

1.

(a) $V = \sqrt[3]{\frac{500^3}{36\pi}}$ (M1)

Note: Award (M1) correct substitution into formula.

$V = 1051.305\dots$ (A1)

$V = 1051.31 \text{ cm}^3$ (A1)(ft) (C3)

Note: Award last (A1)(ft) for correct rounding to 2 decimal places of their answer. Unrounded answer must be seen so that the follow through can be awarded.

(b) 1051 (A1)(ft) (C1)

(c) 1.051×10^3 (A1)(ft)(A1)(ft) (C2)

Note: Award (A1) for 1.051 (accept 1.05) (A1) for $\times 10^3$

[6]

2.

(a) 0.0337 (M1)(A1) (C2)

Note: Award (M1) for substituting into the formula, (A1) for correct answer.

(b) (i) 0.034 (A1)(ft) (C1)

(ii) 3.4% (A1)(ft) (C1)

(c) 3.4×10^{-2} (A1)(ft)(A1)(ft) (C2)

Note: Award (A1) for 3.4 and (A1) for -2 . (ft) is from candidate's answer to part (b)(i) only.

[6]

3.

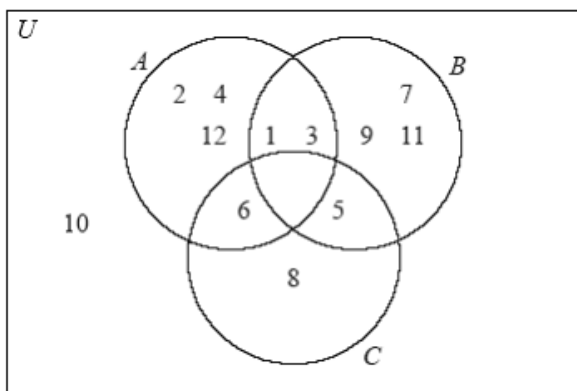
(a) 1 (one) (A1) (C1)

Note: 6, {6} or {1} earns no marks.

(b) 1, 3, 5, 7, 9, 11 (A1) (C1)

Note: Do not penalise if braces, parentheses or brackets are seen.

(c)



(A1)(A1)(ft)(A1)(ft)(A1)(ft) (C4)

Notes: Award (A1) for the empty set $A \cap B \cap C$.

Award (A1)(ft) for the correct placement of 6, 5, 1 and 3.

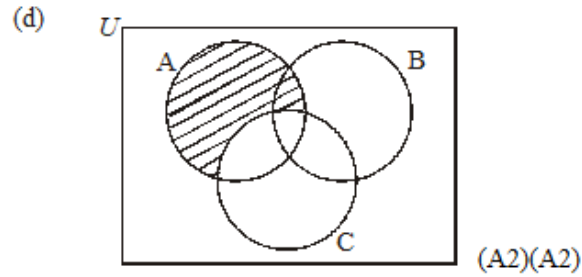
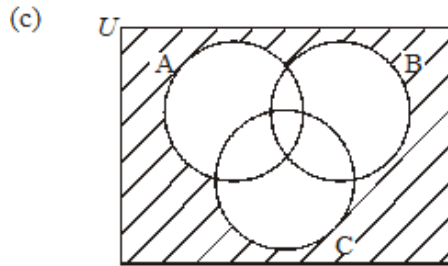
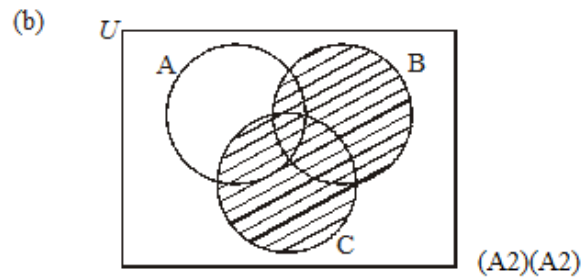
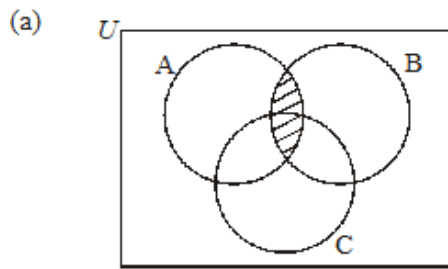
Award (A1)(ft) for the correct placement of 2, 4, 12, 7, 9, 11, 8.

Award (A1)(ft) for the correct placement of 10.

Follow through from part (b).

[6]

4.



Note: Award (A0), (A0), (A2) ft, (A2) ft if \cup and \cap are consistently reversed.

[8]

5.

(a) $\frac{x}{y} = \frac{6.4 \times 10^7}{1.6 \times 10^8}$ (M1)

$= \frac{6.4}{1.6} \times \frac{10^7}{10^8}$ (M1)

$= 4.0 \times 10^{-1}$ (accept 4×10^{-1}). (A1)(A1) (C4)

Note: Award only (G2) for 0.4 or $4E^{-1}$, assumed to be obtained from GDC.

(b) $y - 2x = 1.6 \times 10^8 - 12.8 \times 10^7$ (M1)

$= (1.6 - 1.28) \times 10^8$ (M1)

$= 0.32 \times 10^8$

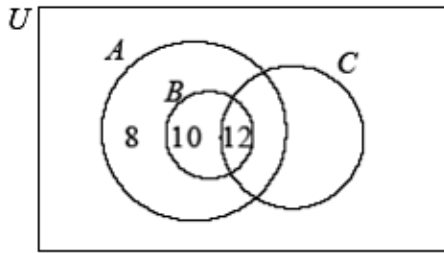
$= 3.2 \times 10^7$ (A1)(A1) (C4)

Notes: Equivalent distribution if converted to 10^7 earlier. Award only (G2) for 32000000 or $3.2E^7$.

[8]

6.

(a)



(A1)(A1)(A1)

Note: Award (A1) for each correct number in the correct position.

(b) 28

(A1)(ft)

Note: 20 + their 8

(c) 59

(A1)(ft)

(d) $10 + 12 + 20 + 6$

(M1)

Note: Award (M1) for use of the correct regions.

= 48

(A1)(ft)(G2)

OR

$59 - 8 - 3$

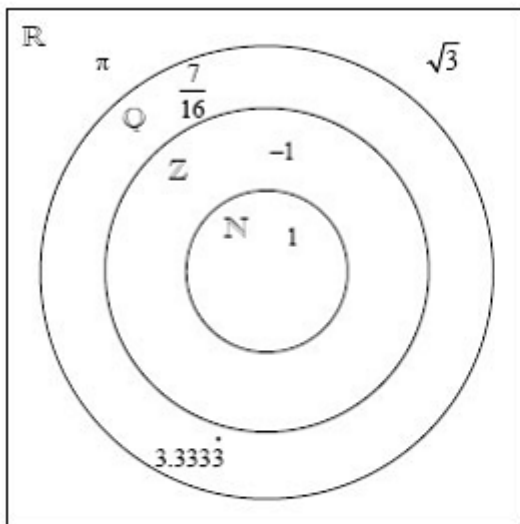
(M1)

= 48

(A1)(ft)

[7]

7.



(A1) (A1)

(A1)

(A1)

(A1)

(A1)

(C6)

8.

$$(a) \quad I = \frac{40\,000(4)(3)}{100} \quad (M1)$$

Note: Award (M1) for substituted simple interest formula.

$$I = 4800 \quad (A1)$$

OR

$$40\,000 + \frac{40\,000(4)(3)}{100} \quad (M1)(M1)$$

Note: Award (M1) for substituted simple interest formula, (M1) for addition of 40 000.

$$\text{Amount} = 44\,800\text{USD} \quad (A1)(G2)$$

Note: Award final (A1) for 44 800 only.

$$(b) \quad 44\,800 \times 18.624 \quad (M1)$$

$$= 834355 \text{ ZAR} \quad (A1)(ft)(G2)$$

Note: Follow through from (a).

$$(c) \quad 50\,000 \times \frac{2.5}{100} \quad (M1)$$

$$= 1250 \text{ USD} \quad (A1)(G2)$$

$$(d) \quad (50\,000 - 1250) \times 10.608 \quad (M1)(M1)$$

Note: Award (M1) for their 48750 seen or implied, (M1) for $\times 10.608$

$$= 517140 \quad (A1)$$

$$= 517\,000 \text{ ZAR} \quad (AG)$$

Note: Follow through from (c), both unrounded and rounded answers must be seen for final (A1) to be awarded.

$$(e) \quad 517\,000 \times (1.01)^{36} \quad (M1)(A1)$$

OR

$$= 517000 \left(1 + \frac{12}{100(12)} \right)^{12 \times 3} \quad (M1)(A1)$$

Note: Award (M1) for substituted compounded interest formula, (A1) for correct substitutions.

$$739\,707 \text{ ZAR} \quad (A1)(G2)$$

Notes: Accept 739 908 if 517 140 used.

[13]

9.

- (a) The only prime number in U is 13. (A2) (C2)

Note: Award (A1) for {1, 13} and (A0) for any other answer.

- (b) $A = \{-4, 1, 13, 69, 10^{33}\}$ (A2) (C2)

- (c) $B = \{-4, -\frac{2}{3}, 1, 13, 26.7, 69, 10^{33}\}$ (A2) (C2)

- (d) $A \cap B = \{-4, 1, 13, 69, 10^{33}\} (= A)$ (A2) (C2)

Note: In (b) and (d) allow (A1) for correct membership with at most one missing or one incorrect entry. A list with no set brackets is acceptable.

In (c) allow at most one missing entry for (A1) but if π is present award (A0).

[8]

10.

- (a) $A \cap B$ (A2)

- (b) $(A \cup B)'$ or $A' \cap B'$ (A2)

- (c) $A' \cap B$ (A2)

Note: Award (A1) for A' , (A1) for $\cap B$.

- (d) $(A \cup B) \cap C$ or $(A \cap C) \cup (B \cap C)$ (A2)

*Note: Award (A1) for both $(A \cap C)$ and $(B \cap C)$ and (A1) for \cup .
(A1) for $(A \cup B)$ and (A1) for $\cap C$.*

[8]

11.

(a) $1650 = \frac{30000 \times r \times 2}{100}$ or equivalent (A1)(M1)

Note: Award (A1) for 1650 or equivalent seen, (M1) for correct substitution into simple interest formula (right-hand side).

$r = 2.75\%$ (A1)(G2)

(b) Amount = $30000 \left(1 + \frac{2.5}{100}\right)^2$ (M1)(A1)

Note: Award (M1) for substitution into compound interest formula, (A1) for correct substitution.

31518.75 AUD (A1)(G2)

OR

$I = 30000 \left(1 + \frac{2.5}{100}\right)^2 - 30000$ (M1)(A1)

Note: Award (M1) for substitution into compound interest formula, (A1) for correct substitution.

31518.75 AUD (A1)(G2)

(c) Rebecca's amount = $30000 \left(1 + \frac{2.5}{100}\right)^n$

Daniel's amount = $30000 + \frac{30000 \times 2.75 \times n}{100}$ (M1)(A1)(ft)

Note: Award (M1) for substitution in the correct formula for the two amounts, (A1) for correct substitution. Follow through from their expressions used in part (a) and/or part (b).

OR

2 lists of values seen (at least 2 terms per list) (M1)

lists of values including at least the terms with $n = 8$ and $n = 9$ (A1)(ft)

For $n = 8$ CI 36552.09 SI = 36600

For $n = 9$ CI 37465.89 SI = 37425

Note: Follow through from their expressions used in part (a) or/and (b).

OR

Sketch showing 2 graphs, one exponential and the other straight line (M1)

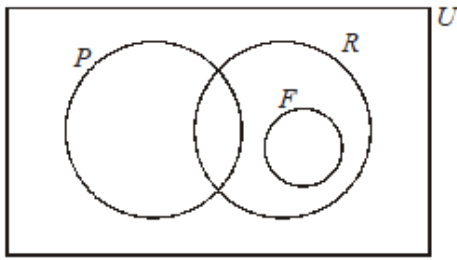
point of intersection identified (M1)

Note: Follow through from their expressions used in part (a) or/and (b).

$n = 9$ (A1)(ft)(G2)

Note: Answer 8.57 without working is awarded (G1).

12.



(A4)

*Note: Award (A1) for rectangle, (A1) for F entirely within R ,
(A1) for F disjoint from P , (A1) for $P \cap R$ non-empty.*

[4]

13.

(a) $(2.6 \times 10^4)(1.9 \times 10^4)$
 $= 4.94 \times 10^8$

(M1)(A1)

(A1)(A1) (C4)

(b) $2(2.6 \times 10^4) + 2(1.9 \times 10^4)$
 $= 9.0 \times 10^4$ (9×10^4)

(M1)(A1)

(A1)(A1) (C4)

[8]

14.

(a) For example, 2, -3, etc

(A1) (C1)

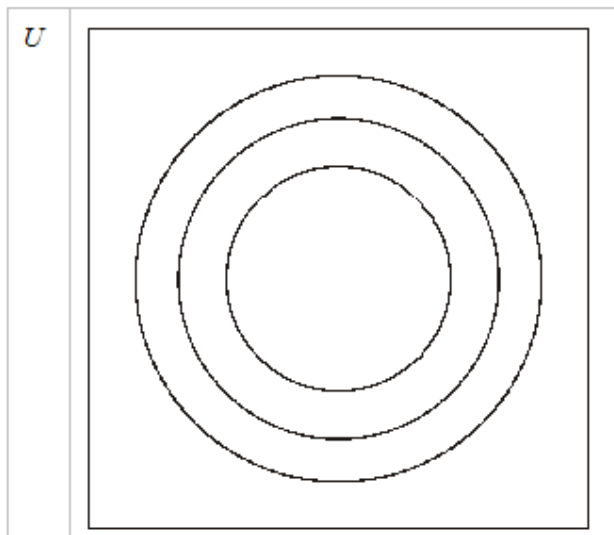
(b) For example, $\frac{3}{5}$ (not $\frac{6}{1}$)

(A1) (C1)

(c) For example, $\sqrt{2}$, π

(A1) (C1)

(d)



For $\mathbb{Z} \subset \mathbb{Q}$

(A1)

For $\mathbb{Z} \subset \mathbb{R}$

(A1)

For $\mathbb{Q} \subset \mathbb{R}$

(A1)

Accept \mathbb{R} as U .

(C3)

[6]

15.

- (a) 1500×21.03464 (M1)
 $= 31552$ (A1) (C2)
- (b) $20\,000 \times \frac{1000}{3.28352}$ (M1)
 $= 6\,091\,000$ (A1) (C2)
- (c) $\frac{21.03464}{3.28352} \times 1000$ (M1)
1 SGD = 6406 IDR (A1) (C2)

Note: Accept 6406.

[6]

16.

- (a) $w = (2.6 \times 10^4) \times (5.0 \times 10^{-8})$
 $= 13 \times 10^{-4}$ or 0.0013 (if written as working) (A2)
 $= 1.3 \times 10^{-3}$ (A1)(A1) (C4)

Note: For incorrect answers with no working, award marks as follows:

13×10^{-4} : (A1)(A1), 0.0013: (G2), $1.3E-3$: (G2), $1.3E3$: (G1),
 1.3×10^3 : (A2)(A0).

- (b) Statements (ii) and (iv) are incorrect. (A2)(A2) (C4)

Note: Both correct statements given with at most one extra, allow (A2).

[8]

17.

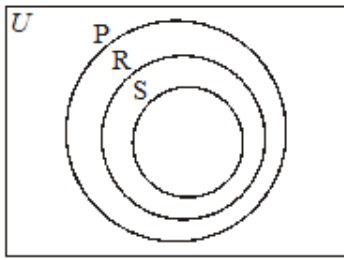
- (a) $\frac{4.24}{256} = 0.0165625$ (M2)(A2) (C4)
- (b) 0.0166 (A2) (C2)
- (c) 1.66×10^{-2} (A1)(A1) (C2)

Note: Award (A1) for 1.66, (A1) for -2.

[8]

18.

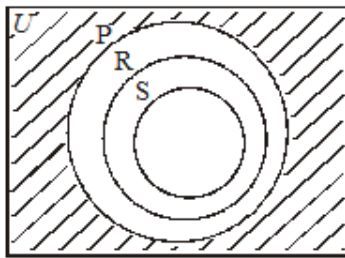
(a)



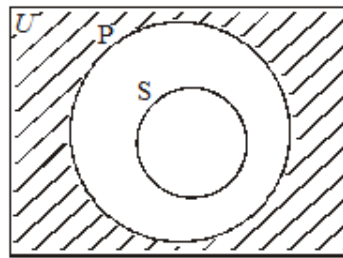
(A4) 4

Note: Award (A1) for rectangle labelled with U, (A1) for R placed correctly with respect to S, (A1) for S placed correctly with respect to P, (A1) for R placed correctly with respect to P.

(b) (i)

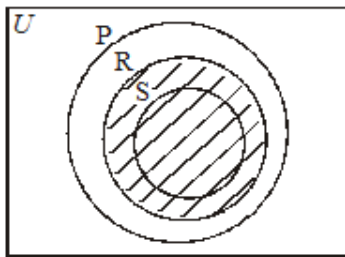


OR

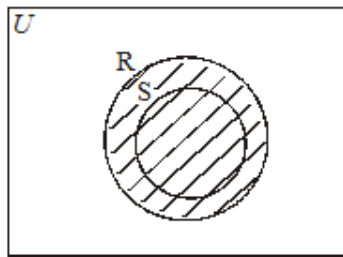


(A2)

(ii)



OR



(A2) 4

Note: Award (A2) for correct shading in each ft from circle placement in (a).

[8]

19.

(a) 10000×1.05
 $= 10\,500$ (A1) (C1)

(b) 10000×1.05^6 (M1)

Note: Award (M1) for correct substitution into correct formula.
 $= 13400$ (A1) (C2)

(c) $50\,000 = 10000 \times 1.05^n$ (M1)(A1)

Note: Award (M1) for 10000×1.05^n or equivalent, (A1) for = 50000

$n = 33.0$ (Accept 33) (A1) (C3)

[6]

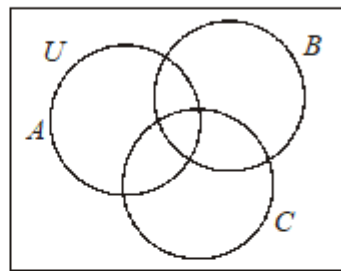
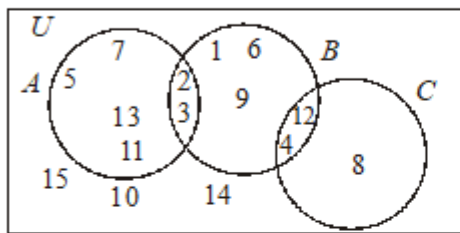
20.

	$\sqrt{3}$	6	$2\frac{1}{2}$	π	-5
N		✓			
Z		✓			✓
Q		✓	✓		✓

21.

- (a) (i) $A = \{2, 3, 5, 7, 11, 13\}$ (A1)
(ii) $B = \{1, 2, 3, 4, 6, 9, 12\}$ (A1)
(iii) $C = \{4, 8, 12\}$ (A1)
(iv) $A \cap B \cap C = \emptyset$ (A1) 4

(b) (i)(ii)



(A2)(A2) 4

Also accept with elements correctly placed

Note: Allow ft from part (a).

Award (A1) for rectangle labelled, (A1) for circles in correct places. Award (A1) for correct elements in intersections, award (A1) for the rest of the elements correctly placed. IF the wrong Universal set is used, penalise only one mark.

(c) **Note:** Award follow through from part (b) only.

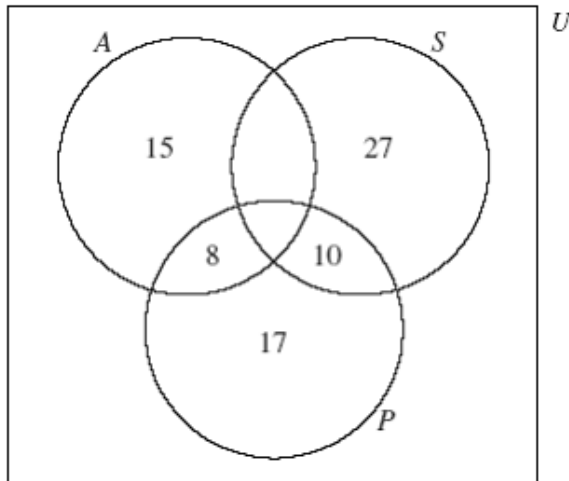
- (i) $A \cap (B \cup C) = \{2, 3\}$ (A1)
(ii) $(A \cap B)' = \{1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$ (A1)

Note: Award follow through from part (c) (ii).

- (iii) $(A \cap B)' \cap C = \{4, 8, 12\}$ (A1) 3

22.

(a)



(A1) for rectangle and three labelled intersecting circles

(A1) for 15, 27 and 17

(A1) for 10 and 8

(A3)

(b) $48 - (8 + 10 + 17)$ or equivalent
 $= 13$

(M1)

(A1)(ft)(G2)

(c) $50 - (27 + 10 + 13)$

(M1)

Note: Award (M1) for working seen.

$= 0$

(A1)

number of elements in A = 36

(A1)(ft)(G3)

Note: Follow through from (b).

(d) 21

(A1)(ft)

Note: Follow through from (b) even if no working seen.

(e) 54

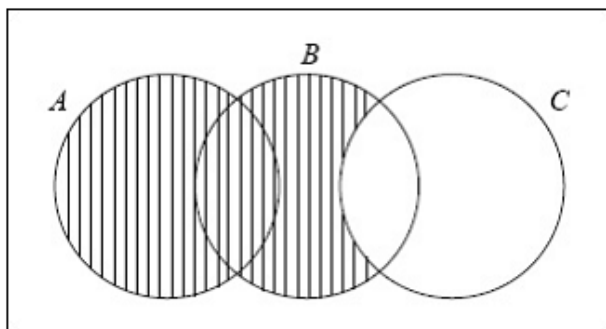
(M1)(A1)(ft)(G2)

Note: Award (M1) for 17, 10, 27 seen. Follow through from (a).

[11]

23.

(a)



not shading C or shading $A \cup B$
 correct shading

(A1)

(A1) (C2)

(b) Identifying the correct 5 numbers 3, 4, 5, 6, 9
 27

(A1)

(A1) (C2)

(c) (i) $M = \{3, 6, 9, 12, 15, 18\}$ brackets not required

(A1)

(ii) $E' \cap M = \{3, 9, 15, 21, 27, 33\}$ (ft) from (i).

(A1)(ft) (C2)

[6]

24.

(a) $I = 1200 \left(1 + \frac{7.2}{600} \right)^{2 \times 12} - 1200$ (M1)(A1)

$I = 518.15$ euros (A1) (C3)

Notes: Award (M1) for substitution in the compound interest formula, (A1) for correct substitutions, (A1) for correct answer. If final amount found is 1718.15 and working shown award (M1) (A1)(A0).

(b) $518.15 = \frac{1200 \times r \times 5}{100}$ (M1)(A1)(ft)

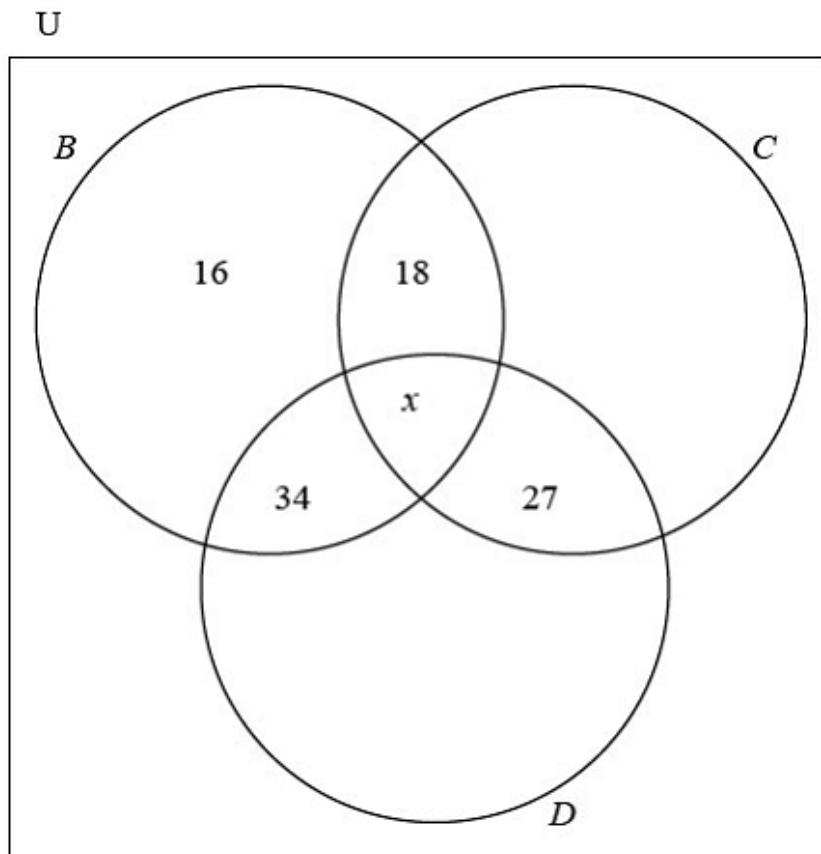
$r = 8.64\%$ (% sign not required) (A1)(ft) (C3)

Note: Award (M1) for substitution in the simple interest formula, (A1)(ft) for correct substitution, (A1)(ft) for answer.

[6]

25.

(a)



(A2) (C2)

Notes: (A1) only if 1 error

(A0) otherwise

(b) $x + 16 + 18 + 34 = 99$

$x = 31$

(A1) (C1)

(c) Choir only = $88 - (18 + 27 + 31) = 12$

(A1)(ft)

Drama only = $110 - (27 + 34 + 31) = 18$

(A1)(ft)

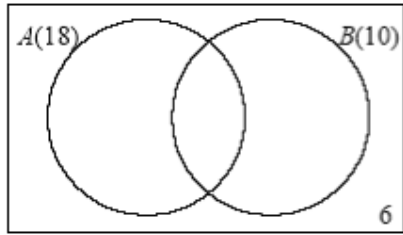
Total = $16 + 34 + 18 + 31 + 12 + 27 + 18 = 156$

(A1)(ft) (C3)

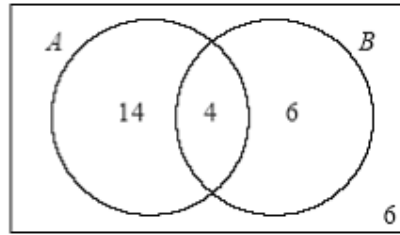
[6]

26.

(a)



OR



(A2) (C2)

Note: Award (A2) for 3 correctly placed values, and no extras (4 need not be seen), (A1) for 2 correctly placed values, (A0) for 1 or no correctly placed values.

(b) $18 + 10 + 6 - 30$
 $= 4$

(M1)

(A1) (C2)

(c) $P(A|B) = \frac{4}{10} \left(\frac{2}{5}, 0.4, 40\% \right)$

(A1)(ft)(A1) (C2)

Note: Award (A1)(ft) for their numerator from part (b), (A1) for denominator.

[6]

27.

(a) 3

(A1)

(b) For 5, 4, 7 (0) seen with no extra values
 16

(A1)

(A1)(G2)

(c) They like (both) the *Salseros* (*S*) and they like the *Bluers* (*B*)

(A1)(A1)

Note: Award (A1) for "and", (A1) for the correct groups.

(d) $R \cap B \cap S'$

(A1)(A1)

Note: Award (A1) for $R \cap B$, (A1) for $\cap S'$

(e) (i) $21 + 3x = 33$
 $x = 4$

(M1)

(A1)(G2)

(ii) 17

(A1)(ft)

[10]

28.

(a) $a = 4, b = 1$

(A1)(A1)

2

(b) $30 - (4 + 12 + 1 + 2 + 4 + 4) = 3$

(M1)(A1) (or (A2))

2

29.

(a) **Option 1:** Amount = $25000 + \frac{25000 \times 6 \times 3}{100}$ (M1)(A1)
 = 29 500.00 (29 500) (A1)(G2)

Note: Award (M1) for substitution in simple interest formula (A1) for correct substitution. Give full credit for use of lists.

Option 2: Amount = $25000 \left(1 + \frac{5}{100}\right)^3$ (M1)(A1)
 = 28 940.63 (A1)(G2)

Note: Award (M1) for substitution in compound interest formula, (A1) for correct substitution. Give full credit for use of lists.

Option 3: Amount = $25000 \left(1 + \frac{4.8}{12(100)}\right)^{3 \times 12}$ (M1)
 = 28 863.81 (A1)(G2)

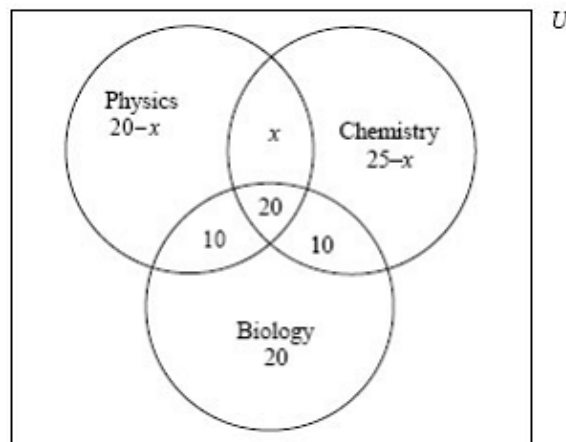
Note: Award (M1) for correct substitution in the compound interest formula. Give full credit for use of lists.

(b) Option 1 is the best investment option. (A1)(ft)

[9]

30.

The full diagram is as follows, but need not be fully filled in.



(a) $50 - (30 + x) = 20 - x$ (M1)(A1) (C2)

Notes: Award (C2) for either of these as final answer.

Can award (M1) for 50 minus a sum of numbers intended to count the entries in all the Physics intersections. Also award (M1)(A0) if the sign is distributed incorrectly, giving answers such as $50 - 30 + x$ or $20 + x$.

(b) $60 + x + (20 - x) + (25 - x) = 90$ (M1)(M1)

Note: Award (M1) for 90 seen on one side of the equation, (M1) for a reasonable attempt to order the entries.

Therefore $x = 15$. (A1)(ft) (C3)

(c) Number studying at least two subjects is 55. (A1)(ft) (C1)

Note: Allow correct (ft) with no marking shown

[6]

31.

- (a) True (A2) (C2)
(b) False (A2) (C2)
(c) True (A2) (C2)
(d) True (A2) (C2)

[8]

32.

(a) $5000 + 3 \times 230 = 5690$ (M1)(A1)(G2)

Note: Accept alternative method.

(b) $A = 5000 \left(1 + \frac{4.2}{100}\right)^{10}$ or equivalent (M1)(A1)

= 7544.79... (A1)

= 7545 USD (AG)

Note: Award (M1) for correct substituted compound interest formula, (A1) for correct substitutions, (A1) for unrounded answer seen. If final line not seen award at most (M1)(A1)(A0).

(c) $5000(1.042)^n > 6500$ (M1)(A1)

Notes: Award (M1) for setting up correct equation/inequality, (A1) for correct values. Follow through from their formula in part (b).

OR

List of values seen with at least 2 terms (M1)

Lists of values including at least the terms with $n = 6$ and $n = 7$ (A1)

Note: Follow through from their formula in part (b).

OR

Sketch showing 2 graphs, one exponential, the other a horizontal line (M1)

Point of intersection identified or vertical line (M1)

Note: Follow through from their formula in part (b).

$n = 7$ (A1)(ft)(G2)

(d) $5000(1.042)^n > 5000 + 230n$ (M1)(A1)

Note: Award (M1) for setting up correct equation/inequality, (A1) for correct values.

OR

2 lists of values seen (at least 2 terms per list) (M1)

Lists of values including at least the terms with $n = 5$ and $n = 6$ (A1)

Note: One of the lists may be written under (c).

OR

Sketch showing 2 graphs of correct shape (M1)

Point of intersection identified or vertical line (M1)

$n = 6$ (A1)(ft)(G2)

Note: Follow through from their formulae used in parts (a) and (b).

- (e) 6610×0.735 (M1)
 $= 4858.35$ (A1)
 $4858.35 \times 0.982 (= 4770.8997\dots)$ (M1)
 $= 4771$ euros (A1)(ft)(G3)

Note: Accept alternative method.

- (f) $800 \times 1.29 (= 1032 \text{ USD})$ (M1)(A1)
Note: Award (M1) for multiplying by 1.29, (A1) for 1032. Award (G2) for 1032 if product not seen.

$$(1032 - 1006.20 = 25.8)$$

$$25.8 \times \frac{100}{1032} \% \quad (A1)(M1)$$

Note: Award (A1) for 25.8 seen, (M1) for multiplying by $\frac{100}{1032}$.

OR

$$\frac{1006.20}{1032} = 0.975 \quad (M1)(A1)$$

OR

$$\frac{1006.20}{1032} \times 100 = 97.5 \quad (M1)(A1)$$

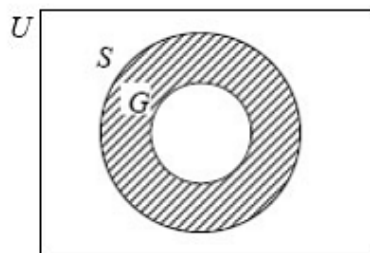
$$= 2.5 \% \quad (A1)(G3)$$

Notes: If working not shown award (G3) for 2.5. Accept alternative method.

[20]

33.

(a)



(A1)(A1)(A1)

Note: Award (A1) for rectangle, (A1) for S drawn and named, (A1) for G completely inside S.

- (b) shading on diagram (A1)(ft)
 (c) sports cars that are not green (A2)

Note: Award (A1) for sports cars intersecting with not green cars.

[6]

34.

(a) $k = 2.034 \times 0.632$ (M1)
 $= 1.29$ (1 GBP = 1.29 EUR) (A1) (C2)

Note: Accept 1.29 only

(b) 400×0.632 (M1)
 $= 252.80$ EUR (A1)

2 % of 252.80 = 5.06 EUR (A1)

She receives 247.74 EUR (A1)

OR

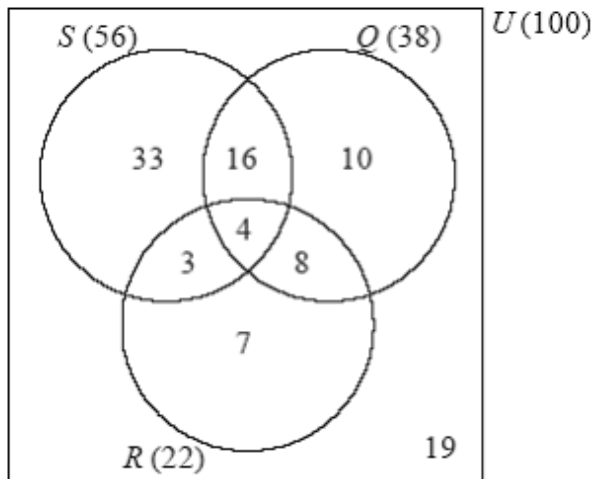
$0.98 \times 252.80 = 247.74$ EUR (A1)(A1) (C4)

Note: Accept (A1) for 0.98 seen.

[6]

35.

(a)



(A1)(A1)(A1)(A1)(A1)

Note: Award (A1) for rectangle (U not required), (A1) for 3 intersecting circles, (A1) for 4 in central intersection, (A1) for 16, 3, 8 and (A1) for 33, 10, 7 (ft) if subtraction is carried out, or for S(56), Q(38) and R(22) seen by the circles.

(b) $100 - 81$ (M1)
 19 (A1)(ft)(G2)

Note: Award (M1) for subtracting their total from 100.

(c) $33 + 10 + 7$ (M1)

Note: Award (M1) for adding their values from (a).

$\left(\frac{50}{100}\right) \times 100\%$ (A1)(ft)

50% (50) (A1)(ft)(G3)