



Mark Scheme (Results)

Summer 2024

Pearson Edexcel International GCSE
In Mathematics A (4MA1) Paper 1H

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

- **Types of mark**
 - M marks: method marks
 - A marks: accuracy marks
 - B marks: unconditional accuracy marks (independent of M marks)
- **Abbreviations**
 - cao – correct answer only
 - ft – follow through
 - isw – ignore subsequent working
 - SC - special case
 - oe – or equivalent (and appropriate)
 - dep – dependent
 - indep – independent
 - awrt – answers which round to

- **No working**

If no working is shown then correct answers normally score full marks

If no working is shown then incorrect (even though nearly correct) answers score no marks.
- **With working**

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If it is clear from the working that the “correct” answer has been obtained from incorrect working, award 0 marks.

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

If there is no answer on the answer line then check the working for an obvious answer.
- **Ignoring subsequent work**

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.

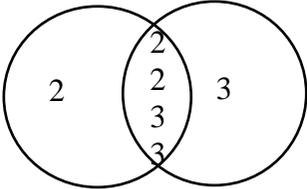
Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.
- **Parts of questions**

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

International GCSE Maths				
Apart from questions 3, 5, 6b, 11, 17 and 24 (where the mark scheme states otherwise) the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method				
Values in quotation marks must come from a correct method previously seen unless clearly stated otherwise.				
Q	Working	Answer	Mark	Notes
1 (a)			2	M1 for $3n + k$ ($k \neq -2$) or $3 \times n + k$ ($k \neq -2$) or $n \times 3 + k$ ($k \neq -2$) (k may be zero or absent)
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	$3n - 2$		A1 oe eg $1 + (n - 1)3$ oe or $3 \times n - 2$ oe or $n \times 3 - 2$ oe NB: award full marks for eg $x = 3n - 2$ oe or $x = 3 \times n - 2$ oe or $x = n \times 3 - 2$ oe or n th term = $3n - 2$ oe or n th term = $3 \times n - 2$ oe or n th term = $n \times 3 - 2$ oe or $3x - 2$ Allow eg T_n or U_n or a_n for n th term but only M1 for $n = 3n - 2$ oe or $x = 3x - 2$
(b)		77	1	B1 cao
			Total 3 marks	

2	$1 - (0.20 + 0.26)$ oe or 0.54 oe or $x + 2x + 0.26 + 0.20 = 1$ oe or $x + 2x = 0.54$ oe or		4	M1 showing clear understanding that the total of probabilities is 1 If probabilities are given as percentages then % sign must be seen
	$\frac{0.54}{3}$ (= 0.18) or $\frac{2}{3} \times 0.54$ (= 0.36) oe or "0.54" \times 450 (= 243)			M1 for a correct method to find x or $2x$
	$(2 \times)$ "0.18" \times 450 oe or 81 or "0.36" \times 450 oe			M1 or for $\frac{81}{450}$ or $\frac{162}{450}$
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	162		A1
				Total 4 marks

2 ALT	$(0.2 \times 450) + (0.26 \times 450)$ (= 207) oe or $90 + 117$ (= 207) or 0.46×450 (= 207)		4	M1
	$450 - "207"$ (= 243)			M1
	$\frac{1}{3} \times "243"$ or 81 or $\frac{2}{3} \times "243"$			M1 or for $\frac{81}{450}$ or $\frac{162}{450}$
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	162		A1
				Total 4 marks

<p>3</p>	<p>1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72 and 1, 2, 3, 4, 6, 9, 12, 18, 27, 36, 54, 108</p> <p>or</p> <p>2 2 2 3 3 oe and 2 2 3 3 3 oe</p> <p>or</p>  <table border="1" data-bbox="759 502 1048 625"> <tbody> <tr> <td>12</td> <td>72</td> <td>108</td> </tr> <tr> <td>3</td> <td>6</td> <td>9</td> </tr> <tr> <td></td> <td>2</td> <td>3</td> </tr> </tbody> </table>	12	72	108	3	6	9		2	3		<p>2</p> <p>M1 for any correct valid method and no errors eg</p> <p>for starting to list at least four different factors of each number and no errors</p> <p>or</p> <p>2 2 2 3 3 and 2 2 3 3 3 seen or 4 2 3 3 and 4 3 3 3 seen or 2 2 2 9 and 2 2 3 9 seen or 4 2 9 and 4 3 9 seen or 2 36 and 3 36 etc (may be in a factor tree or a ladder diagram with no errors and ignore 1)</p> <p>or a fully correct Venn diagram</p> <p>or other clear method, eg table</p>
12	72	108										
3	6	9										
	2	3										
	<p><i>Working required</i></p>	<p>36</p>	<p>A1 dep on M1 Accept $2^2 \times 3^2$ oe</p>									
			<p>Total 2 marks</p>									

4	$1 + 0.15 (= 1.15)$ or $x + 0.15x = 943$ or $100(\%) + 15(\%) (= 115(\%))$ or $\frac{943}{115} (= 8.2)$ oe		3	M1
	$943 \div "1.15"$ or $943 \div "115" \times 100$ or $943 \times 100 \div "115"$ oe or 8.2×100			M1 dep on M1
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	820		A1
				Total 3 marks

5	$(5 - 2) \times 180 (= 540)$ or $360 \div 5 (= 72)$		4	M1 NB If angles are on the diagram they must be from correct working and correctly assigned
	$\frac{"540"}{5} (= 108)$ or $180 - "72" (= 108)$ or $180 - 96 (= 84)$			M1
	$"72" + "84"$ or $360 - (96 + "108")$ or $180 - ("108" - "84")$			M1 for a complete method
	<i>Working required</i>	156		A1 dep on M2
				Total 4 marks

6	(a)	$m^2 - 8m + 5m - 40$		2	M1 for any 3 correct terms from 4 terms or for 4 out of 4 correct terms ignoring signs or for $m^2 - 3m \dots$ or for $\dots - 3m - 40$
		<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	$m^2 - 3m - 40$		A1
	(b)	$9n - 12 = 5n + 6$ oe or $3n - 4 = \frac{5}{3}n + \frac{6}{3}$ oe		3	M1 for removal of fraction and multiplying out LHS or separating fraction (RHS) in an equation
		$9n - 5n = 12 + 6$ oe or $4n = 18$ or $-12 - 6 = 5n - 9n$ oe or $-4n = -18$ oe or $n = \frac{-18}{-4}$ or $3n - \frac{5}{3}n = \frac{6}{3} + 4$ oe			M1 ft (dep on 4 terms) correctly rearranging their 4 term equation for terms in n on one side of equation and number terms on the other
		<i>Working required</i>	$\frac{9}{2}$		A1 dep on M2 oe eg $\frac{18}{4}$ or 4.5 or $4\frac{1}{2}$
					Total 5 marks

7	(a)(i)		23, 24, 27, 29, 30, 31, 33	1	B1 in any order with no repeats
	(a)(ii)		27, 33	1	B1 in any order with no repeats
	(b)	eg 1. Yes, no members/numbers/values in common 2. Yes, nothing in common 3. Yes, no common members/numbers/values 4. Yes, they share no common members/numbers/values 5. Yes, there is not the same members/numbers/values in both sets 6. Yes, there is no intersection or there is nothing in B and C 7. Yes, as there are no members/numbers/values the same (in B and C) 8. Yes, no members/numbers/values in B are in C or vice versa 9. Yes, there are no members/numbers in B that are multiples of 3 10. Yes, there are no members/numbers/values in that empty set 11. Yes, 23, 29, 31 not in C 12. Yes, 24, 27, 30, 33 are not in B Allow sector for set This is not an exhaustive list Allow element(s) for members/numbers/values	Yes, there are no multiples of 3 in set <i>B</i>	1	B1 for Yes and a statement which indicates correct meanings of intersection and empty set. If no box is ticked, then the 'Yes' must be stated in the answer
	(c)		23, 25, 29, 31	2	B2 for the four correct numbers and no additions (B1 for three correct values with no more than one incorrect or for four correct values with no more than one incorrect)
					Total 5 marks

8	$1575 = (\text{area}) \times 21$ oe or $(\text{area} =) 75$ or $1575 = \pi \times r^2 \times 21$ oe or $r^2 = \frac{1575}{21\pi} (= 23.8(732\dots))$ oe or $r = \sqrt{\frac{1575}{21\pi}} (= 4.88(602\dots))$ oe		3	M1 for finding the area using $\text{Vol} = \text{cross sectional area} \times \text{height}$ or finding r or r^2 using $\text{vol} = \pi r^2 h$ NB r^2 and r can be rounded or truncated
	$\frac{84}{75}$ oe or $\frac{84}{\pi \cdot 4.88^2}$ oe or $\frac{84}{\pi \cdot 23.8}$ oe			M1 for $\frac{84}{\text{area of circle}}$
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	1.12		A1 accept 1.06 – 1.121
				Total 3 marks

9	(a)	35 000 000	1	B1
	(b)		2	M1 Allow correct mixture of ordinary numbers and standard form numbers
	$8.2 \times 10^5 + 6\,780\,000$ oe or $820\,000 + 6\,780\,000$ oe or $7\,600\,000$ or 76×10^5 oe or 7.6×10^n where $n \neq 6$			
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	7.6×10^6		A1
				Total 3 marks

10	(a)		1	1	B1
	(b)		6	1	B1 Accept y^6
	(c)		$125a^{12}c^6$	2	B2 for $125a^{12}c^6$ B1 for a product in the form ka^pc^q where 2 from k , p or q are correct eg $5a^{12}c^6$ or $125a^{12}3c^6$ Accept multiplication signs between terms (Allow $125a^{12}$ or $125c^6$ or $a^{12}c^6$ as long as not added to any other terms)
					Total 4 marks

11	$(CM)^2 + (12 \div 2)^2 = 9^2$ oe or $9^2 - (12 \div 2)^2 (= 81 - 36 = 45)$		4	M1 $AM = MB$ $CAM = CBM$	M2 for $(\cos^{-1}(CAM) =) \frac{12 \div 2}{9} = 48.1(896\dots)$
	$\sqrt{9^2 - (12 \div 2)^2}$ oe (= $\sqrt{81 - 36} = \sqrt{45} = 3\sqrt{5} = 6.7(08\dots)$)			M1	and $(CM =)(12 \div 2) \times \tan "48.1\dots" (= 6.7\dots)$ or $(CM =)9 \times \sin "48.1\dots" (= 6.7\dots)$
	$(\text{"7"} + 9 + 9 + 12) \times 21.5(0)$ or $37 \times 21.5(0)$			M1	
	<i>Working required</i>	795.5(0)		A1 dep on M2 SC B3 for awrt 789 for using 6.7...	
					Total 4 marks

12	(a)	$(2y \pm 1)(3y \pm 4)$ or $(2y \pm 4)(3y \pm 1)$ or $2y(3y - 4) + 1(3y - 4)$ or $3y(2y + 1) - 4(2y + 1)$		2	M1 NB factors must be in the form $(ay + b)$ where a and b are integers Condone use of a different letter to y
		<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	$(2y + 1)(3y - 4)$		A1 or $(3y - 4)(2y + 1)$ Ignore further working if solving a quadratic to find roots.
	(b)	$\frac{3(2x+1)}{12x} + \frac{4(7-5x)}{12x}$ or $\frac{3x(2x+1)}{12x^2} + \frac{4x(7-5x)}{12x^2}$ or $\frac{3(2x+1)+4(7-5x)}{12x}$ oe or $\frac{3x(2x+1)+4x(7-5x)}{12x^2}$ oe		3	M1 for two correct fractions with common denominator with the intention to add or a single correct fraction NB $12x$ can be written as $(3)(4x)$ or $(4)(3x)$ for this mark or $12x^2$ can be written as $(3x)(4x)$ for this mark
		$\frac{6x+3+28-20x}{12x}$ oe or $\frac{6x^2+3x+28x-20x^2}{12x^2}$ oe or $\frac{31x-14x^2}{12x^2}$ oe			M1 for a correct single fraction with all brackets expanded
		<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	$\frac{31-14x}{12x}$		A1 or $\frac{14x-31}{-12x}$
					Total 5 marks

13 (a)		$\frac{3}{10}, \frac{7}{10}$ $\frac{5}{9}, \frac{4}{9}$ $\frac{5}{9}, \frac{4}{9}$	2	<p>B2 for all 3 correct pairs of probabilities on the correct branches</p> <p>If not B2 then award B1 for 1 correct pair of probabilities on a correct branch</p> <p>Allow equivalent fractions/decimals (to 2 dp truncated or rounded ie 0.55(...) and/or 0.44(...))</p>
(b)	$\frac{3}{10} \times \frac{5}{9}$ oe or $\frac{7}{10} \times \frac{4}{9}$ oe or $\frac{3}{10} \times \frac{4}{9}$ oe or $\frac{7}{10} \times \frac{5}{9}$ oe or		3	<p>M1 ft (probabilities < 1)</p> <p>Allow equivalent fractions/decimals (to 2 dp truncated or rounded ie 0.55(...) and/or 0.44(...))</p>
	$\frac{3}{10} \times \frac{5}{9} + \frac{7}{10} \times \frac{4}{9}$ oe or $1 - \left(\frac{3}{10} \times \frac{4}{9} + \frac{7}{10} \times \frac{5}{9} \right)$ oe			<p>M1 ft</p> <p>Allow equivalent fractions/decimals (to 2 dp truncated or rounded ie 0.55(...) and/or 0.44(...))</p>
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	$\frac{43}{90}$		<p>A1ft oe</p> <p>0.47(77..) to 2 dp truncated or rounded or 47.(77)% to 2 sf truncated or rounded</p>
				Total 5 marks

14	$1 + 1.45 (= 2.45)$ or $1 + \frac{29}{20} (= \frac{49}{20})$ or $B = 1.45A$ oe or $B = \frac{29}{20}A$ oe or $A + 1.45A$ or $A + \frac{29}{20}A$ or $2.45A$ or $(A : B =) 100 : 145$ oe or $100 + 145 (= 245)$ oe or $(B : C =) 3 : 2$ oe or $B = 1.5C$ oe		5	B1 must identify ratios with Abel and Bahira or Bahira and Chanda Allow any letters for A, B and C
	$A + 1.45A = 15\,435$ or $15\,435 \div "2.45"$ or $15\,435 \div \frac{49}{20}$ or $15\,435 \div "245" \times 100$ or $63 \times 100 (= 6300)$	M2 for $15\,435 \div \left(\frac{1}{1.45} + 1\right) (= 9135)$ oe or $15\,435 \div \left(\frac{49}{29}\right) (= 9135)$ oe		M1 for a method to find Abel's savings or for 6300
	$15\,435 - "6300"$ or $1.45 \times "6300"$ or $145 \times "63" (= 9135)$			M1 for a method to find Bahira's savings or for 9135
	$"9135" \div \frac{3}{2}$ oe or $"9135" \times \frac{2}{3}$ oe			M1 for a method to find to find Chanda's savings
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>		6090	A1
			Total 5 marks	

15 (a)			$(x =) 2$	1	<p>B1 Accept $x = 2$ and $x \neq 2$ x cannot be 2</p> <p>Any response that contains 2 is also acceptable</p> <p>DO NOT ACCEPT WHEN WRITTEN WITH INEQUALITY SIGNS</p> <p>$x > 2$ or $x < 2$ or $x \geq 2$ or $x \leq 2$</p> <p>DO NOT ACCEPT 2 with another number eg 2 & 3</p>
(b)	$y(x-2) = 3x+1$ oe or $yx-2y = 3x+1$ oe	$x(y-2) = 3y+1$ oe or $yx-2x = 3y+1$ oe		3	M1
	$x(y-3) = 1+2y$ oe	$y(x-3) = 1+2x$ oe			M1 for factorising correctly
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>		$\frac{1+2x}{x-3}$		A1 oe eg $\frac{-1-2x}{3-x}$ (must be in terms of x)
					Total 4 marks

16	$\frac{15}{20} \times \frac{14}{19} \times \frac{5}{18} \left(= \frac{35}{228} \right) \text{oe or } \frac{5}{20} \times \frac{4}{19} \times \frac{15}{18} \left(= \frac{5}{114} \right) \text{oe}$ <p>or</p> $\frac{15}{20} \times \frac{14}{19} \times \frac{13}{18} \left(= \frac{91}{228} \right) \text{oe or } \frac{5}{20} \times \frac{4}{19} \times \frac{3}{18} \left(= \frac{1}{114} \right) \text{oe}$		4	M1 for <i>RRY</i> or <i>YYR</i> in any order or <i>RRR</i> or <i>YYY</i> Allow equivalent decimals to 2 dp truncated or rounded Products must be correct (may not be evaluated)	M2 for <i>RY and YR</i> $\frac{15}{20} \times \frac{5}{19} \left(= \frac{15}{76} \right) \text{oe and}$ $\frac{5}{20} \times \frac{15}{19} \left(= \frac{15}{76} \right) \text{oe}$
	$3 \times \frac{15}{20} \times \frac{14}{19} \times \frac{5}{18} \text{oe or } 3 \times \frac{5}{20} \times \frac{4}{19} \times \frac{15}{18} \text{oe}$ <p>or</p> $\frac{15}{20} \times \frac{14}{19} \times \frac{13}{18} \text{oe and } \frac{5}{20} \times \frac{4}{19} \times \frac{3}{18} \text{oe}$			M1 for ($3 \times$ <i>RRY</i>) or ($3 \times$ <i>YYR</i>) or <i>RRY and YYR</i> (any order) or <i>RRR and YYY</i>	
	$3 \times \frac{15}{20} \times \frac{14}{19} \times \frac{5}{18} + 3 \times \frac{5}{20} \times \frac{4}{19} \times \frac{15}{18} \text{oe}$ <p>or</p> $\left(\frac{15}{20} \times \frac{14}{19} \times \frac{5}{18} \right) + \left(\frac{5}{20} \times \frac{4}{19} \times \frac{15}{18} \right) + \left(\frac{15}{20} \times \frac{5}{19} \right) + \left(\frac{5}{20} \times \frac{15}{19} \right) \text{oe}$ <p>or</p> $1 - \left(\frac{15}{20} \times \frac{14}{19} \times \frac{13}{18} + \frac{5}{20} \times \frac{4}{19} \times \frac{3}{18} \right) \text{oe}$			M1 for a complete method using correct products	
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	$\frac{45}{76}$		A1 oe 0.59(21..) to 2 dp truncated or rounded or 59.(21..) % to 2 sf truncated or rounded	
				Total 4 marks	

17	$\frac{1+\sqrt{5}}{3-\sqrt{5}} \times \frac{3+\sqrt{5}}{3+\sqrt{5}} \text{ oe or}$ $\frac{1+\sqrt{5}}{3-\sqrt{5}} \times \frac{-3-\sqrt{5}}{-3-\sqrt{5}} \text{ oe}$		3	M1 for rationalising the denominator by multiplying numerator and denominator by $3+\sqrt{5}$ (or $-3-\sqrt{5}$)
	$\frac{3+\sqrt{5}+3\sqrt{5}+\sqrt{5}\sqrt{5}}{9+3\sqrt{5}-3\sqrt{5}-\sqrt{5}\sqrt{5}} \text{ oe or}$ $\frac{3+\sqrt{5}+3\sqrt{5}+\sqrt{5}\sqrt{5}}{9-\sqrt{5}\sqrt{5}} \text{ oe or}$ $\frac{3+\sqrt{5}+3\sqrt{5}+5}{9+3\sqrt{5}-3\sqrt{5}-5} \text{ oe or}$ $\frac{8+\sqrt{5}+3\sqrt{5}}{9-5} \text{ oe or}$ $\frac{3+4\sqrt{5}+5}{9-5} \text{ oe or}$ $\frac{8+4\sqrt{5}}{4}$			M1 numerator correctly expanded and may be simplified to at least 2 terms and denominator correctly expanded and may be simplified to 1 term
	<i>Working required</i>	$2+\sqrt{5}$		A1 for $2+\sqrt{5}$ from correct working dep on M2
				Total 3 marks

18	$3x^2$ or -40		5	M1 for differentiating one of the first two terms correctly
	$3x^2 - 40$			A1 for both terms correct and no additions
	$"3x^2 - 40" = 8$			M1ft dep on M1 for equating their quadratic derivative with 8 (Derivative must be in the form $ax^2 - 40$ or $3x^2 - b$ where $a \neq 0$ and $b \neq 0$)
	$(y =) "4" - 40 \times "4" + 1 (= -95)$ or $y = (" - 4")^3 - 40 \times " - 4" + 1 (= 97)$			M1ft dep on previous M1 for substituting at least one x value into y NB Following through from $ax^2 - 40 = 8$ or $3x^2 - b = 8$, their x values must be correct
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	$(4, -95), (-4, 97)$		A1 both coordinates must be paired correctly
				Total 5 marks

19	$\frac{(BD)}{\sin 62} = \frac{12.8}{\sin 40}$ oe or		5	M1 for correct use of sine rule for BD	M2 for
	$(BD =) \frac{12.8}{\sin 40} \times \sin 62 (= 17.5(82\dots))$			M1 for finding BD (truncated or rounded)	$(CD =) \frac{12.8}{\sin 40} \times \sin 78$ $(= 19.4(781\dots))$ and $(BD =) \frac{19.4(781\dots)}{\sin 78} \times \sin 62$ $(= 17.5(82\dots))$
	"17.5(82...)" ² = 13.4 ² + 15.2 ² - 2 × 13.4 × 15.2 × cos x or 309(.139) = 179(.56) + 231(.04) - 407(.36)cos x oe			M1 for correct use of cosine rule	
	$(\cos x =) \frac{13.4^2 + 15.2^2 - "17.5(82\dots)"^2}{2 \times 13.4 \times 15.2}$ oe or $(\cos x =) \frac{179(.56) + 231(.04) - 309(.139\dots)}{407(.36)}$ oe or $(\cos x =) \frac{410(.6) - 309(.139\dots)}{407(.36)}$ oe or $(\cos x =) 0.247 - 0.256$ oe			M1 for a correct rearrangement of cos x	
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	75.6		A1 accept 75.1 – 75.7	
				Total 5 marks	

20	eg $\pi r^2 \times \frac{60}{360} - \frac{1}{2} r^2 \sin 60$ oe or $\frac{\pi r^2}{6} - \frac{\sqrt{3}}{4} r^2$ oe		4	M1 for a correct expression for the area of the segment Expression may be embedded in an equation, eg $\pi r^2 \times \frac{60}{360} - \frac{1}{2} r^2 \sin 60 = 38$ or $\pi r^2 \times \frac{60}{360} = 38 + \frac{1}{2} r^2 \sin 60$ or $\pi r^2 \times \frac{60}{360} - 38 = \frac{1}{2} r^2 \sin 60$
	eg $(r^2 =) 38 \div \left(\frac{\pi}{6} - \frac{\sqrt{3}}{4} \right) (= 38 \div 0.09(058)) (= 419(.490\dots))$ oe or $(r =) \sqrt{38 \div \left(\frac{\pi}{6} - \frac{\sqrt{3}}{4} \right)} (= 20.4(81\dots))$ oe			M1 dep on M1 for a correct expression for r^2 or r
	$\frac{\pi}{6} \times "20.4(81\dots)" \times 2 (= 21.4(48\dots))$ oe or			M1 for using the value of r to find arc length
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	41.9		A1 allow 41 - 42
				Total 4 marks

21	(i)		$(-2, -4)$	1	B1
	(ii)		$(5, -10)$	1	B1
					Total 2 marks

22	eg $14 \div 5 (= 2.8)$ or a correct value on the FD scale or $10 \text{ small squares} = 1 \text{ adult oe}$ or $1 \text{ large square} = 2.5 \text{ adults oe}$ or 51 and 8 assigned to correct bars (distances)		3	M1 for finding the frequency density or for finding the number of adults for squares or use of counting squares or blocks
	eg $14 + (15 \times "3.4") + (20 \times "0.4") (= 73) \text{ oe or}$ $100 - [14 + (15 \times "3.4") + (20 \times "0.4")] (= 27) \text{ oe}$ $14 + 51 + 8 (= 73) \text{ oe or}$ $100 - [14 + 51 + 8] (= 27) \text{ oe or}$ $(140 + 510 + 80) \times 0.1 (= 73) \text{ oe or}$ $[1000 - (140 + 510 + 80)] \times 0.1 (= 27) \text{ oe or}$ $(140 + 510 + 80) (= 730) \text{ oe or}$ $[1000 - (140 + 510 + 80)] (= 270) \text{ oe or}$ $(5.6 + 20.4 + 3.2) \times 2.5 (= 73) \text{ oe or}$ $[40 - (5.6 + 20.4 + 3.2)] \times 2.5 (= 27) \text{ oe}$			M1 for a method to find the area of the bars given or for a method to find the missing area
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	Correct height of bar at 2.7 and correct width		A1 for correct bar(s) with frequency of 27 SC B2 for a bar of height 2.7 from 0 – 15 SC B2 for a bar of height 1.8 from 0 – 15
				Total 3 marks

23	$\frac{1}{3}\pi \times (5x)^2 \times 6x$ oe or $50\pi x^3$ oe or $\frac{1}{2} \times \frac{4}{3} \times \pi \times (2x)^3$ or $\frac{16}{3}\pi x^3$ oe or $\frac{4}{3} \times \pi \times (2x)^3$ or $\frac{32}{3}\pi x^3$ oe		5	M1 for finding the volume of cone or hemisphere or sphere NB Ignore missing brackets around $5x$ and $2x$ for this mark
	$\frac{1}{3}\pi \times (5x)^2 \times 6x - \frac{1}{2} \times \frac{4}{3} \times \pi \times (2x)^3 = 6948\pi$ oe or $50\pi x^3 - \frac{16}{3}\pi x^3 = 6948\pi$ or $\frac{134}{3}\pi x^3 = 6948\pi$ oe			M1 for a correct equation for the volume of the shape NB If not expanded at this stage then must see brackets
	$(x^3 =) \frac{6948\pi \times 3}{134\pi} \left(= \frac{10422}{67} = 155.(552\dots) \right)$ oe or $(x =) \sqrt[3]{\frac{6948\pi \times 3}{134\pi}} \left(= \sqrt[3]{\frac{10422}{67}} = \sqrt[3]{155.(552\dots)} = 5.37(8\dots) \right)$ oe			M1 for rearranging the correct equation to find the value of x^3 or x Accept 5.4 or better
	$3 \times \pi \times (2 \times "5.37(8\dots)")^2$ oe or $12 \times \pi \times "5.37(8\dots)"^2$ oe			M1 for finding the surface area of the hemisphere
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	1090		A1 allow 1086 – 1100 Special case for using 6948 without π SC B3 for $x^3 = 49.5(138\dots)$ or $x = 3.67(205\dots)$ SC B4 for awrt 508
				Total 5 marks

24	$\frac{n}{2}[2(84) + (n-1)(4)]$ or $\frac{n}{2}[168 + 4n - 4]$ or $\frac{n}{2}[164 + 4n]$ oe or $82n + 2n^2$ oe		6	M1 for correctly substituting into $S_n = \frac{n}{2}[2a + (n-1)d]$
	$\frac{n}{2}[2(84) + (n-1)(4)] = (n-2) \times 180$ or $\frac{n}{2}[164 + 4n] = (n-2) \times 180$ oe or $82n + 2n^2 = (n-2) \times 180$ oe			M1 for equating S_n with $(n-2)180$ S_n must come from correct substitution of a and d into $\frac{n}{2}[2a + (n-1)d]$
	eg $n^2 - 49n + 180 (= 0)$ oe Allow $n^2 - 49n = -180$			M1dep on M2 for multiplying out and collecting terms, forming a three term quadratic in any form of $an^2 + bn + c (= 0)$ where at least 2 coefficients (a or b or c) are correct
	eg $(n-45)(n-4) (= 0)$ $n = \frac{- -49 \pm \sqrt{(-49)^2 - 4 \times 1 \times 180}}{2}$ e.g. $\left(n - \frac{49}{2}\right)^2 - \left(\frac{49}{2}\right)^2 = -180$			M1ft dep on M2 method to solve their 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{49 \pm \sqrt{2401 - 720}}{2}$ or if factorising allow brackets which expanded give 2 out of 3 terms correct) or correct value for $n = 45$ (ignore $n = 4$)
	$(\text{"45"} - 2) \times 180$ or $\frac{\text{"45"}}{2}[2(84) + (\text{"45"} - 1)(4)]$ oe or $(\text{"44"} - 2) \times 180$ or $\frac{\text{"44"}}{2}[2(84) + (\text{"44"} - 1)(4)]$ oe			M1 dep on previous M1 NB $n > 5$
	<i>Working required</i>	7740		A1 dep on M5 Accept 7560 or 7480
				Total 6 marks

24 ALT	$\frac{n}{2}[2(96) + (n-1)(-4)]$ or $\frac{n}{2}[192 - 4n + 4]$ or $\frac{n}{2}[196 - 4n]$ oe or $98n - 2n^2$ oe		6	M1 for correctly substituting into $S_n = \frac{n}{2}[2a + (n-1)d]$ using exterior angles
	$\frac{n}{2}[2(96) + (n-1)(-4)] = 360$ or $\frac{n}{2}[196 - 4n] = 360$ oe or $98n - 2n^2 = 360$ oe			M1 for equating S_n with 360 S_n must come from correct substitution of a and d into $\frac{n}{2}[2a + (n-1)d]$
	eg $2n^2 - 98n + 360 (= 0)$ $n^2 - 49n + 180 (= 0)$ oe Allow $n^2 - 49n = -180$			M1 dep on M2 for multiplying out and collecting terms, forming a three term quadratic in any form of $an^2 + bn + c (= 0)$ where at least 2 coefficients (a or b or c) are correct
	e.g. $(n-45)(n-4) (= 0)$ $n = \frac{- -49 \pm \sqrt{(-49)^2 - 4 \times 1 \times 180}}{2}$ e.g. $\left(n - \frac{49}{2}\right)^2 - \left(\frac{49}{2}\right)^2 = -180$			M1 ft dep on M2 method to solve their 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{49 \pm \sqrt{2401 - 720}}{2}$ or if factorising allow brackets which expanded give 2 out of 3 terms correct) or correct value for $n = 45$ (ignore $n = 4$)
	("45"-2)×180 or $\frac{"45"}{2}[2(84) + ("45"-1)(4)]$ oe or ("44"-2)×180 or $\frac{"44"}{2}[2(84) + ("44"-1)(4)]$ oe			M1 dep on previous M1 NB $n > 5$
	<i>Working required</i>	7740		A1 dep on M5 Accept 7560 or 7480
				Total 6 marks

25	$\pm 3(x^2 \pm 4x)$ or $\pm 3(x^2 \pm 4x)$ or $b = 3$		4	M1 for factorising $-3x^2 + 12x$ or stating the correct value of b or $b = 3$ embedded in an incorrect final answer in the form $a - 3(x - c)^2$
	$-3[(x-2)^2 \dots\dots\dots]$ or $-3(x-2)^2 \dots\dots\dots$			M1 for a correct first step to complete the square
	$-3[(x-2)^2 - (2)^2] \dots\dots\dots$ oe or $-3(x-2)^2 + 12 \dots\dots\dots$ or $-3[(x-2)^2 - (2)^2 \dots\dots\dots]$ oe			M1 for a correct second step to complete the square
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	$29 - 3(x-2)^2$		A1 oe eg $-3(x-2)^2 + 29$
				Total 4 marks

25 ALT	$-bx^2 + 2bcx - bc^2 + a$ oe or $b = 3$		4	M1 for multiplying out $a - b(x - c)^2$ or stating the correct value of b or $b = 3$ embedded in an incorrect final answer in the form $a - 3(x - c)^2$
	$2bc = 12$ or $a - bc^2 = 17$ oe			M1 for equating coefficients
	$2 \times "3" \times c = 12$ or $a - "3" \times "2" = 17$ oe			M1 for finding at least 2 from a or b or c
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	$29 - 3(x-2)^2$		A1 oe eg $-3(x-2)^2 + 29$
				Total 4 marks

