Mark Scheme (Results)

Summer 2019

Pearson Edexcel International GCSE
In Mathematics A (4MA1)
Paper 2H

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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, then mark the method that gains the lowest marks, 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.

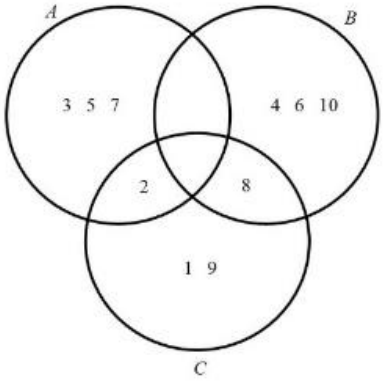
- **Parts of questions**

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

Question		Working	Answer	Mark	Notes
Apart from questions 9, 16, 20, 23 (where the mark scheme states otherwise) the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method					
1		95 × 8 + 105 × 12 + 115 × 15 + 125 × 10 + 135 × 3 (= 5400) **or** 760 + 1260 + 1725 + 1250 + 405 (= 5400)			M2 for at least **4** correct products added (need not be evaluated) **or** If not M2 then award M1 for consistent use of value within interval (including end points) for at least **4** products which must be added **or** correct midpoints used for at least **4** products and not added
		'5400' ÷ '48'			M1 dep on at least M1 Allow division by their Σ*f* provided addition or total under column seen
			112.5	4	A1 oe accept 112 **or** 113 from complete working Accept 112.5 with no working Do not accept 112 **or** 113 with no working
					Total 4 marks

2		Two pairs of intersecting arcs with equal radius centre D and E			M1 for 2 pairs of arcs that intersect within guidelines **or** correct perpendicular bisector without arcs.

			Correct bisector with arcs	2	A1
					Total 2 marks

3	(a)	**Examples** There are no members that are in both *A* and *B* No members in common (in *A* and *B*) No numbers the same (in *A* and *B*) *B* has even numbers. *A* has odd numbers except 2 which is not in *B* Nothing in *A* is in *B* oe No overlap A and B don't share any numbers	Correct statement	1	B1 for a statement which indicates correct meanings for intersection and empty set
	(b)		1 and 9	1	B1
	(c)	e.g.  	1, 2, 8, 9	2	B2 for fully correct (B1 for 3 or 4 correct with no more than one addition or a fully correct Venn diagram)

					Total 4 marks

4		$\pi \times 7^2 \times 20$ (= 3078.76…) **or** 980π			M1 for complete method to find volume
			3080	2	A1 for answer in range 3077.2 − 3080
					Total 2 marks
5	(a)	4 × 120 (= 480)			M1
		e.g. 120 ÷ 2 × 5 (= 300) **or** 120 × 0.4 × 7 (= 336) **or** (120 – '60' – '48') × 8 (= 96) **or** 120 × 0.1 × 8 (= 96)			M1 for a method to find the income for one of the selling prices
		e.g. (120 ÷ 2 × 5) + (120 × 0.4 × 7) + ((120 – '60' – '48') × 8) (= 732) **or** (120 ÷ 2 × 5) + (120 × 0.4 × 7) + (120 × 0.1 × 8) (= 732) **or** '300' + '336' + '96' (= 732)			M1 for a complete method to find the total income
		e.g. $\frac{'732' - '480'}{'480'} \times 100$ **or** '252' ÷ '480' × 100 **or** $\left(\frac{'732'}{'480'} \times 100\right) - 100$ or 152.5 – 100 **or** $\left(\frac{'732'}{'480'} - 1\right) \times 100$ or 0.525 × 100			M1 for a complete method to find the percentage profit
			52.5	5	A1 accept 53
	(b)	e.g. 1 + 0.2 (= 1.2) **or** 100(%) + 20(%) (= 120(%)) **or**			M1

		$\frac{15}{120}$ (= 0.125) oe			
		e.g. 15 ÷ 1.2 **or** 15 ÷ 120 × 100 **or** 15 × 100 ÷ 120			M1 dep
			12.5(0)	3	A1 accept (£)12.5, (£)12.50p, 1250p if the £ sign is crossed out
					Total 8 marks

5 ALT	(a)	4 × 120 (= 480)			M1
		e.g. 120 ÷ 2 × 1 (= 60) **or** 120 × 0.4 × 3 (= 144) **or** (120 – '60' – '48') × 4 (= 48) **or** 120 × 0.1 × 4 (= 48)			M1 for a method to find the profit of one of the books
		e.g. (120 ÷ 2 × 1) + (120 × 0.4 × 3) + ((120 – '60' – '48') × 4) (= 252) **or** (120 ÷ 2 × 1) + (120 × 0.4 × 3) + (120 × 0.1 × 4) (= 252) **or** '60' + '144' + '48' (= 252)			M1 for a complete method to find the total profit
		'252' ÷ '480' × 100 oe			M1 for a complete method to find the percentage profit
			52.5	5	A1 accept 53
	(b)	e.g. 1 + 0.2 (= 1.2) **or** 100(%) + 20(%) (= 120(%)) **or** $\frac{15}{120}$ (= 0.125) oe			M1
		e.g. 15 ÷ 1.2 **or** 15 ÷ 120 × 100 **or** 15 × 100 ÷ 120			M1 dep
			12.5(0)	3	A1 accept (£)12.5, (£)12.50p, 1250p if the £ sign is crossed out
					Total 8 marks

6	(a)	$\frac{15}{6}$ **or** $\frac{6}{15}$ **or** $\frac{4.2}{6}$ **or** $\frac{6}{4.2}$ oe 2.5 **or** 0.4 **or** 0.7 **or** 1.4(2857.....)			M1 for a correct scale factor, accept ratio notation eg 6 : 15
			10.5	2	A1 oe
	(b)	19.5 ÷ 2.5 **or** 19.5 × 0.4 oe **or** $4.2\times\frac{19.5}{(a)}$			M1 If using *DF* ft their answer from part (a)
			7.8	2	A1 oe
					Total 4 marks

7		e.g. 30 × 26.8 (= 804) **or** 13 × 25 (= 325) **or** (26.8 – 25) × 30 **or** 1.8 × 30			M1 for finding the total marks for the boys or the total test marks
		e.g. (30 × 26.8 − 13 × 25) ÷ (30 – 13) (= 28.1764...) **or** ('804' – '325') ÷ (30 – 13) (= 28.1764...) **or** ('804' – '325' ÷ 17) (= 28.1764...) **or** ((26.8 – 25) × 30) ÷ 17 + 25 (= 28.1764...) **or** '1.8' × 30 ÷ 17 + 25 (= 28.1764...)			M1 for a complete method to find the mean mark for the girls
			28.2	3	A1 accept 28.15 – 28.2 (accept without working) (Accept 28 from complete working)
					Total 3 marks

8		(x) × 1000 **or** (x) ÷ 60 **or** (x) ÷ 60 ÷ 60 **or** (x) × 1000 ÷ 60 oe			M1 for at least **one** of × 1000 **or** ÷ 60 **or** $\frac{5}{18}$ oe
		$x \times \frac{1000}{60 \times 60}$ oe			M1 (dep) for a complete correct method
			$\frac{5}{18}x$	3	A1 accept $0.27\dot{x}$ **or** $0.2\bar{7}x$ **or** $\frac{x}{3.6}$ **or** $\frac{1}{3.6}x$
					Total 3 marks

Using elimination then substitution						
9		e.g. $x + 2y = -0.5$ $+ \ 6x - 2y = \ 32$ $(7x = 31.5)$	e.g. $3x + 6y = -1.5$ $- \ 3x - y = \ 16$ $(7y = -17.5)$			M1 for a correct method to eliminate x or y: coefficients of x or y the same **and** correct operation to eliminate selected variable (condone any one arithmetic error)
		e.g. '4.5' + $2y = -0.5$ **or** $3 \times$ '4.5' $- y = 16$	e.g. $x + 2 \times$ '−2.5' = −0.5 **or** $3x -$ '−2.5' = 16			M1 (dep) for substituting their value found of one variable into one of the equations **or** for repeating above method to find second variable
				$x = 4.5$ $y = -2.5$	3	A1 (dep on first M1) for both solutions
						Total 3 marks

Using substitution						
9		$3(-0.5 - 2y) - y = 16$ $(7y = -17.5)$ **or** $\frac{16+y}{3} + 2y = -0.5$ $(7y = -17.5)$	$3x - \left(\frac{-0.5-x}{2}\right) = 16$ $(7x = 31.5)$ **or** $x + 2(3x - 16) = -0.5$ $(7x = 31.5)$			M1 for correctly writing x or y in terms of the other variable and correctly substituting
		e.g. $x = -0.5 - 2'-2.5'$ or $x = \frac{16 + '-2.5'}{3}$	e.g. $y = \frac{-0.5 - '4.5'}{2}$ or $y = 3'4.5' - 16$			M1 (dep) for substituting their value found of one variable into one of the equations
				$x = 4.5$ $y = -2.5$	3	A1 (dep on first M1) for both solutions
						Total 3 marks

10	(a)		$y = 5x - 3$ oe	2	B2 fully correct equation eg $y = 5x + -3$ or $y - -3 = 5(x - 0)$ If not B2 then B1 for $y = 5x$ or $y = 5x + a$ or $y = bx - 3$ or (L=) $5x - 3$
	(b)	$x \geq 0$, $x \leq 2$, $y \geq 1$, $y \leq 3$ or	$0 \leq x \leq 2$ $1 \leq y \leq 3$	2	B2 fully correct oe (B1 for 2 or 3 out of 4 inequalities correct) (Treat double−ended inequalities as two separate inequalities) (SC B2 $y > 3$, $y < 1$, $x < 0$, $x > 2$) Accept <, ≤, > and ≥ throughout
					Total 4 marks

11	(a)	$\pm(7.7 \times 10^4 - 9.5 \times 10^3)$ **or** $\pm(7.7 \times 10^4 - 0.95 \times 10^4)$ **or** ±(77 000 – 9 500) **or** ±67 500 oe			M1 for clearly subtracting the correct values
			6.75×10^4	2	A1 allow -6.75×10^4 allow $\pm 6.8 \times 10^4$
	(b)	$(8.3 \times 10^3) \times 50$ (= 415 000 or 4.15×10^5) **or** $(4.2 \times 10^4) \div 50$ (= 840 or 8.4×10^2) **or** $(4.2 \times 10^4) \div (8.3 \times 10^3)$ (= 5(.060…))			M1 for a relevant calculation
			No supported by correct comparable figures in the same form	2	A1 for NO **and** 415 000 and 42 000 **or** NO **and** 4.15×10^5 NO **and** 840 and 8 300 **or** NO **and** 8.4×10^2 NO **and** 5(.060…)
	(c)	1.15 × 0.92 (= 1.058) oe **or** 105.8 $\frac{n \times 1.15 \times 0.92}{n}$ where *n* is a number or variable e.g. $\frac{200 \times 1.15 \times 0.92}{200}$			M1 condone $x \times 1.15 \times 0.92$ oe
			5.8	2	A1 NB. −5.8 (M1A0) decrease of 5.8% (M1A0)

					Total 6 marks

12		$(ED=)\frac{16.7}{\tan 43}$ (=17.90855...) **or** $(CD=)\frac{16.7}{\sin 43}$ (= 24.48686...)			M1 for a correct method to find length *CD* or *ED* (*E* is the point on line *AD* from where a vertical line is drawn downwards from point *C*) NB. Sine rule may be used
		$(ED=)\frac{16.7}{\tan 43}$ (=17.90855...) **and** $(CD=)\frac{16.7}{\sin 43}$ (= 24.48686...)			M1 for a correct method to find both *CD* **and** *ED* **or** use of Pythagoras theorem $(CD=)\sqrt{16.7^2+'17.90....'^2}$ (= 24.48686...) $(ED=)\sqrt{'24.48....'^2-16.7^2}$ (=17.90855...) NB. Sine rule must be in the correct form to give the answer
		16.7 + 21.2 × 2 + '24.5' + '17.9' (= 101.495...)			M1 (dep on M2) complete method with no extra sides
			101	4	A1 accept 101 – 102
					Total 4 marks

13	(a)		7, 17, 29, 48, 66, 80	1	B1 cao
	(b)				M1 ft from (a) if only one addition error for at least 4 points plotted correctly at end of interval **or** for all 6 points plotted consistently within each interval in the frequency table at the correct height
			Correct cf graph	2	A1 accept curve or line segments accept curve that is not joined to (0,0)
	(c)		17 − 19	1	B1 ft from a cumulative frequency graph dep on M1 in (b)
	(d)	For correct use 20 and 60 (20.25 and 60.75) indicated (horizontal line or mark) on the cumulative frequency axis and their readings taken from time taken axis e.g. readings of 11−13 and 22−24 indicated on horizontal axis or 23 − 12			M1 for a complete method to ft from a cumulative frequency graph dep on M1 in (b)
			9 – 13	2	A1 accept 9 – 13 ft from a cumulative frequency graph dep on M1 in (b)
					Total 6 marks

14					M2 for $\sqrt{5^2+(-12)^2}$ **or** $\sqrt{(-5)^2+12^2}$ **or** $\sqrt{5^2+12^2}$ If not M2 then M1 for $\begin{pmatrix}6\\-9\end{pmatrix}-\begin{pmatrix}1\\3\end{pmatrix}$ or $\begin{pmatrix}6\\-9\end{pmatrix}+\begin{pmatrix}-1\\-3\end{pmatrix}(=\begin{pmatrix}5\\-12\end{pmatrix})$ **or** or $\begin{pmatrix}1\\3\end{pmatrix}-\begin{pmatrix}6\\-9\end{pmatrix}$ or $\begin{pmatrix}1\\3\end{pmatrix}+\begin{pmatrix}-6\\9\end{pmatrix}(=\begin{pmatrix}-5\\12\end{pmatrix})$
			13	3	A1
					Total 3 marks

15		$y^2=\frac{3x-2}{x+1}$			M1 squaring both sides to get a correct equation
		$xy^2 + y^2 = 3x - 2$ oe			M1 for multiplying by the denominator **and** expanding the bracket
		$y^2 + 2 = x(3 - y^2)$ oe			M1 for isolating terms in x **and** factorising the correct expression of the equation
			$x=\frac{2+y^2}{3-y^2}$	4	A1 accept $x=\frac{-2-y^2}{y^2-3}$ oe
					Total 4 marks

16		$\frac{4+\sqrt{8}}{\sqrt{2}-1}\times\frac{\left(\sqrt{2}+1\right)}{\left(\sqrt{2}+1\right)}$			M1 for rationalising the denominator by multiplying numerator and denominator by $\sqrt{2}+1$ (or $-\sqrt{2}-1$) condone missing brackets
		e,g, $\frac{4\sqrt{2}+4+\sqrt{8}\sqrt{2}+\sqrt{8}}{2-1}$ **or** $\frac{4\sqrt{2}+4+4+\sqrt{8}}{2-1}$ **or** $\frac{4\sqrt{2}+4+\sqrt{16}+\sqrt{8}}{2-1}$ **or** $= 4\sqrt{2}+4+4+\sqrt{8}$ oe			M1 (dep) for expansion of numerator with at least 3 terms correct oe Using $-\sqrt{2}-1$ e.g. $\frac{-4\sqrt{2}-4-\sqrt{8}\sqrt{2}-\sqrt{8}}{-2+1}$ **or** $\frac{-4\sqrt{2}-4-4-\sqrt{8}}{-2+1}$ **or** $\frac{-4\sqrt{2}-4-\sqrt{16}-\sqrt{8}}{-2+1}$
			$8+6\sqrt{2}$	3	A1 (dep on M2) or for stating $a = 8$ and $b = 6$
					Total 3 marks

17	(a)	$y = kx^3$ **or** $ky = x^3$			M1 (NB. Not for $y = x^3$) Constant of proportionality must be a symbol such as k	M2 for $20h = k \times h^3$ oe
		$20h = k \times h^3$ oe			M1 substitution of x and y into a correct formula	
			$y = \frac{20x^3}{h^2}$	3	A1 for $y = \frac{20x^3}{h^2}$ oe Award 3 marks if answer is $y = kx^3$ and $k = \frac{20}{h^2}$ oe is seen in part (a) or in part (b)	
	(b)	$\sqrt[3]{67.5h \div '\frac{20}{h^2}'}$ oe			M1 ft, dep on at least M1 in part (a), complete method to find x	
			$1.5h$	2	A1 accept $\frac{3}{2}h$ or $\frac{3h}{2}$	
						Total 5 marks

18		x^2 oe **or** $x(12 - 3x)$ oe			M1 for finding an expression for the area of **one** face
		$x^2 + x^2 + 48x - 12x^2$ $(= 48x - 10x^2)$			M1 for a complete expression for A (**6** sides) with brackets expanded
		'48 – 20x' = 0	'−10'[(x – '2.4')^2 – '2.4'^{2}] oe		M1 for differentiating a correct expression for A (allow 1 error) **and** equating to zero **or** completing the square
		(x = 2.4) 48 × '2.4' – 10 × '2.4'^{2}	'−10' × − '2.4'^{2} or '−10' × − '5.76'		M1 ft if previous M1 awarded for isolating x and substituting into A **or** finding max value of A from completing the square
			57.6	5	A1 accept 58 from correct working
					Total 5 marks

19		250 = 0.5 × 26 × *AC* × sin(39) oe			M1 for using the area formula correctly If this mark is awarded then ft on the remaining M marks
		(*AC*=) 30.5(5579...) or 30.6			A1
		$\frac{(AB)}{\sin 47} = \frac{'30.56'}{\sin 95}$ oe **or** $\frac{(BC)}{\sin(180-95-47)} = \frac{'30.56'}{\sin 95}$ oe			M1 dep on M1 for correct substitution into sine rule
		$(AB =) \frac{'30.56'}{\sin 95} \times \sin 47$ (= 22.4(3407...)) **or** $(BC =) \frac{'30.56'}{\sin 95} \times \sin(180-95-47)$ (= 18.8(8524...))			M1 (dep on previous M marks) for a correct method to find a missing length **or** sight of values in the ranges 22.39 – 22.47 for *AB* 18.8 – 18.92 for *BC*
		250 + 0.5 × '30.56' × '22.43' × sin(180 – 95 – 47) (= 461.03....) **or** 250 + 0.5 × '30.56' × '18.88' × sin(47) (= 461.03....)			M1 for a complete method to find total area
			461	6	A1 accept 461 - 462
					Total 6 marks

20		$x^2 - 3x(9 - x) + 2(9 - x)^2$ (= 0)	$(9 - y)^2 - 3y(9 - y) + 2y^2$ (= 0)			M1 substitution of linear equation into quadratic
		e.g. $6x^2 - 63x + 162$ (= 0) **or** $2x^2 - 21x + 54$ (= 0) allow $2x^2 - 21x = -54$ oe	e.g. $6y^2 - 45y + 81$ (= 0) **or** $2y^2 - 15y + 27$ (= 0) allow $2y^2 - 15y = -27$ oe			A1 (dep on M1) writing the correct quadratic expression in form $ax^2 + bx + c$ (= 0) allow $ax^2 + bx = c$
		e.g. $(2x - 9)(x - 6)$ (= 0) $x = \frac{-(-21) \pm \sqrt{(-21)^2 - 4\times2\times54}}{2\times2}$ e.g. $2\left(\left(x - \frac{21}{4}\right)^2 - \left(\frac{21}{4}\right)^2\right) = -54$	e.g. $(2y - 9)(y - 3)$ (= 0) $y = \frac{-(-15) \pm \sqrt{(-15)^2 - 4\times2\times27}}{2\times2}$ e.g. $2\left(\left(x - \frac{15}{4}\right)^2 - \left(\frac{15}{4}\right)^2\right) = -27$			M1 (dep on M1) for a complete method to solve their 3-term quadratic equation (allow one sign error and some simplification – allow as far as $\frac{21 \pm \sqrt{441 - 432}}{4}$)
		$x = 4.5$ and $x = 6$	$y = 4.5$ and $y = 3$			A1 (dep on M1) both x-values **or** both y-values
				(4.5, 4.5) and (6, 3)	5	A1 (dep on M1) oe Must be paired correctly
						Total 5 marks

20 Alt		$(x - y)(x - 2y)$ (= 0)			M1 for a method to factorise **C**
		$(x - (9 - x))(x - 2(9 - x))$ (= 0)	$(9 - y - y)(9 - y - 2y)$ (= 0)		A1 (dep M1) substitution of **L** into their factorised **C**
		$(2x - 9)(3x - 18)$ (= 0) oe	$(9 - 2y)(9 - 3y)$ (= 0) oe		M1 (dep on M1)
		$x = 4.5$ and $x = 6$	$y = 4.5$ and $y = 3$		A1 (dep on M1) both x-values **or** both y-values
			(4.5, 4.5) and (6, 3)	5	A1 (dep on M1) oe Must be paired correctly
					Total 5 marks

21		e.g. (*AC* =) $\sqrt{(4x)^2 + (2x)^2}$ (= $\sqrt{20}x$) **or** (*AC* =) $\sqrt{(4)^2 + (2)^2}$ (= $\sqrt{20}$) **or** (*AF* =) $\sqrt{(4)^2 + (2)^2 + (3)^2}$ (= $\sqrt{29}$) **or** (*AF* =) $\sqrt{(\sqrt{20})^2 + (3)^2}$ (= $\sqrt{29}$) **or**			M1 for a method to find an expression for length *AC* or length *AF* with or without *x* **or** *x* can represent any number e.g. *AB* : *BC* : *CF* = 2 : 1 : 1.5 $AC^2 = \sqrt{2^2 + 1^2}\left(= \sqrt{5}\right)$
		e.g. (*CAF* =) $\tan^{-1}\left(\frac{3x}{'\sqrt{20}x'}\right)$ (= 33.854...) or (*CAF* =) $\tan^{-1}\left(\frac{3}{'\sqrt{20}'}\right)$ (= 33.854...) or (*CAF* =) $\cos^{-1}\left(\frac{'\sqrt{20}'}{'\sqrt{29}'}\right)$ (= 33.854...) or (*CAF* =) $\sin^{-1}\left(\frac{3}{'\sqrt{29}'}\right)$ (= 33.854...)			M1 for a complete method to find angle *CAF* using length *AC* **or** for a complete method to find angle *CAF* using length *AF* with or without *x* or *x* can represent any number *AB* : *BC* : *CF* = 2 : 1 : 1.5 (*CAF* =) $\tan^{-1}\left(\frac{1.5}{'\sqrt{5}'}\right)$ (= 33.854...)
			33.9°	3	A1 answers in the range 33.85 – 33.9
					Total 3 marks

22		$x(2x + 5)(3x - 1)$ or $(2x + 5)(3x^2 - x)$ or $(2x + 5)(2x - 5)$ oe			M1 for a correct factorisation of the numerator into 2 or 3 factors where one of the factors must be $(2x + 5)$ **or** denominator into 2 brackets where one of the factors must be $(2x + 5)$
		$x(2x + 5)(3x - 1)$ or $(2x + 5)(3x^2 - x)$ **and** $(2x + 5)(2x - 5)$ oe			M1 for a correct factorisation of the numerator into 2 or 3 factors where one of the factors must be $(2x + 5)$ **and** denominator into 2 brackets where one of the factors must be $(2x + 5)$
			$\frac{x(3x-1)}{2x-5}$	3	A1 accept $\frac{3x^2-x}{2x-5}$ oe Do not ISW
					Total 3 marks

23		**RG and GR method**	**RR and GG method**			
		$\frac{3}{t}\times\frac{t-3}{t-1}$ **or** $\frac{t-3}{t}\times\frac{3}{t-1}$	$\frac{3}{t}\times\frac{2}{t-1}$ **or** $\frac{t-3}{t}\times\frac{t-4}{t-1}$			M1 for one correct product
		$\frac{3}{t}\times\frac{t-3}{t-1}+$ $\frac{t-3}{t}\times\frac{3}{t-1}=\frac{12}{35}$ **or** $2\times\frac{3}{t}\times\frac{t-3}{t-1}=\frac{12}{35}$ oe	$\frac{3}{t}\times\frac{2}{t-1}+$ $\frac{t-3}{t}\times\frac{t-4}{t-1}=\frac{23}{35}$			M1 dep on M1 for a correct equation
		e.g. $2t^2 - 37t + 105 (= 0)$ **or** allow $2t^2 - 37t = -105$				A1 (dep on M2) writing the correct quadratic expression in form $ax^2 + bx + c$ (= 0) allow $ax^2 + bx = c$
		e.g. $(2t - 7)(t - 15) = 0$ e.g. $t = \frac{-(-37)\pm\sqrt{(-37)^2 - 4\times2\times105}}{2\times2}$ e.g. $2\left(\left(t-\frac{37}{4}\right)^2-\left(\frac{37}{4}\right)^2\right)=-105$				M1 (dep on A1) for a complete method to solve the 3-term quadratic equation (allow one sign error and some simplification – allow as far as $\frac{37\pm\sqrt{1369-840}}{4}$) **or** Can be implied by answers of 15 (and $\frac{7}{2}$)
				12	5	A1 (dep on A1) cao
						Total 5 marks

23 Alt		**RG and GR method**	**RR and GG method**			
		$\frac{3}{x+3}\times\frac{x}{x+2}$ **or** $\frac{x}{x+3}\times\frac{3}{x+2}$	$\frac{3}{x+3}\times\frac{2}{x+2}$ or $\frac{x}{x+3}\times\frac{x-1}{x+2}$			M1 for one correct product
		$\frac{3}{x+3}\times\frac{x}{x+2}+\frac{x}{x+3}\times\frac{3}{x+2}=\frac{12}{35}$ **or** $2\times\frac{3}{x+3}\times\frac{x}{x+2}=\frac{12}{35}$ oe	$\frac{3}{x+3}\times\frac{2}{x+2}+\frac{x}{x+3}\times\frac{x-1}{x+2}=\frac{23}{35}$			M1 dep on M1 for a correct equation
		e.g. $2x^2 - 25x + 12 (= 0)$ **or** allow $2x^2 - 25x = -12$				A1 (dep on M2) writing the correct quadratic expression in form $ax^2 + bx + c$ (= 0) allow $ax^2 + bx = c$
		e.g. $(2x - 1)(x - 12) = 0$ e.g. $x = \frac{-(-25)\pm\sqrt{(-25)^2 - 4\times2\times12}}{2\times2}$ e.g. $2\left(\left(x-\frac{25}{4}\right)^2-\left(\frac{25}{4}\right)^2\right)=-12$				M1 (dep on A1) for a complete method to solve the 3-term quadratic equation (allow one sign error and some simplification – allow as far as $\frac{25\pm\sqrt{625-96}}{4}$) **or** can be implied by answers of 12 (and $\frac{1}{2}$)
				12	5	A1 (dep on A1) cao

				Total 5 marks

24	(a)		13	1	B1
	(b)	$y = 2\left(x^2 - 10x\right) + 9$ **or** $y = 2\left(x^2 - 10x + \frac{9}{2}\right)$			M1 for a correct equation for a first step in order to complete the square
		e.g. $y = 2\left(\left(x-5\right)^2 - 5^2\right) + 9$ **or** $y = 2\left(\left(x-5\right)^2 - 5^2 + \frac{9}{2}\right)$ **or** $y = 2\left(x-5\right)^2 - 41$ oe			M1 dep
		$\left(x-5\right)^2 = \frac{y+41}{2}$ oe			M1
			$5 + \sqrt{\frac{x+41}{2}}$	4	A1 oe
					Total 5 marks
Note: Allow candidates to swap *x* and *y* when finding the inverse					

24 Alt	(a)		13	1	B1
	(b)	$2x^2 - 20x + (9 - y) = 0$			M1 for a correct first step
		$x = \frac{20 \pm \sqrt{400 - 8(9 - y)}}{4}$ **or** $x = \frac{20 + \sqrt{400 - 8(9 - y)}}{4}$			M1 dep
		$x = 5 \pm \sqrt{\frac{41 + y}{2}}$ oe			M1
			$5 + \sqrt{\frac{x + 41}{2}}$	4	A1 oe
					Total 5 marks
Note: Allow candidates to swap *x* and *y* when finding the inverse					

24 Alt	(a)		13	1	B1
	(b)	$2x^2-20x+(9-y)(=0)$			M1 for a correct first step
		e.g. $2\left((x-5)^2-5^2\right)+9-y$ (= 0) **or** $2\left((x-5)^2-5^2+\frac{9}{2}\right)-y$ (= 0) **or** $2(x-5)^2-41-y$ (= 0)			M1 dep
		$(x-5)^2=\frac{y+41}{2}$ oe			M1
			$5+\sqrt{\frac{x+41}{2}}$	4	A1 oe
					Total 5 marks
Note: Allow candidates to swap *x* and *y* when finding the inverse					

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