Pearson Edexcel

Mark Scheme (Results)

Summer 2025

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 – answer which rounds to
- eeoo – each error or omission

- **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.

  If a candidate misreads a number from the question. Eg. Uses 252 instead of 255; method marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review. If there is a choice of methods shown, mark the method that leads to the answer on the answer line; where no answer is given on the answer line, award the lowest mark from the methods shown.

  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 to another

International GCSE Mathematics

Values in quotation marks must come from a correct method previously seen unless clearly stated otherwise.

Q	Working	Answer	Mark	Notes
1 (a)		$5 < d \leq 10$	1	B1 allow 5 – 10 or 5 to 10 or $5 < d < 10$ or $5 \leq d \leq 10$ or $5 \leq d < 10$
(b)	$2.5 \times 26 + 7.5 \times 40 + 12.5 \times 16 + 17.5 \times 10 + 22.5 \times 8$ (= 920) or 65 + 300 + 200 + 175 + 180 (= 920) [lower bound products are: 0, 200, 160, 150, 160] [sum of lower bound products is: 670] [products using 3, 8, 13, 18, 23 are: 78, 320, 208, 180, 184] [sum of products using 3, 8, 13, 18, 23 is: 970] [upper bound products are: 130, 400, 240, 200, 200] [sum of upper bound products is: 1170]		4	M2 for at least **4** correct products added (need not be evaluated ie can be in the form $2.5 \times 26 + 7.5 \times 40 + \ldots$) If not M2 then award: M1 for consistent use of values within interval (including end points) for at least **4** products added (need not be evaluated ie can be in the form $5 \times 26 + 10 \times 40 + \ldots$) or correct midpoints used for at least **4** products and not added
	"920" ÷ "100"			M1 (dep on at least M1) Allow division by their Σf provided addition or total under column seen
	Correct answer scores full marks (unless from obvious incorrect working)	9.2		A1 oe eg $9\frac{1}{5}$ or $\frac{46}{5}$ SCB2 for answer of 6.7 or 9.7 or 11.7
				Total 5 marks

2	(a)	$4 \times 6 \times 80$ (= 1920)	4×6 (= 24) **or** 2160 ÷ 80 (= 27)	2160 ÷ (80 × 4) (= 6.75)		4	M1 for method to work out total income **or** income from one box **or** expenditure for one box **or** income per cup
		2160 – "1920" (= 240) **or** $\frac{2160}{"1920"}(=1.125)$	"27" – "24" (= 3) **or** $\frac{"27"}{"24"}(=1.125)$	"6.75" – 6 (= 0.75) **or** $\frac{"6.75"}{6}(=1.125)$			M1 for working out the profit **or** income ÷ expenditure
		$\frac{"240"}{"1920"}(\times 100)$ **or** 0.125 (× 100) **or** $\left(\frac{2160}{"1920"}-1\right)(\times 100)$ **or** ("1.125" – 1) (× 100) **or** "1.125" × 100 (= 112.5)	$\frac{"3"}{"24"}(\times 100)$ **or** 0.125 (× 100) **or** $\left(\frac{"27"}{"24"}-1\right)(\times 100)$ **or** ("1.125" – 1) (× 100) **or** "1.125" × 100 (= 112.5)	$\frac{"0.75"}{6}(\times 100)$ **or** 0.125 (× 100) **or** $\left(\frac{"6.75"}{6}-1\right)(\times 100)$ **or** ("1.125" – 1) (× 100) **or** "1.125" × 100 (= 112.5)			M1 for a method to reach one step from the answer ie getting to $\frac{1}{8}$ oe or 0.125 or 112.5
		Working required			12.5		A1 dep on M1
	(b)				8.5	1	B1 cao
	(c)				125	1	B1 allow $124.\dot{9}$ or 124.99…
							Total 6 marks

3	eg 360 – (148 + 50) (= 162) **or** 180 – 50 (= 130) **or** 180 – 148 (= 32)			4	M1 for method to interior angle of the polygon **or** start to the method of finding the exterior angle of the polygon
	eg 180 – "162" (= 18) **or** 148 – "130" (= 18) **or** 50 – "32" (= 18)	eg 180(n – 2) = "162"n **or** 180(n – 2) ÷ n = "162"			M1 for method to find the exterior angle **or** for setting up an equation using sum of interior angles formula
	eg 360 ÷ "18"	eg (n =) 360 ÷ (180 − "162")			M1 for a complete method
	Working required		20		A1 dep on M1
					Total 4 marks

4	(a)		12	1	B1	accept x^{12}
	(b)		5	1	B1	accept y^5
	(c)		$125a^{12}r^6$	2	B2	for $125a^{12}r^6$ (B1 for a product in the form ka^pr^q where 2 from k, p or q are correct eg $5a^{12}r^6$ Allow $125a^{12}$ or $125r^6$ or $a^{12}r^6$ so as long as not added to any other terms)
						Total 4 marks

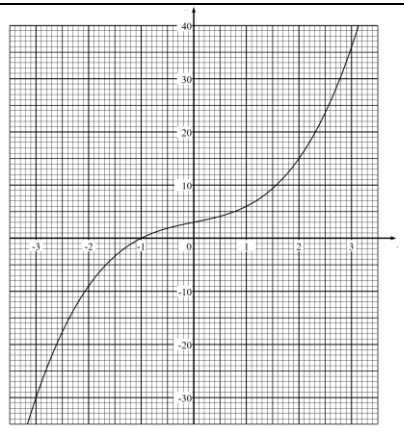
5	eg 1 − 0.28 (= 0.72) oe **or** 0.72x = 198 **or** 100(%) − 28(%) (= 72(%)) **or** $\frac{198}{72}$ (= 2.75) oe		3	M1	for a correct first step
	eg (x =) 198 ÷ "0.72" oe **or** 198 ÷ "72" × 100 oe **or** "2.75" × 100			M1	for a complete method
	Correct answer scores full marks (unless from obvious incorrect working)	275		A1	cao
					Total 3 marks

6 (a)	$6x - 24 = 3 + 2x$ **or** $x - 4 = \frac{3}{6} + \frac{2}{6}x$ oe		3	M1	for correct removal of fraction and expansion of bracket in a correct equation **or** separating fraction (RHS) in an equation
	$6x - 2x = 3 + 24$ **or** $4x = 27$ **or** $-24 - 3 = 2x - 6x$ **or** $-27 = -4x$ oe **or** $x - \frac{2}{6}x = \frac{3}{6} + 4$ oe **or** $-4 - \frac{3}{6} = \frac{2}{6}x - x$ oe			M1ft	(dep on 4 terms) correctly rearranging their 4 term equation for terms in x on one side of equation and number terms on the other
	Working required	$\frac{27}{4}$		A1	oe eg 6.75 or $6\frac{3}{4}$, dep on M1
(b)(i)	$(y \pm 6)(y \pm 5)$ **or** $(6 \pm y)(5 \pm y)$ **or** $y(y - 6) - 5(y - 6)$ **or** $y(y - 5) - 6(y - 5)$		2	M1	for $(y \pm 6)(y \pm 5)$ **or** $(6 \pm y)(5 \pm y)$ **or** for $(y + a)(y + b)$ where $ab = 30$ or $a + b = -11$ **or** $y(y + a) + b(y + a)$ or $y(y + b) + a(y + b)$ where $ab = 30$ or $a + b = -11$
	Correct answer scores full marks (unless from obvious incorrect working)	$(y - 6)(y - 5)$		A1	oe, allow any letter for y
(ii)		$(y =) 6, (y =) 5$	1	B1	must ft from their answer in (b)(i) ft from their factors in the form $(y + a)(y + b)$
					Total 6 marks

7	$3892 = \pi \times 8^2 \times h$ **or** $\pi \times 8^2 \left(= 64\pi = 201...\right)$		3	M1 allow use of 3.14… or $\frac{22}{7}$ for π
	$\left(h =\right) \frac{3892}{\pi \times 8^2}$ oe eg 3892 ÷ 64 = 60.8… **and** 60.8… ÷ π			M1 allow use of 3.14… or $\frac{22}{7}$ for π
	Correct answer scores full marks (unless from obvious incorrect working)	19.4		A1 allow 19.3 – 19.4
				Total 3 marks

8	(a)		5.2×10^8	1	B1
	(b)		0.000 087 9	1	B1
	(c)	35×10^{-138} or $3.5 \times 10 \times 10^{-138}$ or 3.5×10^n where $n \neq -137$		2	M1
		Correct answer scores full marks (unless from obvious incorrect working)	3.5×10^{-137}		A1
					Total 4 marks

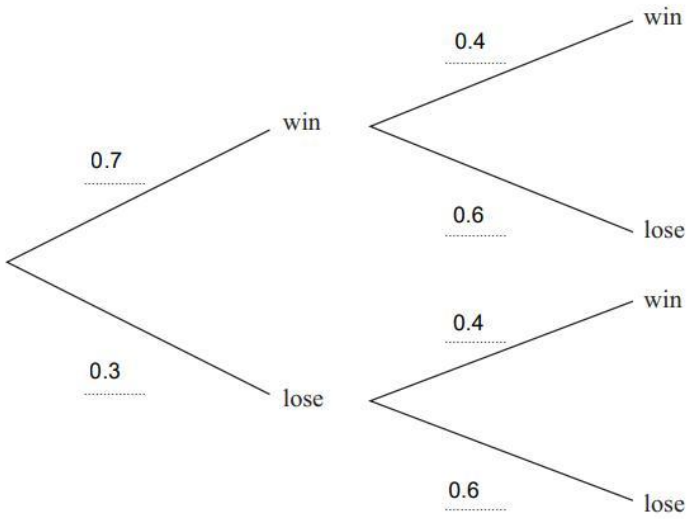
9	eg $12\sin 60\left(=6\sqrt{3}=10.3(9...)\right)$ **or** $\sqrt{12^2-"6"^2}\left(=6\sqrt{3}=10.3(9...)\right)$ **or** (Area *ADC* =) $\frac{1}{2}\times 12\times 47\times\sin 60\,(=244.2...)$		5	M1	for a method find the height of the trapezium **or** the area of triangle *ADC* The first two M1 marks can be awarded in either order
	eg $12\cos 60\left(=6\right)$ **or** $\sqrt{12^2-\left("6\sqrt{3}"\right)^2}\left(=6\right)$			M1	(indep) for a method find the base of the triangle, condone missing brackets around $"6\sqrt{3}"$ The first two M1 marks can be awarded in either order
	eg (*AB* =) 47 – "6" – "6" (= 35)			M1	(dep on previous M1) for method to find the length of *AB*
	eg (Trapezium =) $\frac{1}{2}\times\left(47+"35"\right)\times"10.3(9...)"$ **or** (Rectangle + 2 × Triangle =) $"35"\times"10.3(9...)"+2\times\frac{1}{2}\times"6"\times"10.3(9...)"$ **or** (Rectangle + 2 × Triangle =) $"35"\times"10.3(9...)"+2\times\frac{1}{2}\times"6"\times 12\times\sin 60$ **or** (Triangle *ADC* + Triangle *ABC* =) $"244.2..."+\frac{1}{2}\times 12\times"35"\times\sin 120$ oe eg $\left(47-"6"\right)\times"10.3(9...)"$			M1	for a complete method There are other methods and marks should be awarded for a complete method that should give the correct area
	Working required	426		A1	(dep on M1) allow 420 – 427 from correct working
					Total 5 marks

10	(a)		−30, 15	1	B1	for −30 and 15 in the correct place, this may be awarded if plotted correctly on the graph
	(b)			2	M1ft	for at least 6 points plotted correctly (within the circles on the overlay) ft their incorrect table
		 *Correct answer scores full marks (unless from obvious incorrect working)*	Correct graph		A1	for correct curve between $x = -3$ and $x = 3$ (clear intention to go through all the points and which must be curved) Ignore to the left of $x = -3$ and to the right of $x = 3$ **Note**: If a fully correct graph is shown, but a blank table is shown in (a), then award the mark for (a)
						Total 3 marks

11	eg $\pi \times 16^2 \times \frac{140}{360}$ oe eg $256\pi \times \frac{7}{18}$		2	M1 allow use of 3.14… or $\frac{22}{7}$ for π $\frac{140}{360}$ may be seen as an equivalent fraction or decimal eg $\frac{7}{18}$ or $0.3\dot{8}$ 0.388(8…) or 0.389
	Correct answer scores full marks (unless from obvious incorrect working)	313		A1 accept 311.8 – 313
				Total 2 marks

12	eg $\frac{5(6x)}{24x}+\frac{4(x-3)}{24x}$ oe **or** $\frac{5(6x)}{4(6x)}+\frac{4(x-3)}{4(6x)}$ oe **or** $\frac{30x}{24x}+\frac{4(x-3)}{24x}$ oe **or** $\frac{30x+4(x-3)}{24x}$ oe **or** $\frac{15x}{12x}+\frac{2(x-3)}{12x}$ oe **or** $\frac{15x+2(x-3)}{12x}$ oe		3	M1 for two correct fractions with common denominator **or** a single correct fraction
	eg $\frac{30x+4x-12}{24x}$ oe **or** $\frac{30x}{24x}+\frac{4x-12}{24x}$ oe **or** $\frac{30x}{24x}+\frac{4x}{24x}-\frac{12}{24x}$ oe **or** $\frac{34x}{24x}-\frac{12}{24x}$ oe **or** $\frac{34x-12}{24x}$ oe **or** $\frac{15x+2x-6}{12x}$ oe			M1 for correct fraction(s) with bracket(s) expanded correctly
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{17x-6}{12x}$		A1 oe but must be simplified eg $\frac{-6+17x}{12x}$ do not ISW incorrect simplification eg $\frac{17x-6}{12x}=\frac{11}{12}$ is M2A0
				Total 3 marks

13	750 000 × (1 – 0.04) (= 720 000) oe **and** "720 000" × (1 – 0.065) (= 673 200) **or** 750 000 × (1 – 0.04) × (1 – 0.065) (= 673 200) **or** 750 000 × 0.96 × 0.935 (= 673 200)		3	M1	(NB: accept $\left(1-\frac{4}{100}\right)$ for 0.96 but not (1 – 4%) and accept $\left(1-\frac{6.5}{100}\right)$ for 0.935 but not (1 – 6.5%)) Calculations may be seen as part of an equation eg 750 000 × 0.96 × 0.935 × $\left(1+\frac{x}{100}\right)$ = 698 445 1.0375 or 25245 imply M1
	eg $\frac{698\,445-"673\,200"}{"673\,200"}(\times 100)$ (= 0.0375) **or** $\frac{698\,445}{"673\,200"}-1$ (= 0.0375) **or** 1.0375 – 1 (= 0.0375) oe **or** $\frac{698\,445}{"673\,200"}\times 100\,(=103.75)$			M1	for a method to reach value one step away from *x* ie a method leading to 0.0375 or 103.75
	Correct answer scores full marks (unless from obvious incorrect working)	3.75		A1	oe eg $3\frac{3}{4}$ or $\frac{15}{4}$
					Total 3 marks

14 (a)		Correct probabilities	2	B2	for all 3 correct pairs of probabilities on the correct branches for 1 or 2 correct pairs of probabilities on the correct branches) Allow equivalent fractions or percentages
(B1					
(b)	"0.3" × "0.6"		2	M1ft	(Both probabilities must be less than 1)
	Correct answer scores full marks (unless from obvious incorrect working)	0.18		A1ft	oe eg $\frac{18}{100}$ or $\frac{9}{50}$ or $\frac{0.18}{1}$ or 18%
					Total 3 marks

15	(a)		9	1	B1	allow $9\sqrt{3}$
	(b)	$\frac{21}{3-\sqrt{2}}\times\frac{3+\sqrt{2}}{3+\sqrt{2}}$ **or** $\frac{21}{3-\sqrt{2}}\times\frac{-3-\sqrt{2}}{-3-\sqrt{2}}$		3	M1	for explicitly multiplying the numerator and the denominator by $3+\sqrt{2}$ or $-3-\sqrt{2}$
		eg $\frac{21\left(3+\sqrt{2}\right)}{9-3\sqrt{2}+3\sqrt{2}-2}$ **or** $\frac{21\left(3+\sqrt{2}\right)}{3^2-2}$ **or** $\frac{21\left(3+\sqrt{2}\right)}{9-2}$ **or** $\frac{21\left(3+\sqrt{2}\right)}{7}$ **or** $\frac{63+21\sqrt{2}}{9-2}$ **or** $\frac{63+21\sqrt{2}}{7}$			M1	dep on M1 (denominator may be 4 terms which all need to be correct) $\frac{21}{3-\sqrt{2}}\times\frac{3+\sqrt{2}}{3+\sqrt{2}}=9+3\sqrt{2}$ scores M1M0
		Working required	$9+\sqrt{18}$		A1	dep on M2 SCB1 for $9+\sqrt{18}$ gained with no method marks awarded SCB2 for $9+\sqrt{18}$ gained if you would award 1st M1 but not 2nd M1 (total 2 marks)
						Total 4 marks

16	(a)		6	1	B1	cao
	(b)	$9-\sqrt{4x^2}\ (<0)$		3	M1	for substituting g(x) in f(x), allow incorrect inequality sign or = sign
		eg $9-2x\ (<0)$ **or** $9 < 2x$ **or** $81 < 4x^2$ **or** $9^2 < 4x^2$			M1	for removing the square root, allow incorrect inequality sign or = sign
		Working required	$x > \frac{9}{2}$		A1	(dep on M1) oe eg $x > 4.5$, $\frac{9}{2} < x$, $4.5 < x$
						Total 4 marks

17	freq density × mins 10 × 2.5 (= 25) 5 × 4 (= 20) 15 × 3.6 (= 54) 20 × 0.5 (= 10) 10 × 1.7 (= 17) 10 × 0.5 (= 5) (area of 40 to 50 bar) counting cm^2 2 × 5 (= 10) 1 × 8 (= 8) 3 × 7.2 (= 21.6) 4 × 1 (= 4) 2 × 3.4 (= 6.8) 2 × 1 (= 2) (area of 40 to 50 bar)	counting small squares 10 × 25 (= 250) 5 × 40 (= 200) 15 × 36 (= 540) 20 × 5 (= 100) 10 × 17 (= 170) 10 × 5 (= 50) (area of 40 to 50 bar)		3	M1 for finding the area of at least 2 bars either using freq density × mins **or** use of counting small squares or cm^2 Values may be seen on the diagram 22 or 220 or 8.8 implies M1
	(10 × 2.5) + (5 × 4) + (15 × 3.6) + (20 × 0.5) + (10 × 1.7) (= 126) **or** "25" + "20" + "54" + "10" + "17" (= 126) **or** "250" + "200" + "540" + "100" + "170" (= 1260) **or** "10" + "8" + "21.6" + "4" + "6.8" (= 50.4)				M1 for method to find total number of people (allow one error or omission) **or** total number of small squares/ cm^2 for method used (allow one error or omission)
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{11}{63}$			A1 oe eg $\frac{22}{126}$ or $\frac{220}{1260}$ or 0.174(60…) or 0.175 or 17.4(60…)% or 17.5% or 22 out of 126 If $\frac{22}{126}$ is seen in the workings and 22 is on the answer line, award M2A0
					Total 3 marks

18	$y = \frac{k}{x^3}$	$hy = \frac{1}{x^3}$		4	M1	do not award for $y = \frac{1}{x^3}$ Constant of proportionality must be a symbol such as k Condone use of $\propto$ for method marks
	$4 = \frac{k}{3^3}$ **or** $k = 4 \times 3^3$ (= 108)	$h \times 4 = \frac{1}{3^3}$ **or** $h = \frac{1}{4 \times 3^3} \left(= \frac{1}{108} \right)$			M1	for substitution of x and y into a correct formula Condone use of $\propto$ for method marks
	eg $\left(x^3 =\right) \frac{4 \times 3^3}{864} \left(= \frac{1}{8} \right)$ **or** $\left(x^3 =\right) \frac{"108"}{864} \left(= \frac{1}{8} \right)$ oe				M1	for method to find x^3 Condone use of $\propto$ for method marks
	Correct answer scores full marks (unless from obvious incorrect working)		0.5		A1	oe
						Total 4 marks

19	(i)		8, –9	1	B1 cao
	(ii)		4, –12	1	B1 cao
					Total 2 marks

20	$\left(BD^2 =\right)9.4^2 + 12.8^2 - 2\times 9.4\times 12.8\times\cos 72$ (= 177.8…) **or** $\left(BD^2 =\right)88.36 + 163.84 - 2\times 9.4\times 12.8\times\cos 72$ (=177.8…) oe **or** $\left(BD =\right)\sqrt{9.4^2 + 12.8^2 - 2\times 9.4\times 12.8\times\cos 72}$		5	M1	for applying cosine rule
		(BD =)13.3		A1	allow 13.3 – 13.342 or $\sqrt{177.8...}$ or $\sqrt{178}$
	eg $\frac{BC}{\sin 39} = \frac{"13.3..."}{\sin 54}$ **or** $\frac{\sin 39}{BC} = \frac{\sin 54}{"13.3..."}$			M1ft	for applying the sine rule, allow use of their BD
	$\left(BC =\right)\frac{"13.3..."}{\sin 54}\times\sin 39$			M1ft	for method to find BC using the sine rule allow use of their BD
	Correct answer scores full marks (unless from obvious incorrect working)	10.4		A1	allow 10.3 – 10.4
					Total 5 marks

21	eg (P(RRY) =) $\frac{9}{20}\times\frac{8}{19}\times\frac{7}{18}\left(=\frac{504}{6840}=\frac{7}{95}\right)$ oe **or** (P(RRG) =) $\frac{9}{20}\times\frac{8}{19}\times\frac{4}{18}\left(=\frac{288}{6840}=\frac{4}{95}\right)$ oe **or** (P(RRR) =) $\frac{9}{20}\times\frac{8}{19}\times\frac{7}{18}\left(=\frac{504}{6840}=\frac{7}{95}\right)$ oe **or** (P(RRR′) =) $\frac{9}{20}\times\frac{8}{19}\times\frac{11}{18}\left(=\frac{792}{6840}=\frac{11}{95}\right)$ oe **or** (P(YYR) =) $\frac{7}{20}\times\frac{6}{19}\times\frac{9}{18}\left(=\frac{378}{6840}=\frac{21}{380}\right)$ oe **or** (P(YYG) =) $\frac{7}{20}\times\frac{6}{19}\times\frac{4}{18}\left(=\frac{168}{6840}=\frac{7}{285}\right)$ oe **or** (P(YYY) =) $\frac{7}{20}\times\frac{6}{19}\times\frac{5}{18}\left(=\frac{210}{6840}=\frac{7}{228}\right)$ oe **or** (P(YYY′) =) $\frac{7}{20}\times\frac{6}{19}\times\frac{13}{18}\left(=\frac{546}{6840}=\frac{91}{1140}\right)$ oe **or** (P(GGR) =) $\frac{4}{20}\times\frac{3}{19}\times\frac{9}{18}\left(=\frac{108}{6840}=\frac{3}{190}\right)$ oe **or** (P(GGY) =) $\frac{4}{20}\times\frac{3}{19}\times\frac{7}{18}\left(=\frac{84}{6840}=\frac{7}{570}\right)$ oe **or** (P(GGG) =) $\frac{4}{20}\times\frac{3}{19}\times\frac{2}{18}\left(=\frac{24}{6840}=\frac{1}{285}\right)$ oe **or** (P(GGG′) =) $\frac{4}{20}\times\frac{3}{19}\times\frac{16}{18}\left(=\frac{192}{6840}=\frac{8}{285}\right)$ oe **or** (P(RGY) =) $\frac{9}{20}\times\frac{7}{19}\times\frac{4}{18}\left(=\frac{252}{6840}=\frac{7}{190}\right)$ oe		3	M1	for finding one correct product, does not need to be labelled **or** for an answer of $\frac{17}{76}$ oe eg 0.22(3…) **or** 22(.3…)% **or** $\frac{65}{76}$ oe eg 0.85(5…) **or** 85(.5…)%
	(P(RRR′ or YYY′ or GGG′) =) $\left(3\times\frac{9}{20}\times\frac{8}{19}\times\frac{11}{18}\right)+\left(3\times\frac{7}{20}\times\frac{6}{19}\times\frac{13}{18}\right)+\left(3\times\frac{4}{20}\times\frac{3}{19}\times\frac{16}{18}\right)$oe **or** (P(RRY or RRG or YYR or YYG or GGR or GGY) =) $\left(3\times\frac{9}{20}\times\frac{8}{19}\times\frac{7}{18}\right)+\left(3\times\frac{9}{20}\times\frac{8}{19}\times\frac{4}{18}\right)+\left(3\times\frac{7}{20}\times\frac{6}{19}\times\frac{9}{18}\right)+$ $\left(3\times\frac{7}{20}\times\frac{6}{19}\times\frac{4}{18}\right)+\left(3\times\frac{4}{20}\times\frac{3}{19}\times\frac{9}{18}\right)+\left(3\times\frac{4}{20}\times\frac{3}{19}\times\frac{7}{18}\right)$oe **or** (1 – P(RRR or YYY or GGG or RGY) =) $1-\left(\left(\frac{9}{20}\times\frac{8}{19}\times\frac{7}{18}\right)+\left(\frac{7}{20}\times\frac{6}{19}\times\frac{5}{18}\right)+\left(\frac{4}{20}\times\frac{3}{19}\times\frac{2}{18}\right)+\left(6\times\frac{9}{20}\times\frac{7}{19}\times\frac{4}{18}\right)\right)$oe			M1	for a complete calculation
	Correct answer scores full marks (unless from obvious incorrect working) SCB1 for an answer of $\frac{669}{1000}$ oe eg 0.66(9) or 66(.9)%	$\frac{51}{76}$		A1	oe eg 0.67(1…) or 67(.1…)%
					Total 3 marks

22	eg $x^2+3(x+2)+(x+2)^2=7$	eg $(y-2)^2+3y+y^2=7$		5	M1	for substitution of $y=x+2$ (or $x=\pm y\pm 2$) into $x^2+3y+y^2=7$ to obtain an equation in x only (or y only)
	eg $2x^2+7x+3(=0)$ $2x^2+7x=-3$	eg $2y^2-y-3(=0)$ $2y^2-y=3$			M1ft	dep on previous M1 for multiplying out and collecting terms, forming a three term quadratic in any form of $ax^2 + bx + c$ (= 0) where at least 2 coefficients (a or b or c) are correct
	eg $(2x+1)(x+3)(=0)$ or $x=\dfrac{-7\pm\sqrt{(7)^2-4\times2\times3}}{2\times2}$ or $\left(x+\dfrac{7}{4}\right)^2-\left(\dfrac{7}{4}\right)^2=-\dfrac{3}{2}$ $\left(x=-\dfrac{1}{2}\text{ and }x=-3\right)$	eg $(y+1)(2y-3)(=0)$ or $y=\dfrac{-(-1)\pm\sqrt{(-1)^2-4\times2\times-3}}{2\times2}$ or $\left(y-\dfrac{1}{4}\right)^2-\left(\dfrac{1}{4}\right)^2=\dfrac{3}{2}$ $\left(y=-1\text{ and }y=\dfrac{3}{2}\right)$			M1ft	dep on first M1 method to solve **their** 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\dfrac{-7\pm\sqrt{49-24}}{4}$ **or** $\dfrac{1\pm\sqrt{1+24}}{4}$ **or** if factorising allow brackets which expanded give 2 out of 3 terms correct) **or** correct values for x **or** correct values for y
	$y="-\dfrac{1}{2}"+2\left(=\dfrac{3}{2}\right)$ **and** $y="-3"+2(=-1)$	$x="-1"-2(=-3)$ **and** $x="\dfrac{3}{2}"-2\left(=-\dfrac{1}{2}\right)$			M1ft	dep on previous M1 for substituting **their** 2 found values of x or y into one of the two given equations **or** fully correct values for the other variable (correct labels for x / y) **or** for one correct pair of values
	Working required		$x=-\dfrac{1}{2}\text{ and }y=\dfrac{3}{2}$ $x=-3\text{ and }y=-1$		A1	oe dep on M2 (allow coordinates)
						Total 5 marks

If they find the values of y but think they are the values of x then the maximum mark is 3

23	(a)		$-12\mathbf{a} + 8\mathbf{b}$	1	B1	oe
	(b)	$\left(\overrightarrow{PR} =\right) 6\mathbf{a} + 3("-12\mathbf{a} + 8\mathbf{b}")\left(= -30\mathbf{a} + 24\mathbf{b}\right)$ oe **or** $\left(\overrightarrow{RP} =\right) -3("-12\mathbf{a} + 8\mathbf{b}") - 6\mathbf{a}\left(= 30\mathbf{a} - 24\mathbf{b}\right)$		4	M1	for method to find $\overrightarrow{PR}$ **or** $\overrightarrow{RP}$, ft their $\overrightarrow{AB}$
		$\left(\overrightarrow{PQ} =\right) -6\mathbf{a} + n\mathbf{b}$ oe eg $\left(\overrightarrow{PQ} =\right) -6\mathbf{a} + m \times 8\mathbf{b}$ **or** $\left(\overrightarrow{OQ} =\right)$ 6**a** + k("$-30\mathbf{a} + 24\mathbf{b}$") **or** $\left(\overrightarrow{AQ} =\right) -12\mathbf{a} + n\mathbf{b}$			M1	for method to find $\overrightarrow{PQ}$ **or** $\overrightarrow{OQ}$ **or** $\overrightarrow{AQ}$
		$\overrightarrow{PQ} = \lambda\overrightarrow{PR}$ eg $-6\mathbf{a} + n\mathbf{b} = \lambda("-30\mathbf{a} + 24\mathbf{b}")$ **or** $-6 = -30\lambda$ oe **or** $\lambda = \frac{1}{5}$ oe **OR** $\mu\overrightarrow{PQ} = \overrightarrow{PR}$ eg $\mu(-6\mathbf{a} + n\mathbf{b}) = "-30\mathbf{a} + 24\mathbf{b}"$ **or** $-6\mu = -30$ oe **or** $\mu = 5$ **OR** $\overrightarrow{OQ} = \overrightarrow{OP} + k\overrightarrow{PR}$ eg $n\mathbf{b}$ = 6**a** + k("$-30\mathbf{a}$ + 24**b**") **or** 0 = 6 – 30k or $k = \frac{1}{5}$ oe **OR** $\overrightarrow{AQ} = \overrightarrow{AR} + x\overrightarrow{RP}$ eg $-12\mathbf{a} + n\mathbf{b} = 3("-12\mathbf{a} + 8\mathbf{b}") + x("30\mathbf{a} - 24\mathbf{b}")$ **or** $-36 + 30x = -12$ **or** $x = \frac{4}{5}$ oe			M1	for setting up an equation to find the value of the unknown coefficient(s)
		Working required	4.8		A1	oe eg $\frac{24}{5}$, dep on M1
						Total 5 marks

24	$123 = a + (20 - 1)d$ **or** $123 = a + 19d$			5	M1	for using $U_n = a + (n-1)d$
	$2880 = \frac{30}{2}(2a + (30-1)d)$ **or** $2880 = \frac{30}{2}(2a + 29d)$ **or** $192 = 2a + 29d$				M1	for using $S_n = \frac{n}{2}(2a + (n-1)d)$
	eg $192 = 2a + 29d$ $123 = a + 19d$ (× 2) $246 = 2a + 38d$ Subtracting $54 = 9d$ **or** $192 = 2(123 - 19d) + 29d$ oe **or** $d = 6$	eg $192 = 2a + 29d$ (× 19) $123 = a + 19d$ (× 29) $3648 = 38a + 551d$ $3567 = 29a + 551d$ Subtracting $81 = 9a$ **or** $192 = 2a + 29\left(\frac{123 - a}{19}\right)$ oe **or** $a = 9$			M1	(dep on M2) for a correct method to find a or d: coefficients of a or d the same in correct equations **and** correct operator to eliminate selected variable resulting in an equation in a only or in d only **or** writing a or d in terms of the other variable and correctly substituting (condone missing brackets)
	eg $192 = 2a + 29$("6") oe **or** $123 = a + 19$("6") oe	eg $192 = 2$("9") $+ 29d$ oe **or** $123 =$ "9" $+ 19d$ oe			M1	(dep on M3) for substituting their found value of a or d into a correct equation
	Working required		$a = 9$ $d = 6$		A1	dep on M2 a and d must be clearly identified
						Total 5 marks

25	$\left(\frac{4+8}{2}, \frac{7-5}{2}\right)$ oe or (6, 1)		5	M1	for finding the midpoint of *PR*
	$\frac{7--5}{4-8}\left(=-\frac{12}{4}=-3\right)$ oe			M1	for method to find the gradient of *PR*
	$"-3"\times m=-1$ oe or $(m=)\frac{-1}{"-3"}$ or $(m=)\frac{1}{3}$			M1ft	for finding the gradient of *QS*, may be seen embedded in an equation, ft their gradient of *PR*
	$"1"="\frac{1}{3}"("6")+c$ oe or $c = -1$ **or** $y-1=\frac{1}{3}(x-6)$ **or** $y=\frac{1}{3}x-1$			M1ft	(dep on previous M1) for finding the equation through *QS*, ft their gradient of *PR* and their midpoint of *PR*, do not allow (4, 7) or (8, –5) as midpoint *PR*
	Correct answer scores full marks (unless from obvious incorrect working)	$3y = x - 3$		A1	oe eg $6y = 2x - 6$ or $3y - x + 3 = 0$ etc but must be integer coefficients accept $a = 3$, $b = 1$, $c = -3$
					Total 5 marks