoring a point: $1 - 0.6 = 0.4$

(c) $0.7 > 0.5$ (point) and

$0.2 > 0.1$ (goal)

(d) No

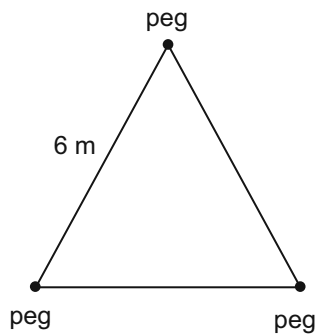
While the probability of Peadar scoring is higher, it does not mean that he will score (or score more) in any particular game.

↑ Reason

(e) $\frac{12}{20} = \frac{3}{5}$ or 0.6 ←

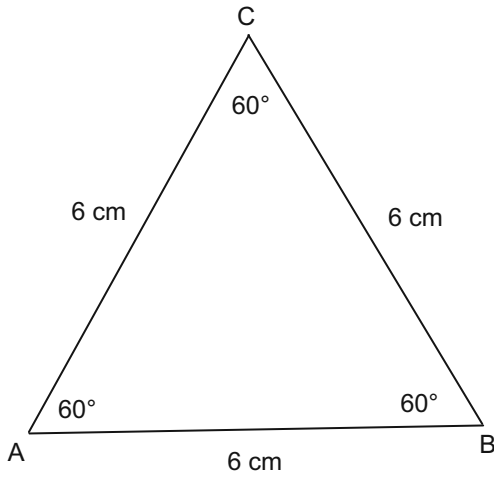
Probability = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{12}{20} = \frac{3}{5}$

4.



(a) Perimeter of triangle: $6 + 6 + 6 = 18$ m

(b)



Steps:

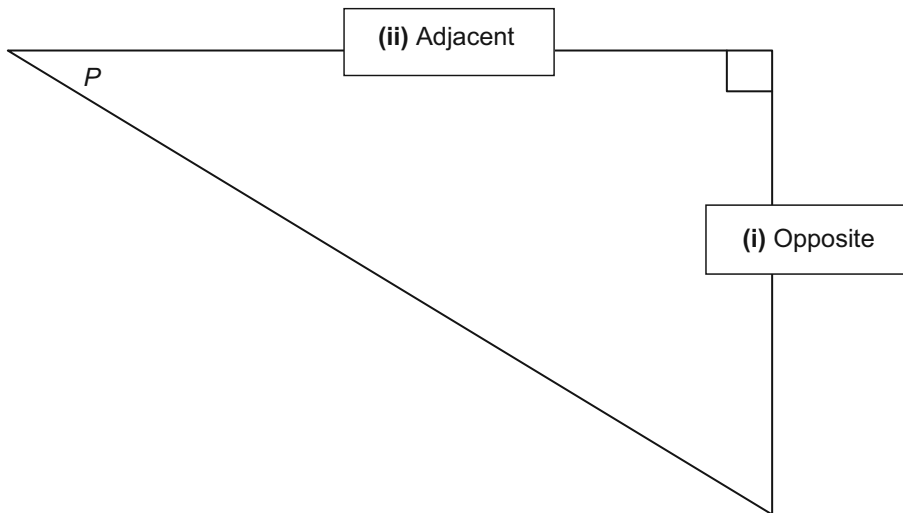
1. Draw a line $AB = 6$ cm in length.
(Scale is 1 cm : 1 m).
2. With a protractor, draw an angle from A at 60° .
3. With a protractor, draw an angle from B at 60° .
4. Complete the triangle so that these lines meet at C.

5. (a) $\sin 25^\circ = 0.4226$

$\cos 39^\circ = 0.7771$

$\tan 40^\circ = 0.8391$

(b) The angle P is shown in the triangle below.

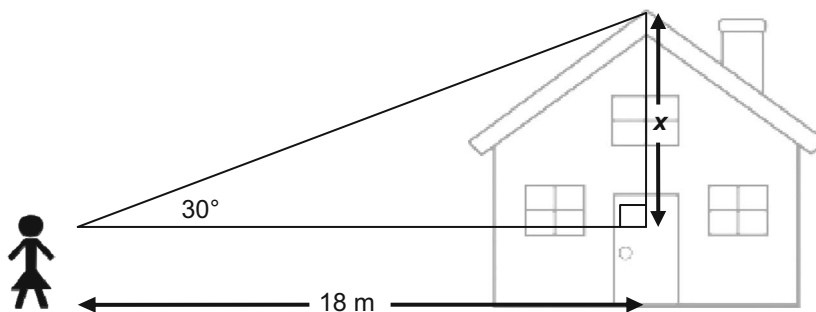


(iii) $H^2 = 12^2 + 9^2 = 225$

← The Theorem of Pythagoras

$H = \sqrt{225} = 15$

6.



(a) $\tan 30^\circ = \frac{x}{18}$
 $x = 18 \tan 30$

← $\tan 30^\circ = \frac{\text{Opposite}}{\text{Adjacent}} = \frac{x}{18}$

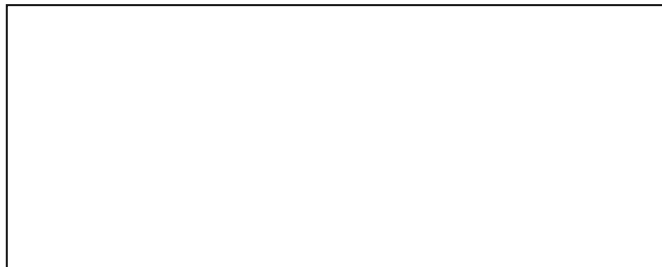
$$= 18 (0.57735\dots)$$

$$= 10.3923$$

$$= 10.4 \text{ m}$$

(b) Jasmine's height

7. (a)



9 cm

$$2(l + w) = 28$$

$$2(9 + w) = 28$$

$$18 + 2w = 28 \quad \text{or}$$

$$2w = 28 - 18 = 10$$

$$w = 5 \text{ cm}$$

$$2(l + w) = 28$$

$$9 + w = 14$$

$$w = 14 - 9$$

$$= 5 \text{ cm}$$

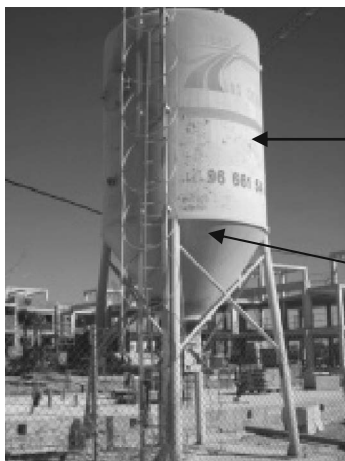
(b) Circumference = $5(2\pi r)$

$$= 5 \times 2 \times 3.142 \times 4$$

$$= 125.68 \text{ m}$$

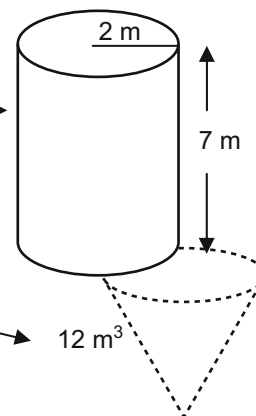
Length of a circle = $(2\pi r)$
See page 8 of *Formulae and Tables*.

8.



Cylinder

Cone



(a) $V = \pi r^2 h$

$$= 3.142 \times 2^2 \times 7$$

$$= 87.976$$

$$= 88 \text{ m}^3$$

Volume of a Cylinder formula:
See page 10 of *Formulae and Tables*.

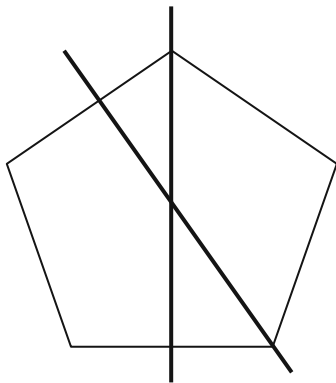
(b) $V = 88 + 12$
 $= 100 \text{ m}^3$

or

$V = 87.976 + 12$
 $= 99.976$
 $= 100 \text{ m}^3$

(c) $100 \times 2.5 = 250 \text{ tonnes}$

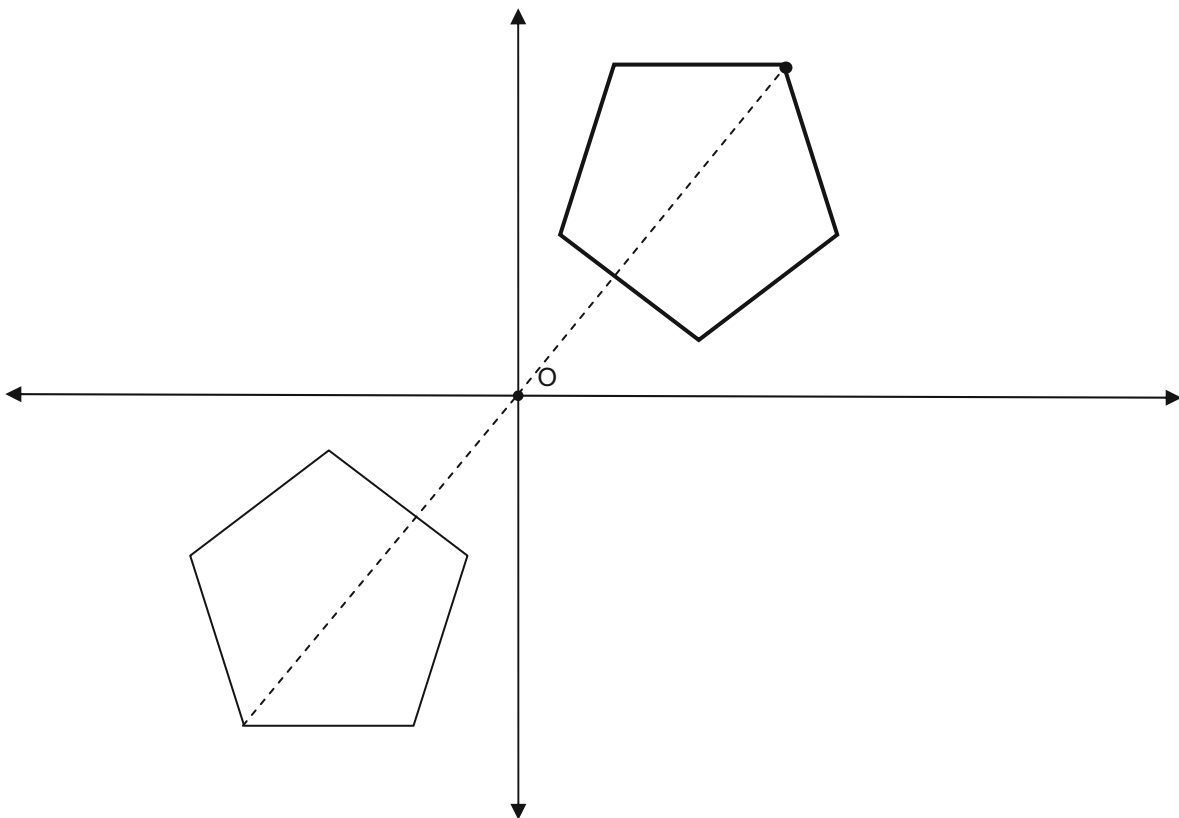
9. (a)



← There are 5 axes of symmetry but you are only asked to show 2 of them.

(b) 5

(c)



10. (a) (i) 1.30 pm = 13:30

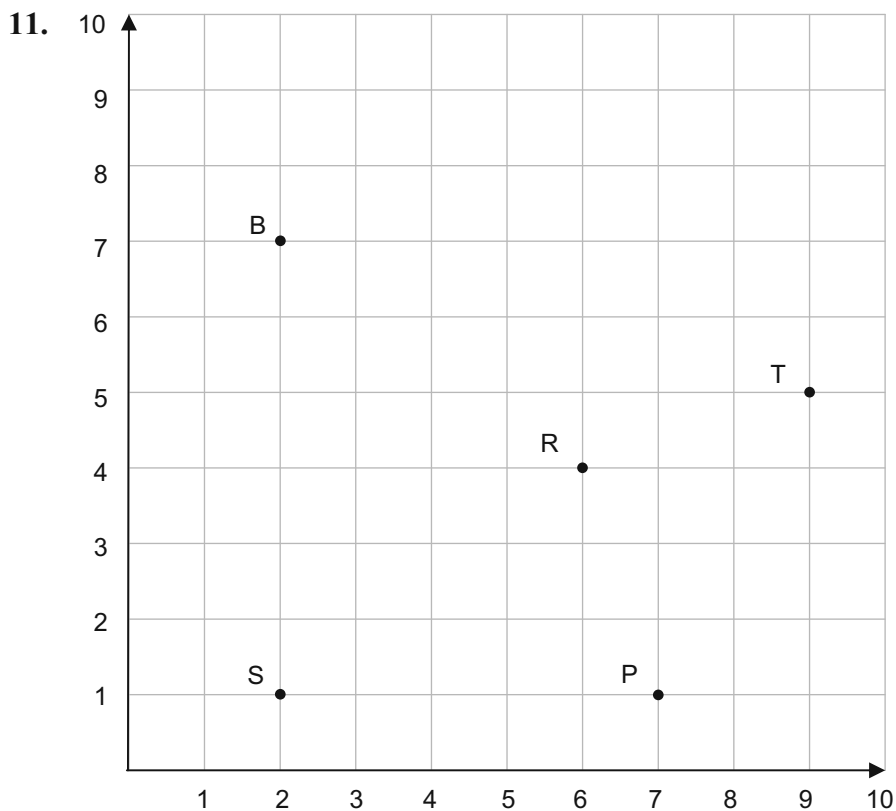
(ii) 7.15 am = 07:15

(iii) 9.50 pm = 21:50

(b) $\text{Speed} = \frac{D}{T}$
 $= \frac{4596}{6.5}$
 $= 707(\cdot 076\dots) \text{ km/h}$

(c) $6.5 \text{ h} = 390 \text{ min}$
 $240 \times 390 = 93\,600 \text{ litres}$

(d) $93\,600 \times 120\% =$ or $93\,600 \times 20\% = 18\,720$
 $112\,320 \text{ litres}$ $93\,600 + 18\,720 = 112\,320 \text{ litres}$



(a) $B = (2, 7)$
 $P = (7, 1)$
 $R = (6, 4)$
 $S = (2, 1)$
 $T = (9, 5)$

(b) $10 \times 10 = 100 \text{ m}^2$

(c) Ring (R)

(d) 6 (by inspection)

or

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

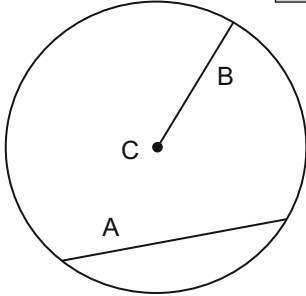
$$= \sqrt{(2 - 2)^2 + (7 - 1)^2} = \sqrt{36} = 6$$

Distance formula : $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
See page 18 of *Formulae and Tables*.

(e) $\frac{7-1}{2-7} = -\frac{6}{5}$

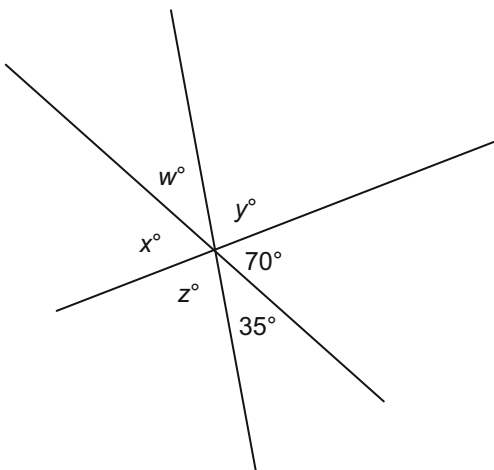
Slope = $\frac{\text{Rise}}{\text{Run}}$

12. (a)



A	Chord
B	Radius
C	Centre

(b)



x	70°
w	35°
y	75°
z	75°

$$70 + 35 = 105$$

$$180 - 105 = 75$$

(c)

Triangle	Sides
A	5, 3, 4
B	5, 6, 5
C	5, 6, 7
D	5, 6, 8

B

Answer

B has two sides of equal length.

Reason

(d) $14 + 32 + 6 + 17 + 19 + 15 + 3 + 35 + 42 + 25 + 9 + 2 + 34 + 18 + 40 + 11 + 16 + 28 + 31 + 7$

$= 430$

$\frac{430}{20} = 21.5$

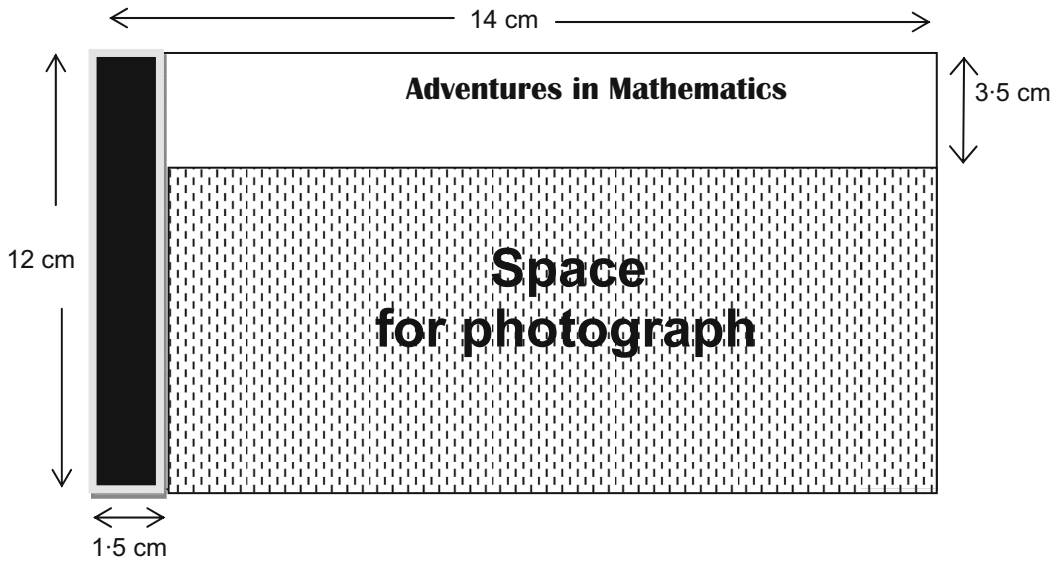
← To find the mean, add all the items and divide by the number of data items.

(e) 6 students sent > 30 texts.

$\frac{6}{20} \times 100 = 30\%$

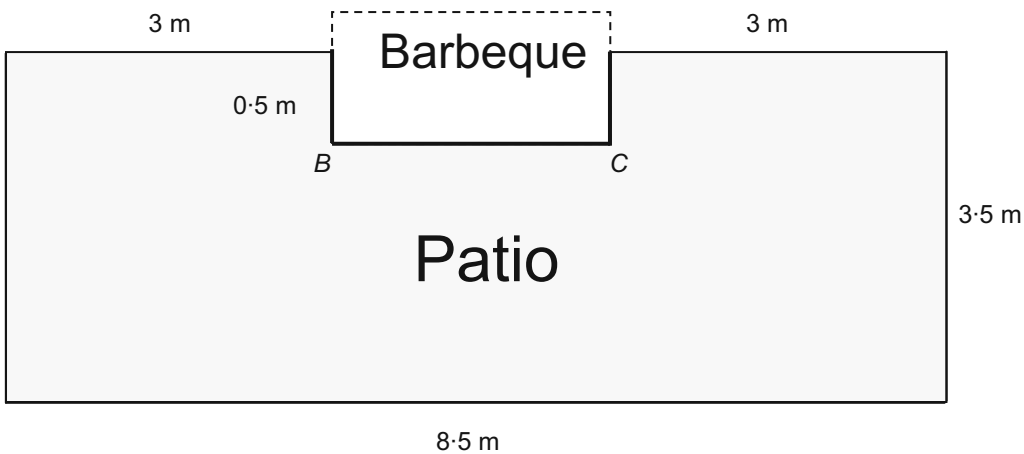
2012 SEC Paper 2 (Phase 2)

1.



$$\begin{aligned}
 14 - 1.5 &= 12.5 & 12 \times 14 - [12.5 \times 3.5 + 12 \times 1.5] \\
 12 - 3.5 &= 8.5 & \text{or } &= 168 - [43.75 + 18] \\
 12.5 \times 8.5 & & &= 106.25 \text{ cm}^2 \\
 &= 106.25 \text{ cm}^2 & &
 \end{aligned}$$

2.



(a) $8.5 - 3 - 3 \leftarrow 8.5 - 6 = 2.5 \text{ m}$ (Make sure you always include units.)
 $= 2.5 \text{ m}$

(b) $3 + 0.5 + 2.5 + 0.5 + 3 + 3.5 + 8.5 + 3.5 = 25 \text{ m}$

(c) $8.5 \times 3.5 - 2.5 \times 0.5 = 29.75 - 1.25 = 28.5 \text{ m}^2 \leftarrow$ Area of rectangle = Length \times Breadth

(d) $0.5 \times 0.5 = 0.25 \text{ m}^2$

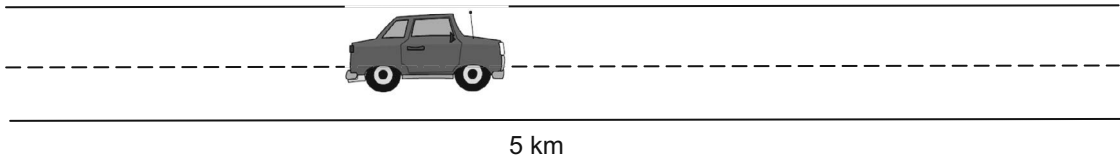
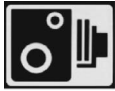
$$\frac{28.5}{0.25} = 114$$

(e) No, because she would need €513 to get all the slabs.

3. (a) 1 hour and 45 minutes

(b) $\frac{112}{1 \text{ hr } 45 \text{ mins}} = \frac{112}{1.75} = 64 \text{ km/hr}$

(c)



$\frac{5 \text{ km}}{4 \text{ mins}} = 1.25 \text{ km/min}$

← Speed = Distance ÷ Time

(d) $1.25 \times 60 = 75 \text{ km/h}$

(e) No, because 75 km/h is within the speed limit.

4. (a) {Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sept, Oct, Nov, Dec}

(b) $P(J) = \frac{1}{4}$

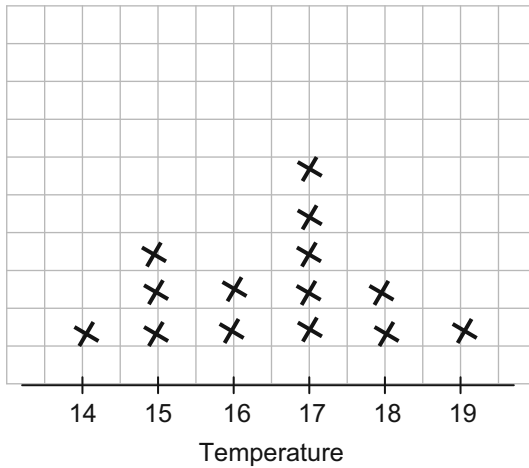
← Probability = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{3}{12} = \frac{1}{4}$

5.

Day	Temperature
Monday 15th	17°
Tuesday 16th	18°
Wednesday 17th	16°
Thursday 18th	17°
Friday 19th	16°
Saturday 20th	18°
Sunday 21st	17°
Monday 22nd	19°
Tuesday 23rd	17°
Wednesday 24th	15°
Thursday 25th	15°
Friday 26th	15°
Saturday 27th	14°
Sunday 28th	17°

(a) 17°

(b)



Range: The difference between the highest temperature and the lowest temperature.
 $19 - 14 = 5^\circ$

(c) 5°

(d) 17° ← The mode is the temperature that occurs most often.

(e) Yes, because the average for the first week was 17° but the average for the second week was only 16° .

6. (a) 198 cm

(b) 12

(c) $\frac{7}{22} \times \frac{100}{1} = 31.8181 = 32\%$

(d) Find the median arm span.

176, 178, 178, 180, 180, 181, 182, 182, 182, 184, 184, 185, 185, 186, 188, 189, 189, 190, 190, 193, 196, 201

$\frac{184 + 185}{2} = 184.5$ cm

← To get the median, arrange the data in order to find the mean of the middle values.

(e)

Player	Height	Arm span
Tallest (cm)	198	201
Shortest (cm)	177	176

(f) Tallest: 198:201 Shortest: 177:176

(g) Tallest: 0.99 Shortest: 1.01

(h) 170 cm, because the ratio is almost 1:1.

7. (a) $375 + 195 + 120 + 45 + 165 = 900$
 $1500 - 900 = 600$

(b)

	RTE1	Today FM	Newstalk	Lyric FM	2FM	No national station
Frequency	375	195	120	45	165	600
Relative frequency (as a fraction)	$\frac{375}{1500}$	$\frac{195}{1500}$	$\frac{120}{1500}$	$\frac{45}{1500}$	$\frac{165}{1500}$	$\frac{600}{1500}$
Relative frequency (as a decimal)	0.25	0.13	0.08	0.03	0.11	0.4

(c) $\frac{375}{1500} + \frac{195}{1500} + \frac{120}{1500} + \frac{45}{1500} + \frac{165}{1500} + \frac{600}{1500} = \frac{1500}{1500} = 1$

$\frac{\text{Relative Frequency}}{\text{Total}} = \frac{\text{Frequency}}{1500}$
--

(d) $0.25 + 0.13 + 0.08 + 0.11 + 0.40 = 1.00$

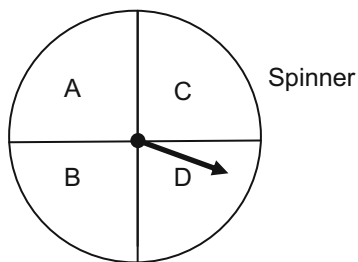
(e) No, because they should add up to 1.

(f) No, because some people may not listen to any radio station at all.

8.



Die



Spinner

(a)

Die	Spinner			
	A	B	C	D
1	(1,A)	(1,B)	(1,C)	(1,D)
2	(2,A)	(2,B)	(2,C)	(2,D)
3	(3,A)	(3,B)	(3,C)	(3,D)
4	(4,A)	(4,B)	(4,C)	(4,D)
5	(5,A)	(5,B)	(5,C)	(5,D)
6	(6,A)	(6,B)	(6,C)	(6,D)

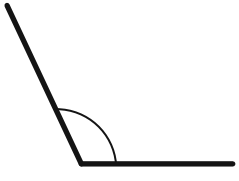
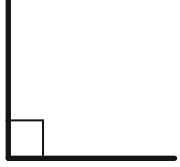
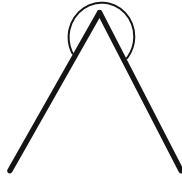
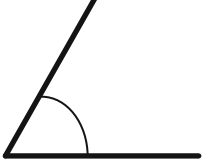
(b) 24

(c) 3

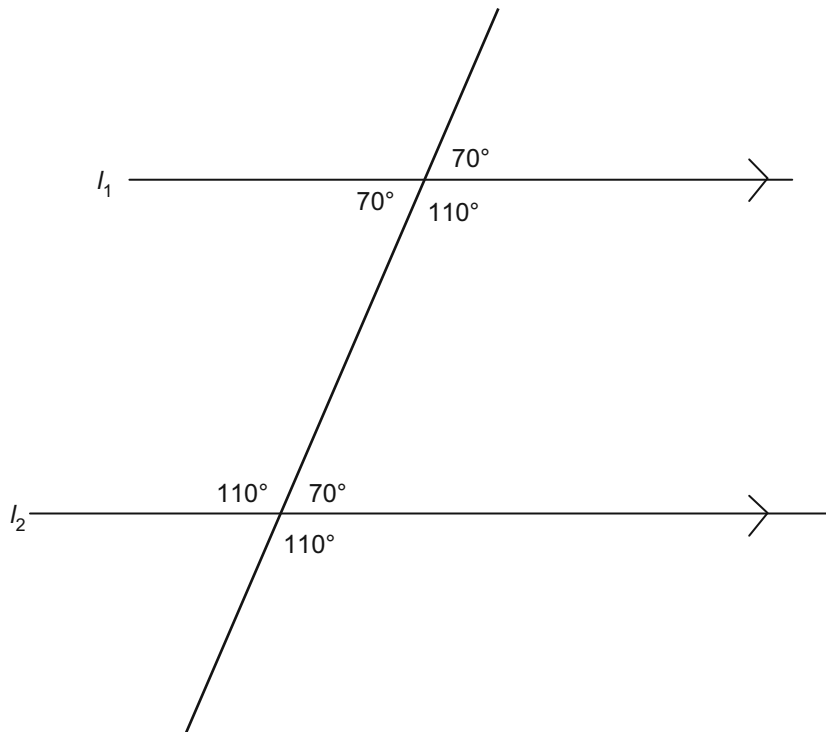
(d) This is $\frac{1}{2}$.

$\text{Probability} = \frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{12}{24} = \frac{1}{2}$

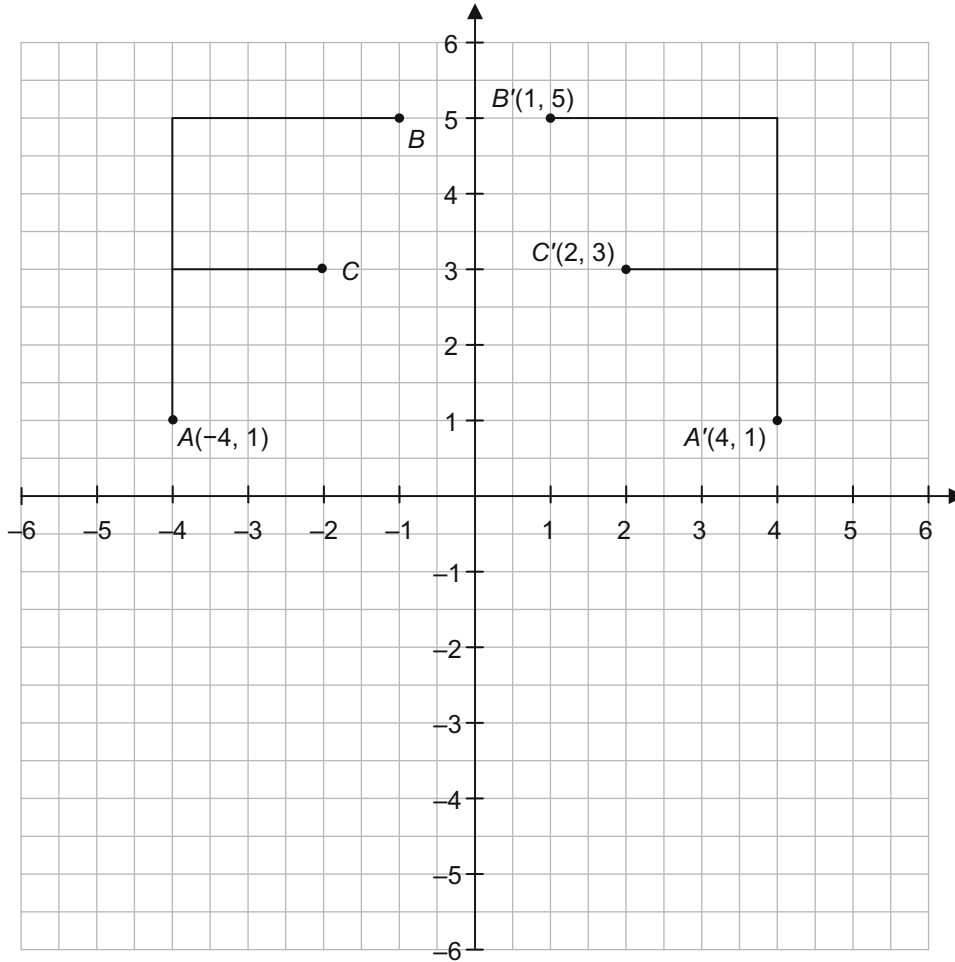
9. (a)

			
Obtuse	Right	Reflex	Acute

(b)



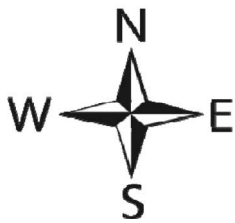
10. (a)



(b) $B(-1, 5)$ $C(-2, 3)$

(c) $A'(4, 1)$ $B'(1, 5)$ $C'(2, 3)$

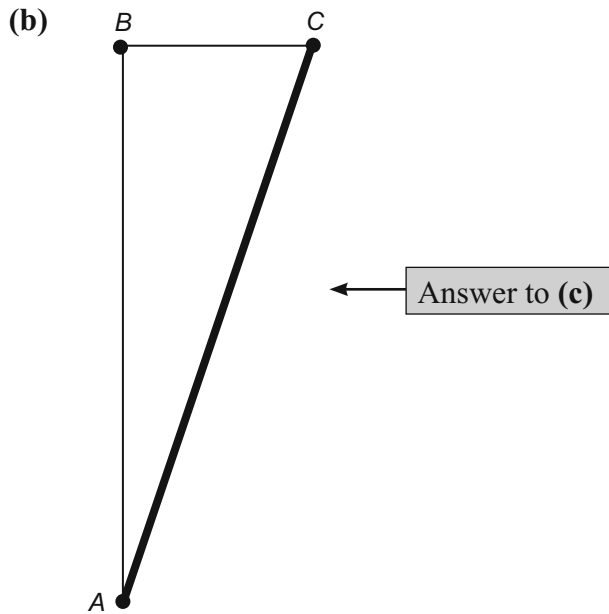
11.



(a) $20 \frac{\text{km}}{\text{h}}$ for $\frac{1}{2}$ hour = 10 km

$10 \frac{\text{km}}{\text{h}}$ for $\frac{2}{5}$ hour = 4 km

Total = 14 km



(c)

$$x^2 = 10^2 + 4^2$$

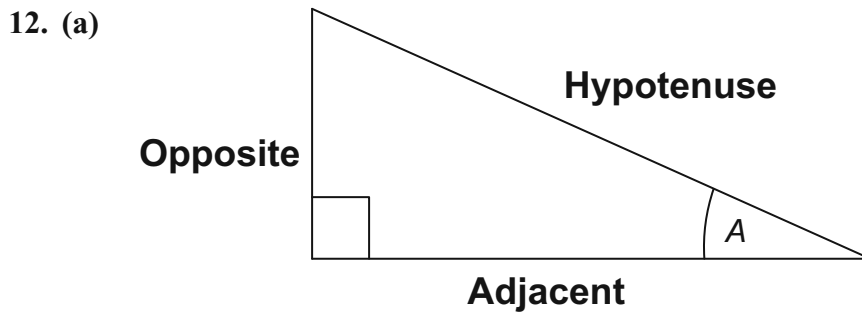
$$x^2 = 100 + 16$$

$$x^2 = 116$$

$$x = \sqrt{116}$$

$$x = 10.77$$

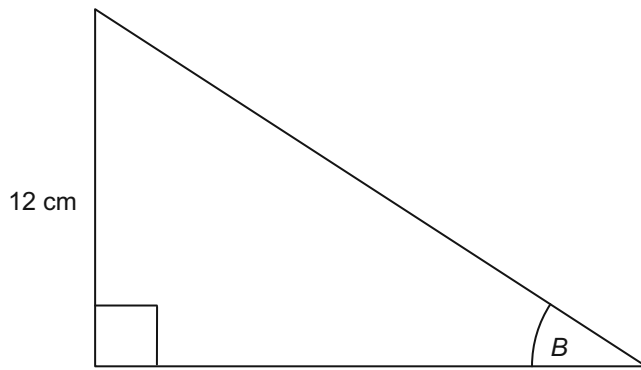
$$x = 11 \text{ Km}$$



(b)

Trigonometric Ratio	Ratio
Sin	$\frac{\textit{Opposite}}{\textit{Hypotenuse}}$
Cos A	$\frac{\textit{Adjacent}}{\textit{Hypotenuse}}$
Tan	$\frac{\textit{Opposite}}{\textit{Adjacent}}$

(c)



$$\sin 35^\circ = \frac{\text{Opp}}{\text{Hyp}}$$

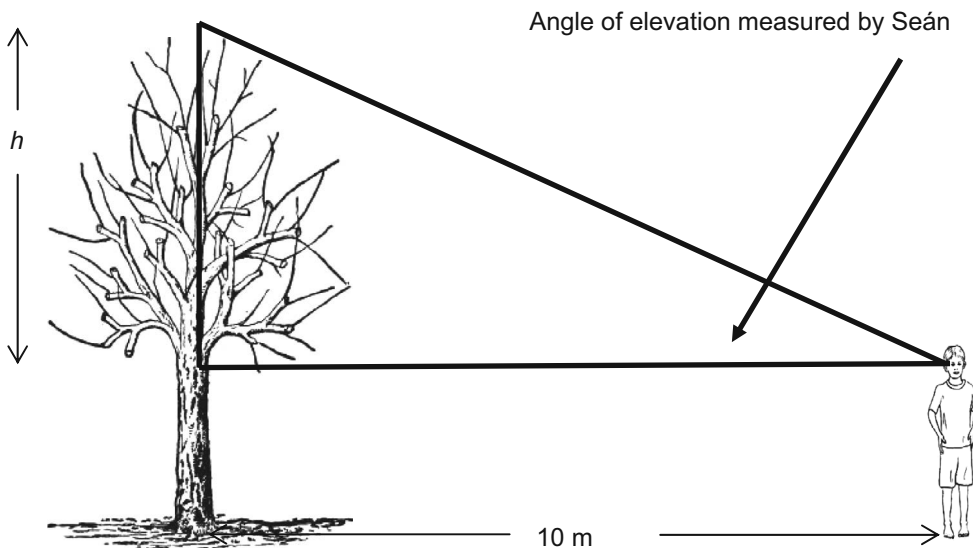
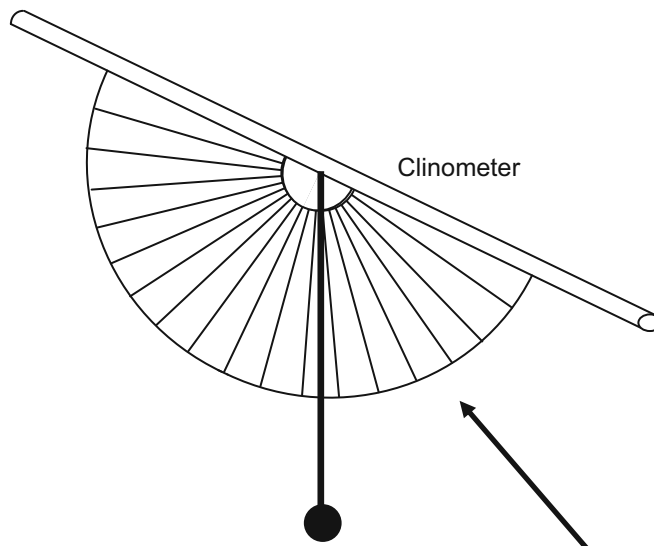
$$0.5736 = \frac{12}{x}$$

$$x = \frac{12}{0.5736}$$

$$x = 20.9205$$

$$x = 21 \text{ cm}$$

13.



(a) 65°

(b) $\tan 65^\circ = \frac{\text{Opp}}{\text{Adj}}$

$$2.1445 = \frac{h}{10}$$

$$h = 10 (2.1445)$$

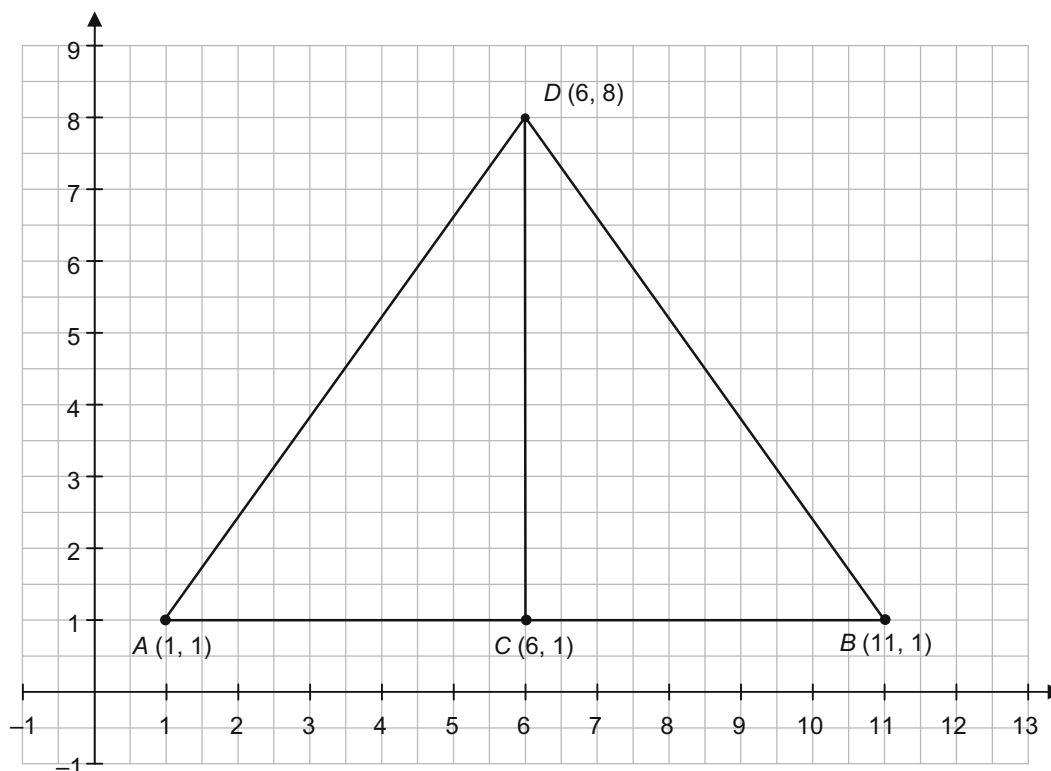
$$h = 21.445$$

$$h = 21.45 \text{ m}$$

(c) $21.45 + 1.75 = 23.2 \text{ m}$

(d) He could have used 64° .

14. (a), (b) and (d)



(c) $\left(\frac{1+11}{2}, \frac{1+1}{2}\right) = (6, 1)$

← Mid-Point formula: See page 18 of *Formulae and Tables*.

(e) $\sqrt{(6-1)^2 + (8-1)^2}$

$$\sqrt{25 + 49}$$

$$\sqrt{74}$$

$$\sqrt{(6-11)^2 + (8-1)^2}$$

$$\sqrt{25 + 49}$$

$$\sqrt{74}$$

← Distance formula: $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
see page 18 of *Formulae and Tables*.

(f) Type: Isosceles

Reason: Two sides are the same from (e) above.

(g) Answer: Yes, they are congruent.

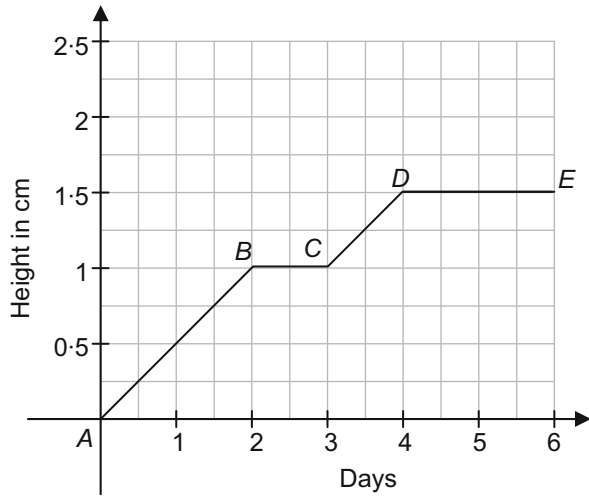
Reason: $AC = BC$

$$AD = BD$$

$$CD = CD$$

\therefore S S S

15.



- (a) Period 1: B to C
 Period 2: D to E
- (b) Find the slope of $AB = \frac{\text{Rise}}{\text{Run}} = \frac{1}{2} (= 0.5)$
- (c) Find the slope of $CD = \frac{\text{Rise}}{\text{Run}} = \frac{0.5}{1} (= 0.5)$
- (d) Yes, because the slopes of the lines are the same.
- (e) The seedling grows steadily for two days.
 It then stops for a day.
 Then it grows for a day.
 Then it stops growing for two more days.

Educate.ie Sample 1

Paper 2

1. (a) $6 \times 12 = 72 \text{ m}^2$

Area of garden (rectangle) = Length \times Breadth

(b) $\pi r^2 \div 2$

Area of lawn = Area of a semicircle = $\frac{1}{2} \pi r^2$

$(3 \cdot 14)(6)(6) \div 2 = 56 \cdot 52 \text{ m}^2$

Area of disc: See page 8 of *Formulae and Tables*.

(c) $72 - 56 \cdot 52 = 15 \cdot 48 \text{ m}^2$

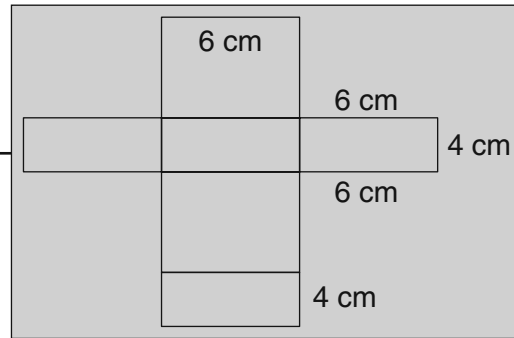
Area of flowerbeds = Area of a Garden – Area of lawn

2. (a) $2 \times 2 \times 2 = 8 \text{ cm}^3$

Volume of cube = 2^3 : Make sure you put units in the answer.

(b) $18 \times 8 = 144 \text{ cm}^3$

(c) $2(6 \times 6) + 2(6 \times 4) + 2(6 \times 4)$
 $= 72 + 48 + 48$
 $= 168 \text{ cm}^2$



(d) $168 \times 25 = \text{€}4,200$

3. 820

$+ 475$
 $\hline 1295 \div 1000 = 1 \cdot 295 \text{ kg}$

Weight of flour + Weight of sugar
 $= 820 \text{ grams} + 475 \text{ grams}$
 $= 1295 \text{ grams}$

4. (a) Mode is the number that appears most often = 4.

1000 grams = 1 kilogram

1295 grams = 1·295 kilograms

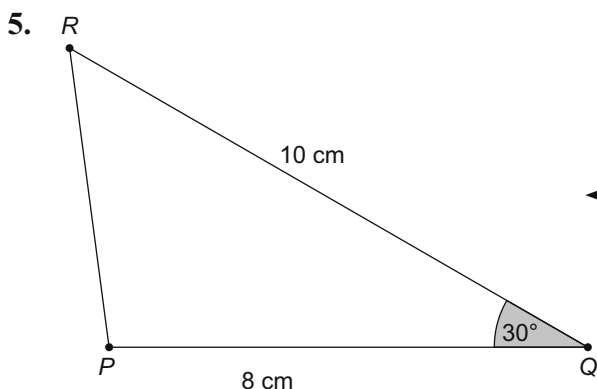
(b) 2 hours

(c) Friday

It is the lowest bar. She studied for 1 hour on Friday.

(d) Total hours = $2 + 3 \cdot 5 + 3 + 2 \cdot 5 + 1$
 $= 12$

$\frac{3}{12} \times 100 = 25\%$



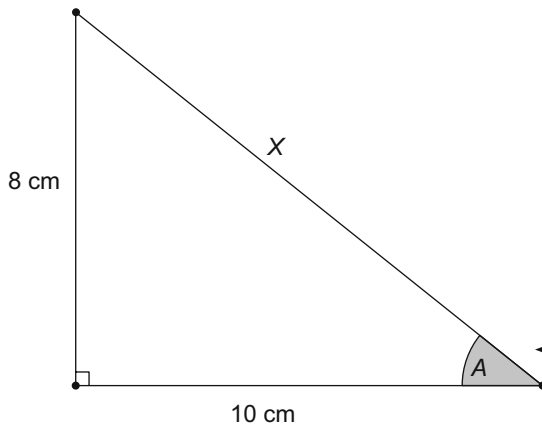
Steps:

1. Draw a line 8 cm in length with a ruler. Label it as PQ .
2. With the centre of the protractor on Q , mark out an angle of 30° .
3. With a compass, mark off 10 cm along the 30° line. Label the point 10 cm from Q as R .
4. Join R to P .

6. $4 \times 3 = 12$

This is the Fundamental Principle of Counting. Choosing from 4 and then choosing from 3 gives a total of 4×3 options.

7. (a)



Angle of Elevation (looking up)

(b) We know the opposite side = 8 and the adjacent = 10.

So we use $\tan A$.

Tan of an angle = $\frac{\text{Opposite}}{\text{Adjacent}}$




(c) Correct to the nearest degree

$\tan A = \frac{8}{10} = 0.8$

Tan of $A = \frac{\text{Opposite}}{\text{Adjacent}} = \frac{8}{10} = 0.8$

$A = \tan^{-1}(0.8)$

$A = 39^\circ$

If you have a Casio Calculator press   then type in 0.8 and press . This gives an answer of 38.6598 degrees = 39° to the nearest degree.

(d) $x^2 = 8^2 + 10^2$

$x = \sqrt{164} = 12.8$

Using Pythagoras's Theorem we can find x .

(e) No, as it is less than 40° and not ideal.

8. (1) That you will one day die

Any two events that are going to happen

(2) That you will drink a liquid within the next week

9. (a) $\frac{5}{12}$

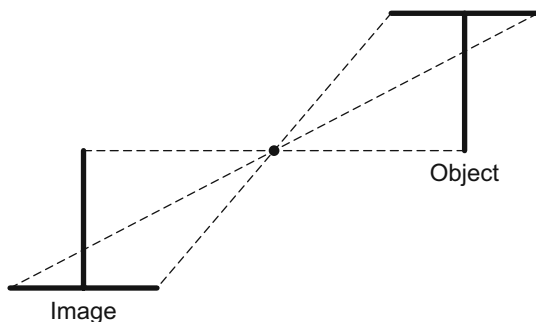
Probability = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}}$

(b) $\frac{2}{12} = \frac{1}{6}$

Always write your answer as the smallest fraction.

(c) $\frac{5}{12}$

10. (a)



- (b) The shape is turned upside down and back to front.
 (c) The lengths, angles and area stay the same in the shape.

11. Congruent by SSS

← Side, Side, Side = Side, Side, Side

$$\begin{aligned} |AB| &= |AC| && \text{Both } 5 \\ |AD| &= |AD| && \text{Common side} \\ |BD| &= |DC| && \text{Both } 3 \end{aligned}$$

12. (a) It is a Δ where 2 sides are the same length and the 3rd side is different.

(b) $x = 56^\circ$ Isosceles triangle

$$y = 180 - 56 - 56$$

$$y = 68^\circ \text{ since the 3 angles in a triangle equal } 180^\circ.$$

13. $A = 65^\circ$ Corresponding angle

$B = 65^\circ$ Vertically opposite A

$C = 140^\circ$ Straight line since $40^\circ + 140^\circ = 180^\circ$

14. (a) $3x - 4(0) = 12$

$$3x = 12$$

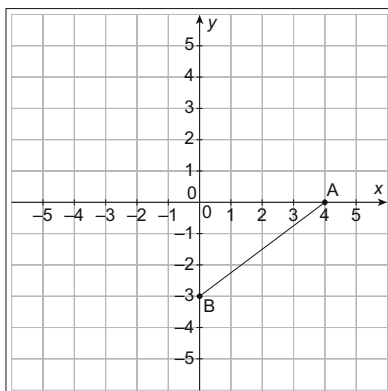
$$x = \frac{12}{3} = 4 \quad (4, 0) = A$$

(b) $3(0) - 4y = 12$

$$-4y = 12$$

$$y = -3 \quad (0, -3) = B$$

(c)



(d) $\sqrt{(0-4)^2 + (-3-0)^2}$ ← Distance formula: See page 18 of *Formulae and Tables*.

$$\sqrt{16 + 9}$$

$$\sqrt{25} = 5$$

← Or use Pythagoras's Theorem.

$$|AB|^2 = 3^2 + 4^2$$

$$= 9 + 16$$

$$= 25$$

$$|AB| = \sqrt{25} = 5$$

(e) $\frac{-3-0}{0-4} = \frac{-3}{-4} = \frac{3}{4}$ ← Slope formula: See page 18 of *Formulae and Tables*.

15. (a)

	1	2	3	4	5
T	(1, T)	(2, T)	(3, T)	(4, T)	(5, T)
H	(1, H)	(2, H)	(3, H)	(4, H)	(5, H)

(b) $5 \times 2 = 10$ ← Or count the outcomes

(c) (1, T) (3, T) (5, T) = $\frac{3}{10}$

(d) $\frac{2}{10} = \frac{1}{5}$ ← (2, H) (4, H)

(e) Answer: Both are correct.

Explanation: Since there are 3 prime and 3 odd numbers on the spinner

Prime Numbers = {2, 3, 5}

Odd Numbers = {1, 3, 5}

16. A population is when everybody is surveyed (e.g. the entire school). A sample is when only a small portion of the population is surveyed (e.g. Third Years).

17. (a)

1	1	4				
2	2	2	2	3	9	
3	0	2	3	4	4	9
4	1	3				

key $4|1 = 41$

(b) 15

(c) 22 ← Mode = Most common

(d) $43 - 11 = 32$ ← Range = Largest number – Smallest number

(e) 30 ← Median is the middle number when the numbers are arranged in order.

(f) He is the best in the class.

Educate.ie Sample 2

Paper 2

1. (a) $\frac{56}{2} = 28 \text{ cm}$

← Radius = half the diameter

(b) $2\pi r = 2(3.142)(28) = 175.952$
 $= 176 \text{ cm}$

← Length of circle: $= 2\pi r$

See page 8 of *Formulae and Tables*.

(c) $1.76 \text{ m} \times 250 = 440 \text{ m}$

← $100 \text{ cm} = 1 \text{ m}$

$176 \text{ cm} = 1.76 \text{ m}$

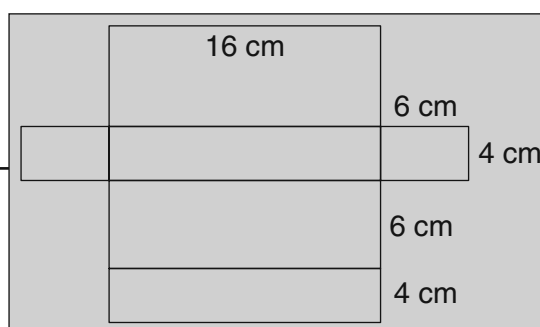
2. (a) $16 \times 4 \times 6 = 384 \text{ cm}^3$

← Volume of block = Length \times Breadth \times Height

(b) 1 cube $= 2 \times 2 \times 2 = 8 \text{ cm}^3$

No. of cubes $= \frac{384}{8} = 48 \text{ cubes}$

(c) $2(16 \times 4) + 2(16 \times 6) + 2(4 \times 6)$
 $= 128 + 192 + 48$
 $= 368 \text{ cm}^2$



3. (a) Certain

(b) Unlikely

(c) Likely

(d) Even chance

(e) Impossible

4. (a) $180 - 90 - 50 = 40^\circ$

Since the three angles in a triangle add up to 180°

(b) $\sin 40^\circ$
 $= 0.642787609$
 $= 0.64$

← Calculator: $\sin 40 =$

(c) $\cos 50 = \frac{|QR|}{8}$
 $|QR| = 8 \cos 50$
 $= 5.1 \text{ m}$

← Calculator: $8 \cos 50 =$

Or

$8 \sin 40 =$

5. (a)

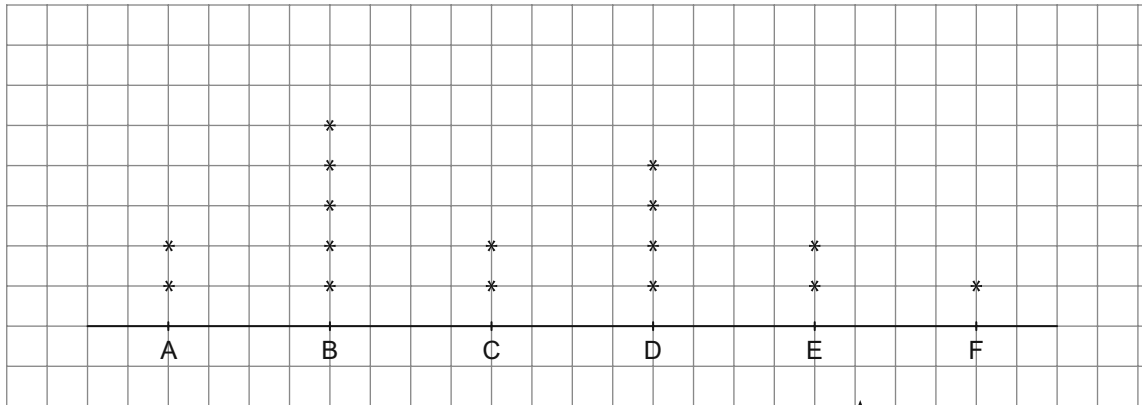
	Fish (F)	Beef (B)	Lamb (L)	Pasta (P)
Cake (C)	(F, C)	(B, C)	(L, C)	(P, C)
Ice cream (I)	(F, I)	(B, I)	(L, I)	(P, I)
Jelly (J)	(F, J)	(B, J)	(L, J)	(P, J)

(b) $4 \times 3 = 12$

(c) 3

This is the Fundamental Principle of Counting. Choosing from 4 and then choosing from 3 gives a total of 4×3 options.

6. (a)



(b) B

The most common grade

This is often called a dot plot.

(c) $2 + 5 + 2 = \frac{9}{16} \times 100 = 56\%$

(d) Disagree as only 3 students did not pass and 56% got a grade A, B or C.

7. (a) $\frac{8}{30} = \frac{4}{15}$

(b) $\frac{15}{30} = \frac{1}{2}$

(c) $\frac{7}{30}$

(d) $\frac{23}{30}$

8. (a) Cuts x axis $7x - 2(0) = -14$

$$7x = -14$$

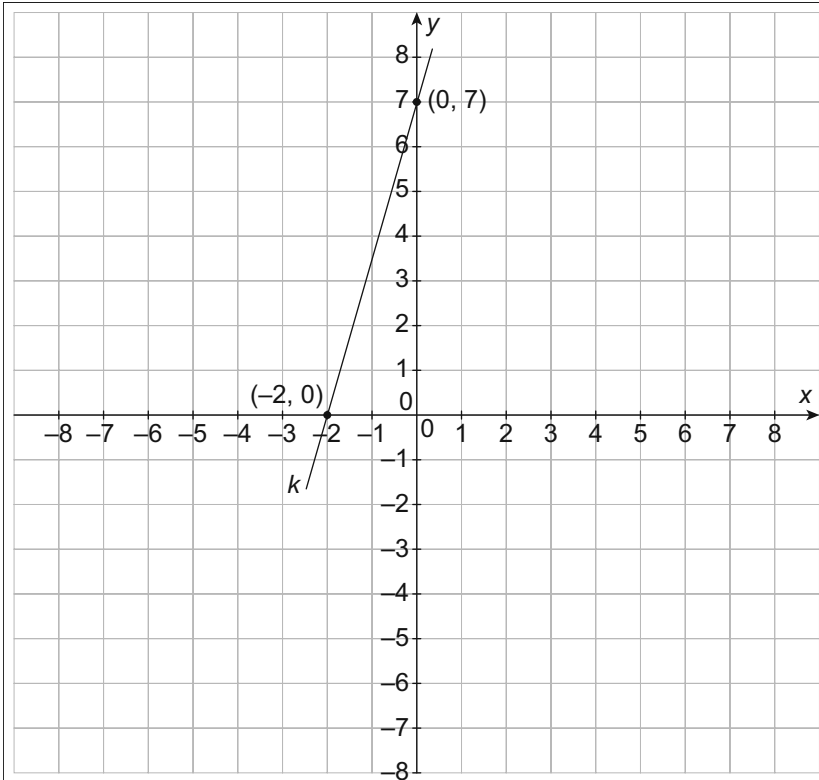
$$x = -2 \quad (-2, 0)$$

Cuts y axis $7(0) - 2y = -14$

$$2y = 14$$

$$y = 7 \quad (0, 7)$$

(b)



(c) $\frac{0 - 7}{-2 - 0} = \frac{-7}{-2} = \frac{7}{2}$

← Slope formula: See page 18 of *Formulae and Tables*.

9. (a) $x + 2x = 3x = 90^\circ$
 $x = 30^\circ$

The 2 angles x and $2x$ make a right (90°) angle.

(b) $x = 122^\circ$

A straight angle adds up to 180° degrees.

$180 - 58 = 122^\circ$

10. (a) $\cos 60 = 0.5$

(b) $\cos 60 = \frac{|PR|}{12}$

$|PR| = 12 \cos 60$
 $= 6$

← Calculator:

1	2	cos	6	0	=
---	---	-----	---	---	---

11. (a) $\frac{2 + 5 + 11}{3} = \frac{18}{3} = 6$ years

(b) $360 - 150 - 30 - 60 = 120^\circ$

(c) $150^\circ = 10$ students

$15^\circ = 1$ student

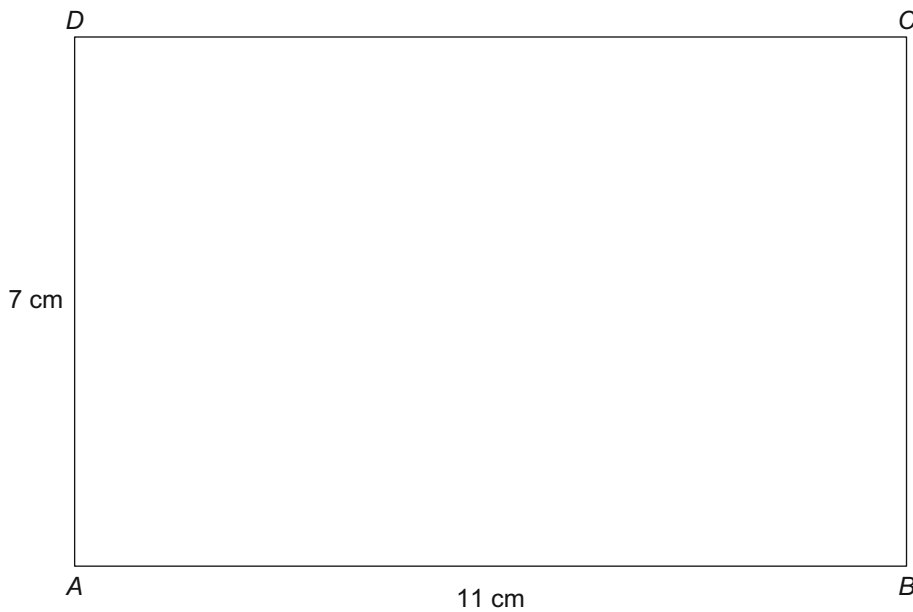
$30^\circ = 2$ students

Therefore, 2 students study Italian.

(d) $15^\circ = 1 \text{ student}$
 $360 \div 15 = 24 \text{ students}$

(e) $360 - 60 = 300^\circ$
 $300 \div 15 = 20 \text{ students}$

12. (a)



Steps:

1. Draw a line 11 cm in length with a ruler. Label it as AB .
2. With the centre of the protractor on A , mark out an angle of 90° .
3. With a compass, mark off 7 cm along the 90° line. Label the point 7 cm from A as D .
4. With the centre of the protractor on B , mark out an angle of 90° .
5. With a compass, mark off 7 cm along the 90° line. Label the point 7 cm from B as C .
6. Join D to C .

(b) Measure using your ruler.

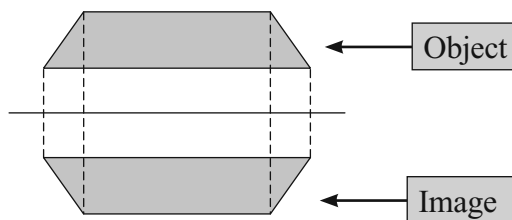
$|AC| = 13 \text{ cm}$

Or use Pythagoras's Theorem

$$\begin{aligned} |AC|^2 &= 11^2 + 7^2 \\ &= 121 + 49 \\ &= 170 \\ |AC| &= \sqrt{170} = 13.04 \text{ cm} \end{aligned}$$

(c) It divides the angle DAB into two unequal angles.

13. (a)



(b) Answer: No.

Explanation: The lengths of the sides and the angles remain the same. Axial symmetry merely turns the object upside down.

14. (a)

$$\begin{array}{r} 18:50 \\ - 15:20 \\ \hline 3 \text{ hrs } 30 \text{ mins} \end{array}$$

(b) $\text{Speed} = \frac{182}{3.5} = 52 \text{ km/h}$

$\text{Speed} = \frac{\text{Distance(km)}}{\text{Time(hours)}}$

(c) $\text{Time} = \frac{182}{45.5} = 4 \text{ hours}$

15. (a) Only people interested in reading books would go to a book shop.
(b) Meet people entering a shopping centre with many alternative shops.
(c) 1. What are your hobbies?
2. How often do you purchase a book?

16. Side = $\frac{27 \text{ cm}}{3} = 9 \text{ cm}$

In an equilateral triangle, the three sides are equal, therefore one side is 27 cm divided by 3.

Educate.ie Sample 3

Paper 2

1. (a) $75 + 25 = 100 \text{ m}$

(b) $110 + 75 + 80 + 25 + 30 + 100 = 420 \text{ m}$ ← Add the lengths of all of the sides.

(c) $420 \div 5 = 84 \times \text{€}47.30 = \text{€}3,973.20$

2. (a) $\pi r^2 = (3.142)(4)(4) = 50.272 \text{ cm}^2$ ← Area of a disc: $= \pi r^2$
See page 8 of *Formulae and Tables*.

(b) $\pi r^2 h = (3.142)(4)(4)(12.2)$ ← Volume of a Cylinder: $= \pi r^2 h$
See page 10 of *Formulae and Tables*.
 $= 613.3184$
 $= 613 \text{ cm}^3$

3. $50 \times 25 = 1250 \text{ m}$

$1250 \div 1000 = 1.25 \text{ km}$ ← 1000 m = 1 km

4. A ← Probability = 0

E ← Probability = 1

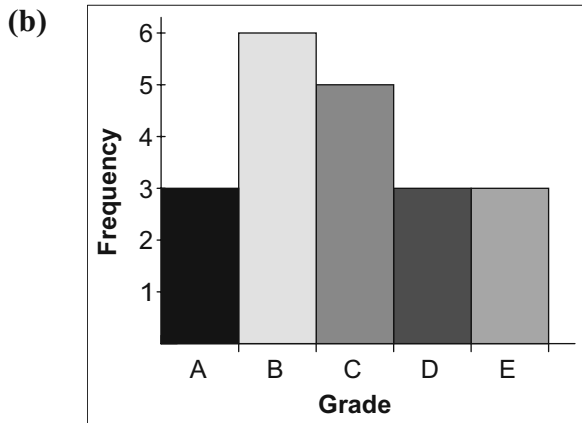
B ← Probability = $\frac{2}{8} = \frac{1}{4}$

C ← Probability = $\frac{4}{8} = \frac{1}{2}$

D ← Probability = $\frac{6}{9} = \frac{2}{3}$

5. (a)

Grade	A	B	C	D	E
Tally					
Frequency	3	6	5	3	3



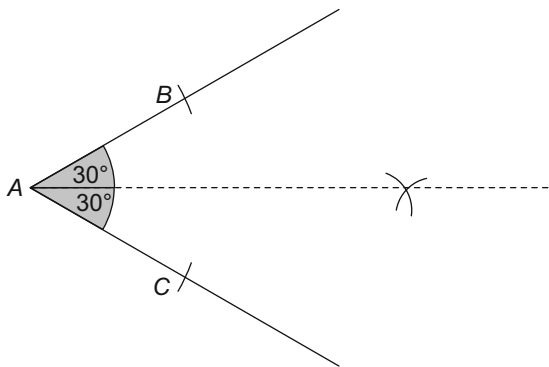
This is a histogram. A bar chart, pie chart or a line graph would also display the data.

(c) B ← The most common grade

(d) $\frac{3}{20}$ ← Probability = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}}$

(e) $\frac{11}{20}$

6.



Steps:

1. Place the point of the compass on B and draw an arc of any radius.
2. Place the point of the compass on C and keeping the same radius, draw an arc to cut the first arc.
3. Join the point where these two arcs cut to A .

7. (a) Using Pythagoras's Theorem

$$(13)^2 = (5)^2 + (BC)^2$$

$$\sqrt{169 - 25} = |BC|$$




$$12 \text{ m} = |BC|$$

(b) $\cos A = \frac{5}{13}$

$$\cos A = 0.384615384$$

$$A = \cos^{-1}(0.384615384)$$

$$A = 67^\circ$$

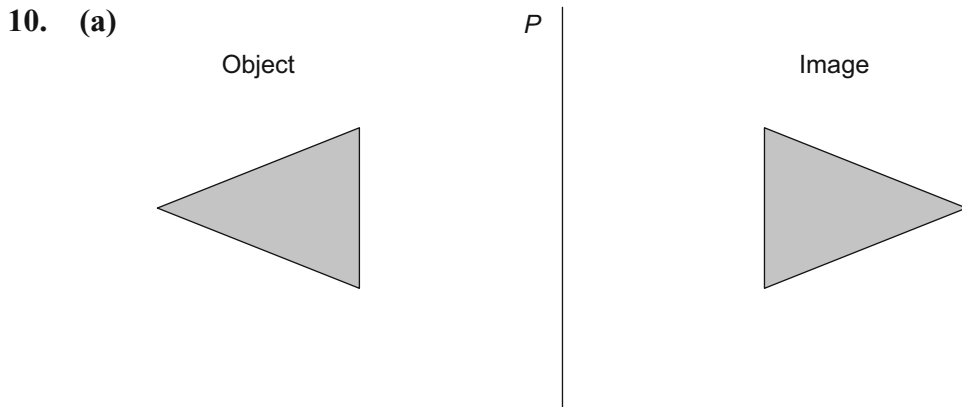
If you have a Casio Calculator press   then type in 0.38461 and press . This gives an answer of 67.38 degrees = 67° to the nearest degree.

8. Categorical
Numerical
Categorical
Categorical
Numerical

9. (a) $5 \times 3 = 15$ ← This is the Fundamental Principle of Counting. Choosing from 5 and then choosing from 3 gives a total of 5×3 options.

(b)

	White	Blue	Orange
Silk	(White, Silk)	(Blue, Silk)	(Orange, Silk)
Nylon	(White, Nylon)	(Blue, Nylon)	(Orange, Nylon)
Cotton	(White, Cotton)	(Blue, Cotton)	(Orange, Cotton)
Denim	(White, Denim)	(Blue, Denim)	(Orange, Denim)
Linen	(White, Linen)	(Blue, Linen)	(Orange, Linen)



(b) Answer: No.

Explanation: In both the object and the image the sides lengths and angles remain the same.

11. $A = 125^\circ$ (3 angles in Δ equal 180°)

$B = 40^\circ$ Alternate angle

$C = 15^\circ$ Alternate angle

12. (a) 1. Questions must be relevant to the survey being done.

2. No biased or misleading questions to be asked.

13. (a) 5

(b) $\sin A = \frac{\text{Opposite}}{\text{Hypotenuse}} = \frac{5}{13}$

(c) $\cos |\angle PQR| = \frac{4}{10} = \frac{2}{5}$

(d) $\cos |\angle PQR| = \frac{2}{5}$

$\cos |\angle PQR| = 0.4$

$|\angle PQR| = \cos^{-1}(0.4) = 66^\circ$

14. (a) $\frac{4 + 6 + 7 + 12 + 16}{5} = \frac{45}{5} = 9$

(b) 4

(c) $2 + 4 + 6 + 10 + 5 + 3 = 30$

(d) D ← The most common grade

Use Pythagoras's Theorem

$13^2 = 12^2 + |BC|^2$

$169 = 144 + |BC|^2$

$169 - 144 = |BC|^2$

$25 = |BC|^2$

$|BC| = \sqrt{25} = 5$

You should know some Pythagorean Triplets such as 3, 4, 5: 6, 8, 10: 5, 12, 13.

← then type in 0.4 and press =. This gives an answer of 66.4218 degrees = 66° to the nearest degree.

(e) $5 + 3 = 8$

(f) $\frac{6}{30} \times 100$

$\frac{1}{5} \times 100 = 20\%$

15. (a) $\left(\frac{3+1}{2}, \frac{5-7}{2}\right)$
 $\left(\frac{4}{2}, \frac{-2}{2}\right) = (2, -1)$

← Midpoint formula: See page 18 of *Formulae and Tables*.

(b) $\frac{-7-5}{1-3} = \frac{-12}{-2} = 6$

← Slope formula: See page 18 of *Formulae and Tables*.

(c) $m = 6$ Point (3, 5)

$y - 5 = 6(x - 3)$

$y - 5 = 6x - 18$

$0 = 6x - y - 13$

← Equation of a line formula: $y - y_1 = m(x - x_1)$. See page 18 of *Formulae and Tables*.

16. Yes they are congruent

Both have a right angle

$|OQ| = |AB| = 6 \text{ cm}$ (side)

$|OP| = |AC| = 4 \text{ cm}$ (side)

by RHS they are congruent.

As this is a right-angled triangle, the third side in both triangles is also equal. Therefore Side, Side, Side = Side, Side, Side which means the triangles are congruent.

17. $x = 70^\circ$ Isosceles triangle

$180 - 70 - 70 = 40^\circ = y$

3 angles in a triangle equal 180°

Educate.ie Sample 4

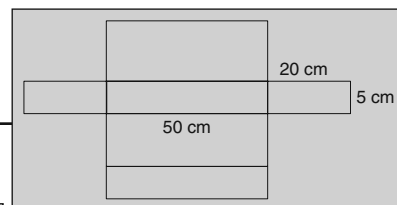
Paper 2

1. $2\pi r = 2 \times \frac{22}{7} \times 3.5$
 $= 22 \text{ cm}$

← Length of a circle: $= 2\pi r$
 See page 8 of *Formulae and Tables*.

2. (a) $20 \times 50 \times 5 = 5000 \text{ cm}^3$

(b) $2(20 \times 50) + 2(20 \times 5) + 2(50 \times 5)$
 $= 2000 + 200 + 500$
 $= 2700 \text{ cm}^2$



3. (a) $7 \times 2 = 14$

← This is the Fundamental Principle of Counting. 7 options and then 2 options give a total of 7×2 possibilities.

(b)

	1	2	3	4	5	6	7
Heads (H)	(1, H)	(2, H)	(3, H)	(4, H)	(5, H)	(6, H)	(7, H)
Tails (T)	(1, T)	(2, T)	(3, T)	(4, T)	(5, T)	(6, T)	(7, T)

(c) $\frac{3}{14}$ ← Probability $= \frac{3}{14}$

4. (a) Vandalism

(b) Speeding

(c) $5 + 3 + 4 + 6 + 2 = 20$

(d) $\frac{4}{20} = \frac{1}{5} = 20\%$

5. (a) $180 - 90 - (90 - 41) = |\angle BAC|$
 $180 - 90 - 49 = |\angle BAC|$
 $41^\circ = |\angle BAC|$

← Or $|\angle BAC| = |\angle DCA|$ Reason: Alternate angles

(b) $\tan 41^\circ = \frac{35}{|AB|}$
 $|AB| = 35 \div \tan 41^\circ$
 $|AB| = 40 \text{ m}$

← Calculator: $\tan 41 = 0.869286$. Now divide 35 by 0.869286 to give $40.26 = 40 \text{ m}$ to the nearest metre.

6. (a) 180° ← The three angles of a triangle add to 180° .

(b) $180 - 51 - 79 = 50^\circ$

(c) 180° ← A straight angle equals 180° .

(d) The exterior angle D is equal to the sum of the two interior opposite angles ($51^\circ + 79^\circ$).

(e) $180 - 50 = 130^\circ$

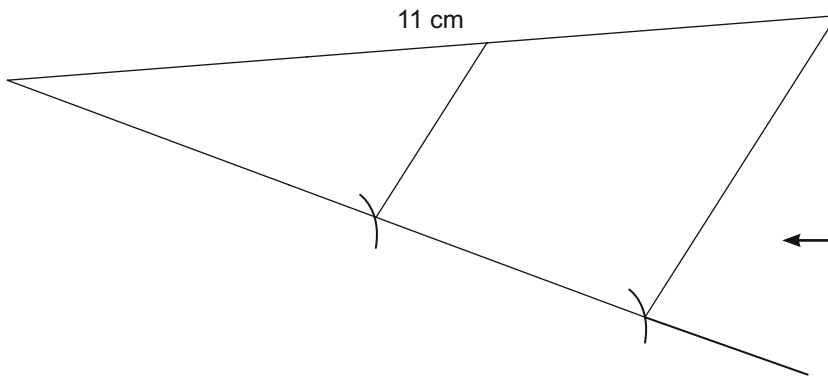
7. (1) Do you eat bread?

(2) What is your favourite type of bread?

← Or any other relevant question

(3) How much would you pay for fresh, wholesome bread?

8.



Steps:

1. Draw, with a ruler, a line 11 cm in length.
2. Draw another line at an angle to the first line.
3. With a compass, draw two arcs of equal length to cut the line that is at an angle to the line of 11 cm.
4. Join the outside arc to the end of the 11 cm line.
5. Through the other arc, draw a line parallel to the line going through the first arc. The 11 cm line will now be divided into two equal segments. Note: one could just bisect the 11 cm line.

9. (a) $\frac{8-0}{0+4} = \frac{8}{4} = 2$

← Slope formula: See page 18 of *Formulae and Tables*.

(b) $y - 0 = 2(x + 4)$
 $y = 2x + 8$
 $0 = 2x - y + 8$

← Equation of a line formula: $y - y_1 = m(x - x_1)$. See page 18 of *Formulae and Tables*. Note: You can use either of the points as (x_1, y_1) .

10. The median is the middle number when the data points are arranged in order. If there is an odd number of data points there is no problem. Example: the median of 2, 5, 7, 11, 13 is 7 as 7 is the middle number when they are arranged in order. If there is an even number of numbers then the average (mean) of the middle two numbers is taken when they are arranged in order. Example 2, 5, 8, 13. The median is $(5 + 8) \div 2 = 6.5$ which was not in the original data set.

11. (a) $2(0) + 3y - 6 = 0$
 $3y = 6$
 $y = 2 \quad R = (0, 2)$

(b) $(0, 2) \rightarrow (0, 0) \rightarrow (0, -2)$

Reason: The x parts $0 \rightarrow 0 \rightarrow 0$ and the y parts $2 \rightarrow 0 \rightarrow -2$. 0 is the centre of each of the maps.

12. (a) The listeners were being bribed with prizes.

(b) Only people with internet access could reply to the survey.

(c) Only people who exercise would have been in his gym.

13. (a) 10 ← The hypotenuse is always the longest side in a right-angled triangle.

(b) $\frac{6}{10} = \frac{3}{5}$ ← $\cos C = \frac{\text{Adjacent}}{\text{Hypotenuse}}$

(c) $\cos C = \frac{3}{5}$
 $\cos C = 0.6$

$C = \cos^{-1}(0.6)$ ← Calculator: 
 $C = 53^\circ$

14. (a) (-2, -1)

(b) (-2, -1) → (0, -1) → (2, -1)

(c) (-2, -1) → (-2, 0) → (-2, 1)

(d) (-2, -1) → (0, 0) → (2, 1)

15. (a)

25 000	34 000
<u>19 000</u>	<u>32 000</u>
6 000	2 000

(b) $\frac{18\,000}{25\,000} \times \frac{100}{1} = 72\%$ $\frac{26\,000}{29\,000} \times \frac{100}{1} = 90\%$

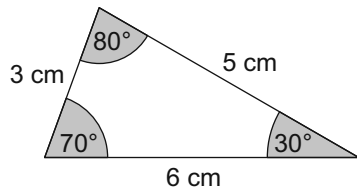
(c) $35\,000 - 29\,000 = \text{€}6000$

(d) Answer: Yes

Reason: Males' salary went up €10 000.

Females' salary went up €15 000.

16. A scalene triangle has 3 sides of different length and 3 angles of different size.

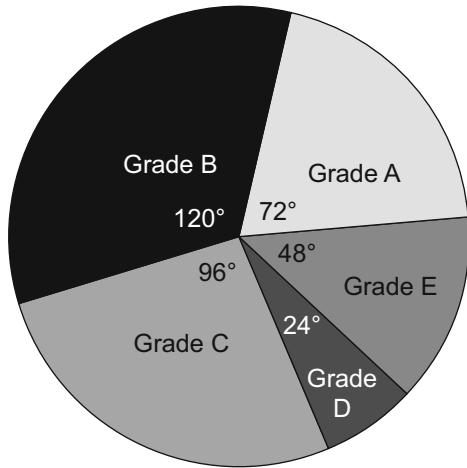


17. (a)

Grade	A	B	C	D	E
Tally					
Frequency	3	5	4	1	2

(b) B ← The most common grade

- (c) Grade A = $\frac{3}{15} \times 360 = 72^\circ$
Grade B = $\frac{5}{15} \times 360 = 120^\circ$
Grade C = $\frac{4}{15} \times 360 = 96^\circ$
Grade D = $\frac{1}{15} \times 360 = 24^\circ$
Grade E = $\frac{2}{15} \times 360 = 48^\circ$



- (d) $\frac{12}{15} = \frac{4}{5}$
- (e) I disagree, as 12 out of 15 got a grade A, B or C.

SEC

Supplementary Questions

1. (a) Length = 360 feet; Area = 57 600 feet² ←

2 cm = 160 ft
 1 cm = 80 ft
 4.5 cm = 360 ft
 These answers can vary slightly. They depend on the accuracy of the measurements.
 Area = 360 x 160 = 57 600 ft²

- (b) 5354 m²

1 m = 3.28 ft. Therefore 1 m² = 3.28 x 3.28 = 10.7584 ft².
 57 600 ft² = 57 600 ÷ 10.7584 = 5354 m²

2. (a) 5(x - 3) and 2(x - 3) ←

5 is a common factor in 5x - 15.
 2 is a common factor in 2x - 6.

- (b) $\frac{5x - 15}{2x - 6} = \frac{5}{2}$ ← $\frac{5}{2}$ is a constant so they are proportional.

3. Example: €200 is the selling price and VAT is 10%.

$$€20 = 10\% \quad (200 \div 10)$$

€220 is selling price + VAT.

4. (a)

3	2	3
2	4	2
3	2	3

- (b) 6 rows and 6 columns

- (c) Every square can be passed through by at least one vertical and one horizontal line.

- (d) 3 lines

5. (a) Maximum = 8; Mean = 5.75. ← Maximum is the largest number which is 8.

- (b) 6, 6 are the missing numbers. Mean is (3 + 5 + 7 + 8) ÷ 4 = 5.75.

Mean = 6

6. (a)

Instruction	Result of each instruction
Think of a number.	x
Multiply the number by 3.	$3x$
Add 2 to your answer.	$3x + 2$
Subtract your original number (i.e. x).	$2x + 2$
Divide your answer by 2.	$x + 1$
Subtract your original number.	1

(b)

Instruction	Result of each instruction
Think of a number.	x
Multiply the number by 2.	$2x$
Add 6 to your answer.	$2x + 6$
Add your original number (i.e. x).	$3x + 6$
Divide your answer by 3.	$x + 2$
Subtract your original number.	2