

1	$30 + 4x + 10 + x + 20 (= 5x + 60)$ or $180 - 30 (=150)$		4	M1 Allow $5x + 60 = n$ where $n \neq 180$ or for subtracting 30 from 180	M2 for $5x + 30 = 150$ oe
	e.g. $30 + 4x + 10 + x + 20 = 180$ or $5x + 60 = 180$ oe or $180 - 30 - 10 - 20 (=120)$			M1 for setting up the equation or for subtracting all numerical values of angles from 180	
	$5x = '120'$ or $'120' \div 5$			M1 for correctly simplifying to $ax = b$ or for dividing '120' by 5	
		24		A1 for 24	
				Total 4 marks	

2	(a)		x^7	1	B1
	(b)	eg $7^8 \times 7^4 = 7^{12}$ or $7^8 \div 7^3 = 7^5$ or $7^5 \times 7^4 = 7^9$ or $7^4 \div 7^3 = 7$ or $7^8 \times 7 = 7^{12}$ or $7^{12} \div 7^3 = 7^{12-3}$		2	M1 for one correct step – must be written as a power of 7
			7^9		A1 for 7^9
					Total 3 marks

3	(a)	$m^2 - 8m + 5m - 40$		2	M1 for any 3 correct terms or for 4 out of 4 correct terms ignoring signs or for $m^2 - 3m \dots$ or for $\dots - 3m - 40$
			$m^2 - 3m - 40$		A1
					Total 2 marks

4		$12 \times 9 (=108) \text{ or } (9 - 6) \times x (= 3x)$		4	M1 for one correct relevant area
		E.g. $129 - '108' (= 21) \text{ or } '108' + '3x' = 129$			M1 (dep on M1) for 129 used correctly with another area or for a correct equation (ft) with bracket(s) expanded
		E.g. $'21' \div (9 - 6) \text{ or } x = \frac{129 - '108'}{9 - 6}$			M1 for a complete method
			7		A1 Accept 7 cm
					Total 4 marks

5	$\frac{14}{3}(+)\frac{19}{5} \text{ or } (4)\frac{10}{15}(+)(3)\frac{12}{15} \text{ or } (4)\frac{10a}{15a}(+)(3)\frac{12a}{15a}$		3	M1 for correct improper fractions or fractional part of numbers written correctly over a common denominator
	eg $\frac{14 \times 5 + 19 \times 3}{3 \times 5} \text{ or } \frac{70}{15} + \frac{57}{15} \text{ or } \frac{70a}{15a} + \frac{57a}{15a} \text{ or } 4\frac{10}{15} + 3\frac{12}{15} = 7\frac{22}{15}$ oe			M1 for correct fractions with a common denominator of 15 or a multiple of 15
	$\frac{70}{15} + \frac{57}{15} = \frac{127}{15} = 8\frac{7}{15} \text{ or } 7\frac{22}{15} = 8\frac{7}{15}$ or if shows $8\frac{7}{15} = \frac{127}{15}$ at the beginning then show that the addition comes to $\frac{127}{15}$	Shown		A1 dep on M2 for a correct answer from fully correct working or shows that $\text{RHS} = \frac{127}{15} \text{ and fully correct working}$ shows LHS = $\frac{127}{15}$
				Total 3 marks

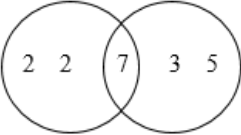
6		E.g. $6x - 15$ or $12x - 30$ oe		4	M1 for expansion of a correct bracket
		$2 \times 3(2x - 5) = 9 - x$ oe or $2(6x - 15) = 9 - x$ oe or $3(2x - 5) = \frac{9}{2} - \frac{x}{2}$ oe			M1 for removal of fraction or separating fraction (RHS) in an equation
		$12x + x = 9 + 30$ oe or $6x + \frac{x}{2} = \frac{9}{2} + 15$ oe			M1 ft (dep on 4 terms) for terms in x on one side of equation; number terms on the other
			3		A1 dep on at least M2 awarded
					Total 4 marks

7			$5y(1 + 4y)$	2	B2 If not B2 then award B1 for $5(y + 4y^2)$ or $y(5 + 20y)$ or $5y(a + 4y)$ where a is an integer and $a \neq 0$ or $5y(1 + by)$ where b is an integer and $b \neq 0$
					Total 2 marks

8		$2x > 4 - 7$ or $x + 3.5 > 2$		2	M1 For a correct first step allow $2x = 4 - 7$ or $x + 3.5 = 2$ or an answer of $x = -1.5$ or $x < -1.5$ or -1.5
			$x > -1.5$		A1 for $x > -1.5$ oe
					Total 2 marks

9	$(x \pm 8)(x \pm 5)$	$\frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 1 \times (-40)}}{2 \times 1}$ or $\frac{3 \pm \sqrt{9+160}}{2}$			M1 or $(x + a)(x + b)$ where $ab = -40$ or $a + b = -5$ OR correct substitution into quadratic formula (condone one sign error in a , b or c and missing brackets) (if + rather than $\pm$ shown then award M1 only unless recovered with answers)
	$(x - 8)(x + 5)$	$\frac{3 \pm \sqrt{169}}{2} \text{ or } \frac{3 \pm 13}{2}$			M1 $\frac{3 \pm \sqrt{169}}{2}$ or $\frac{3 \pm 13}{2}$
			8, -5	3	A1 dep on at least M1 for correct values
					Total 3 marks

10		$(2x + 5)(x + 1) = 2x^2 + 2x + 5x + 5$ $(= 2x^2 + 7x + 5)$ or $(x + 1)(3 - x) = -x^2 + 3x - x + 3$ $(= -x^2 + 2x + 3)$ or $(3 - x)(2x + 5) = -2x^2 + 6x - 5x + 15$ $(= -2x^2 + x + 15)$		3	M1 for multiplying out two brackets correctly at least 3 terms correct	M2 for at least 4 terms correct out of a maximum of 8 terms $6x^2 - 2x^3 + 6x - 2x^2 + 15x - 5x^2 + 15 - 5x$
		E.g. $[(2x^2 + 7x + 5)(3 - x) =]$ $-2x^3 - 7x^2 - 5x + 6x^2 + 21x + 15$ or $[(-x^2 + 2x + 3)(2x + 5) =]$ $-2x^3 - 5x^2 + 10x + 4x^2 + 6x + 15$ or $[(-2x^2 + x + 15)(x + 1) =]$ $-2x^3 - 2x^2 + 15x + x^2 + x + 15$			M1 for at least 3 terms correct out of a maximum of 6 terms or for at least 4 terms correct out of a maximum of 8 terms	
			Shown		A1	
						Total 3 marks

11		28, 56, 84, 112... and 105, 210, 315, 420... or 2, 2, 7 and 3, 5, 7 or  or $\frac{28 \times 105}{7}$ or 2, 2, 3, 5, 7 oe		2	M1 for any correct valid method e.g. for starting to list at least four multiples of each number or 2, 2, 7 and 3, 5, 7 seen (may be in a factor tree and ignore 1) or a fully correct Venn diagram
			420		A1 cao
					Total 2 marks

12	(a)		4.35	1	B1 accept 4.349
	(b)		4.25	1	B1 cao
					Total 2 marks

13			Trapezium with vertices at (6, 3) (8, 3) (8, 6) (4, 6)	2	B2 If not B2 then award B1 for shape of correct size and orientation or 3 or 4 points plotted correctly
					Total 2 marks

14		Fully correct angle bisector with all relevant arcs shown	2	B2	Fully correct angle bisector with all arcs shown. B1 for all arcs and no angle bisector drawn or for a correct angle bisector within guidelines but not arcs or insufficient arcs
					Total 2 marks

15	(a)	E.g. $56 - 38$		2	M1 for subtracting readings from 60 and 20 oe
			18		A1 for answer in the range 17 – 19
	(b)	[40.5, 43]		3	B1
		'42' $\div$ 0.6 oe			M1 for complete method to find the number of men
			70		A1
					Total 5 marks

16			1	1	B1
					Total 1 mark

17	$y^2 = \frac{x+1}{x-4}$		4	M1	for squaring
	$y^2(x-4) = x+1$ or $y^2x - 4y^2 = x+1$			M1	for removing the fraction
	$y^2x - x = 4y^2 + 1$ or $-4y^2 - 1 = x - y^2x$ or $x(y^2 - 1) = 4y^2 + 1$ or $-4y^2 - 1 = x(1 - y^2)$			M1	for expanding the bracket and rearranging for x so that the terms in x are on one side of the correct equation
		$x = \frac{4y^2 + 1}{y^2 - 1}$		A1	for $x = \frac{4y^2 + 1}{y^2 - 1}$ or $x = \frac{-4y^2 - 1}{1 - y^2}$ (need to see $x =$ somewhere)
					Total 4 marks

18	$6 \times 6 + 6 \times 2\sqrt{12} + 6 \times 2\sqrt{12} + (2 \times \sqrt{12})^2$ or $36 + 12\sqrt{12} + 12\sqrt{12} + 4\sqrt{12}\sqrt{12}$ or $36 + 12\sqrt{12} + 12\sqrt{12} + (4 \times 12)$ or $36 + 24\sqrt{3} + 24\sqrt{3} + 48$ or $36 + 2 \times 24\sqrt{3} + 48$ or $36 + 6 \times 2 \times 2\sqrt{12} + 48$		3	M1 for correct expansion of brackets showing four terms (need not be simplified) or for the use of $(a + b)^2 = a^2 + 2ab + b^2$ or for showing or stating $\sqrt{12} = 2\sqrt{3}$ oe
	$84 + 48\sqrt{3}$			M1 (dep on M1)
		Shown		A1 for fully correct working leading to given expression
				Total 3 marks

19		C, B, E	3	B3 for all 3 correct (B2 for 2 correct) (B1 for 1 correct)
				Total 3 marks

20		E.g. $\left(\frac{3a^4}{t^5}\right)^{-2}$ or $\left(\frac{t^{15}}{27a^{12}}\right)^{\frac{2}{3}}$ or $\left(\frac{729a^{24}}{t^{30}}\right)^{-\frac{1}{3}}$		3	M1 for one of cube rooting or inverting or squaring or $\frac{ka^{-8}}{t^{-10}}$ where k is an integer $\neq 0$
		E.g. $\left(\frac{9a^8}{t^{10}}\right)^{-1}$ or $\frac{3^{-2}a^{-8}}{t^{-10}}$ or $\frac{1}{9}a^{-8}$ or $\left(\frac{t^5}{3a^4}\right)^2$ or $\left(\frac{t^{30}}{729a^{24}}\right)^{\frac{1}{3}}$ or $\frac{a^{-8}}{9t^{-10}}$			M1 for two of cube rooting or inverting or squaring or $\frac{t^{10}}{ka^8}$ where k is an integer $\neq 0$
			$\frac{t^{10}}{9a^8}$		A1 Allow $\frac{t^{10}a^{-8}}{9}$ or $\frac{1}{9}t^{10}a^{-8}$
					Total 6 marks

21			$x \geq -1$ oe $x + y \leq 4$ oe $y \geq \frac{1}{3}x - 2$ oe	3	B3 for all 3 correct inequalities (B2 for two correct inequalities B1 for one correct inequality) (SC B3 for $x \leq -1$, $x + y \geq 4$ and $y \leq \frac{1}{3}x - 2$ oe) (If no marks gained B1 for understanding of equation $x + y = 4$ e.g. $y > 4 - x$) Accept < for $\leq$ and > for $\geq$ throughout
					Total 3 marks

22	32.4×100^3		2	M1 for 32.4×100^3 oe
		32 400 000		A1 for 32 400 000 accept 3.24×10^7
				Total 2 marks

23	$x^2 + (x+2)^2 - 2(x+2) = 24$		5	M1	for substituting linear equation into the quadratic equation
	$2x^2 + 2x - 24 (=0)$ or $x^2 + x - 12 (=0)$ or $2x^2 + 2x = 24$ or $x^2 + x = 12$			A1	for a correct equation in the form $ax^2 + bx + c = 0$ or $ax^2 + bx = -c$
	$(x+4)(x-3) (=0)$ or $x = \frac{-1 \pm \sqrt{1^2 - (4 \times 1 \times -12)}}{2 \times 1}$ or $\left(x - \frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2 - 12 = 0$			M1ft	dep on M1 for solving their quadratic equation using any correct method (allow one sign error and some simplification – allow as far as $\frac{-1 \pm \sqrt{1+48}}{2}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct)
	$x = -4$ and $x = 3$			A1	for both x values dep on M1
	$(-4, -2)$ and $(3, 5)$	$(-4, -2)$ and $(3, 5)$		A1	for both solutions dep on M1
Alternative mark scheme for 23					
	$(y-2)^2 + y^2 - 2y = 24$		5	M1	for substituting linear equation into the quadratic equation
	$2y^2 - 6y - 20 (=0)$ or $y^2 - 3y - 10 (=0)$ $2y^2 - 6y = 20$ or $y^2 - 3y = 10$			A1	for a correct equation in the form $ay^2 + by + c = 0$ or $ay^2 + by = -c$
	$(y-5)(y+2) = 0$ or $y = \frac{- -3 \pm \sqrt{(-3)^2 - (4 \times 1 \times -10)}}{2 \times 1}$ or $\left(y - \frac{3}{2}\right)^2 - \left(\frac{3}{2}\right)^2 - 10 = 0$			M1ft	dep on M1 for solving their quadratic equation using any correct method (allow one sign error and some simplification – allow as far as $\frac{3 \pm \sqrt{9+40}}{2}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct
	$y = 5$ and $y = -2$			A1	for both y values dep on M1
	$(-4, -2)$ and $(3, 5)$	$(-4, -2)$ and $(3, 5)$		A1	for both solutions dep on M1
					Total 5 marks

24	$\overrightarrow{PM} = -\frac{3}{2}\mathbf{a} - \frac{3}{4}\mathbf{b} + 4\mathbf{a} + \frac{1}{2}(2\mathbf{b} - 4\mathbf{a}) \left(= \frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b} \right)$ $\overrightarrow{AM} = 4\mathbf{a} + \frac{1}{2}(2\mathbf{b} - 4\mathbf{a}) (= 2\mathbf{a} + \mathbf{b})$ $\overrightarrow{AM} = 2\mathbf{b} + \frac{1}{2}(4\mathbf{a} - 2\mathbf{b}) (= 2\mathbf{a} + \mathbf{b})$ $\overrightarrow{MA} = \frac{1}{2}(2\mathbf{b} - 4\mathbf{a}) - 2\mathbf{b} (= -2\mathbf{a} - \mathbf{b})$ $\overrightarrow{MA} = \frac{1}{2}(4\mathbf{a} - 2\mathbf{b}) - 4\mathbf{a} (= -2\mathbf{a} - \mathbf{b})$		3	M1 for finding $\overrightarrow{PM}$ or $\overrightarrow{AM}$ or $\overrightarrow{MA}$
	$(AP : PM =) \left \frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b} \right : \left \frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b} \right \text{ oe}$ $(AP : AM =) \left \frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b} \right : 2\mathbf{a} + \mathbf{b} (= 3 : 4) \text{ oe } (AM : PM =) 2\mathbf{a} + \mathbf{b} : \left \frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b} \right (= 4 : 1) \text{ oe}$ $AP = 3PM \text{ oe eg } \frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b} = 3\left(\frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b}\right) \text{ oe}$ $AM = \frac{4}{3}AP \text{ oe}$ $AM = 4PM \text{ oe}$			M1 For use of a correct ratio or fraction linking AP and PM or AP and AM or AM and PM (in either order) vectors must be in form $p\mathbf{a} + q\mathbf{b}$
		3 : 1		A1
				Total 3 marks

25	$\frac{4(2x-3)-3(2x-5)}{(2x-5)(2x-3)}$ or $\frac{8x-12-6x+15}{(2x-5)(2x-3)}$ oe		4	M1 Writing 1st fraction as a fraction over a common denominator (can be 2 separate fractions)
	$x(3-2x)(3+2x)$ or $(3x-1)(2x-5)$			M1 Complete factorisation of numerator or denominator of 2nd fraction
	$\frac{2x+3}{(2x-5)(2x-3)} \times \frac{(3x-1)(2x-5)}{x(3-2x)(3+2x)}$			M1 may be partially simplified
		$\frac{3x-1}{x(2x-3)(3-2x)}$		A1 e.g. $\frac{3x-1}{x(2x-3)(3-2x)}$ or $\frac{1-3x}{x(2x-3)^2}$ or $\frac{3x-1}{x(12x-9-4x^2)}$ or $\frac{3x-1}{(12x^2-9x-4x^3)}$ oe isw for incorrect denominator expansion
				Total 4 marks

26	$\frac{18}{\sqrt{7}+1} \times \frac{\sqrt{7}-1}{\sqrt{7}-1}$		3	M1 for $\frac{18}{\sqrt{7}+1} \times \frac{\sqrt{7}-1}{\sqrt{7}-1}$
	eg $\frac{18(\sqrt{7}-1)}{7-1}$			M1 Dep on M1 for a correct numerator and multiplying out the denominator to $7-1$ or 6
	$3\sqrt{7}-3$	$3\sqrt{7}-3$		A1 Dep on M2 Allow $3(\sqrt{7}-1)$
				Total 3 marks

27	e.g. $n^2 - (n-1)^2$ or $(n+1)^2 - n^2$		3	M1 for setting up a correct algebraic expression (any letter can be used)
	e.g. $n^2 - n^2 + 2n - 1$ or $n^2 + 2n + 1 - n^2$			M1 Correct expansion of brackets and correct signs or a correct result
		e.g. $2n - 1$ is always odd		A1 dep on M2 for eg $2n - 1$ or $2n + 1$ or $-(2n + 1)$ oe and a suitable conclusion SCB1 for eg $(2n)^2 - (2n - 1)^2$ or $(2n + 1)^2 - (2n)^2$ oe
				Total 3 marks

Practice Papers Set 12 – 1H						Edexcel averages: scores of candidates who achieved grade:							
Qn	Paper	Question	Skill tested	Max score	Mean %	ALL	9	8	7	6	5	4	3
1	2H	Q04	Angles, lines and triangles	4	81	3.24	3.99	3.97	3.94	3.72	3.32	2.36	1.53
2	2H	Q01	Powers and roots	3	89	2.68	2.97	2.97	2.93	2.83	2.66	2.50	2.20
3	1H	Q07a	Algebraic manipulation	2	89	1.78	1.99	1.97	1.95	1.90	1.88	1.64	1.36
4	1H	Q03	Mensuration of 2D shapes	4	81	3.23	3.99	3.95	3.90	3.70	3.41	2.36	1.64
5	2H	Q03	Fractions	3	84	2.51	2.95	2.90	2.83	2.69	2.57	2.04	1.73
6	1H	Q07d	Linear equations	4	79	3.15	3.96	3.92	3.77	3.48	2.86	2.32	1.92
7	1H	Q07b	Algebraic manipulation	2	76	1.51	1.98	1.93	1.79	1.62	1.38	1.15	0.79
8	2H	Q07a	Inequalities	2	79	1.57	1.96	1.89	1.79	1.71	1.43	1.31	1.11
9	2H	Q07b	Quadratic equations	3	69	2.08	2.94	2.87	2.66	2.20	1.74	1.25	0.70
10	1H	Q15a	Algebraic manipulation	3	64	1.91	2.96	2.91	2.59	2.12	1.42	0.73	0.34
11	1H	Q02	Applying number	2	71	1.42	1.91	1.77	1.58	1.41	1.24	1.05	1.01
12	1HR	Q11ab	Degree of accuracy	2	156	1.56	1.94	1.83	1.55	1.39	1.20	0.73	0.44
13	1H	Q08	Transformation geometry	2	63	1.26	1.93	1.81	1.51	1.34	1.05	0.69	0.44
14	2H	Q05	Construction	2	58	1.16	1.86	1.60	1.36	1.18	0.88	0.70	0.41
15	1H	Q12	Graphical representation of data	5	53	2.67	4.68	3.91	3.27	2.70	1.93	1.19	0.72
16	1H	Q07c	Powers and roots	1	57	0.57	0.90	0.76	0.64	0.57	0.47	0.34	0.27
17	2H	Q16	Expressions and formulae	4	50	2.01	3.83	3.28	2.50	1.77	1.12	0.70	0.45
18	1H	Q17a	Applying number	3	44	1.33	2.77	2.43	1.72	0.95	0.57	0.30	0.13
19	2H	Q15	Graphs	3	46	1.39	2.66	2.06	1.42	1.07	0.90	0.70	0.66
20	1H	Q17b	Powers and roots	3	38	1.13	2.51	1.97	1.32	0.79	0.47	0.33	0.17
21	1H	Q10	Inequalities	3	35	1.04	2.65	1.99	1.26	0.58	0.22	0.09	0.05
22	2H	Q02	Measures	2	32	0.64	1.67	1.15	0.66	0.42	0.17	0.10	0.04
23	2H	Q22	Quadratic equations	5	32	1.59	4.49	2.96	1.57	0.83	0.36	0.11	0.09
24	2H	Q23	Vectors	3	31	0.94	2.74	1.74	0.90	0.43	0.22	0.09	0.06
25	2H	Q24	Algebraic manipulation	4	25	0.98	2.60	1.62	1.01	0.56	0.37	0.22	0.09
26	2H	Q20	Applying number	3	24	0.73	2.44	1.42	0.57	0.19	0.08	0.02	0.00
27	2H	Q17	Algebraic manipulation	3	20	0.60	2.14	1.17	0.35	0.11	0.08	0.01	0.01
			TOTAL	80	56	44.68	73.41	62.75	51.34	42.26	34.00	25.03	18.36

Suggested grade boundaries

Grade	9	8	7	6	5	4	3
Mark	68	57	47	38	29	21	17