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' ÷ 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 $7^5 \times 7^4$ or $7^4 \div 7^3 = 7$ or $7^8 \times 7$ 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 $m^2 - 3m$ … **or** for …– $3m - 40$
			$m^2 - 3m - 40$		A1
					Total 2 marks

4		12×9 (=108) **or** $(9 - 6) \times x$ (= $3x$)		4	M1 for one correct relevant area
		E.g. 129 – '108' (= 21) **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' ÷ (9 – 6) **or** $x = \frac{129 - '108'}{9 - 6}$			M1 for a complete method
			7		A1 Accept 7 cm
					Total 4 marks

5	$\frac{14}{3}(+)\frac{19}{5}$ or $(4)\frac{10}{15}(+)(3)\frac{12}{15}$ 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 $\frac{14\times5+19\times3}{3\times5}$ or $\frac{70}{15}+\frac{57}{15}$ or $\frac{70a}{15a}+\frac{57a}{15a}$ 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
	$\frac{70}{15}+\frac{57}{15}=\frac{127}{15}=8\frac{7}{15}$ 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 RHS = $\frac{127}{15}$ **and** fully correct working shows LHS = $\frac{127}{15}$
					Total 3 marks

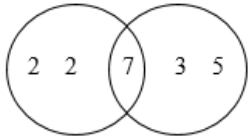
6		E.g. $6x-15$ or $12x-30$ oe		4	M1 for expansion of a correct bracket
		$2 \times 3(2x-5) = 9-x$ oe **or** $2(\text{'}6x-15\text{'}) = 9-x$ oe **or** $3(2x-5) = \frac{9}{2}-\frac{x}{2}$ oe			M1 for removal of fraction **or** separating fraction (RHS) in an equation
		$12x+x = 9+30$ oe **or** $6x+\frac{x}{2} = \frac{9}{2}+15$ 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 ± shown then award M1 only unless recovered with answers)
	$(x - 8)(x + 5)$	$\frac{3 \pm \sqrt{169}}{2}$ **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** $\frac{28\times105}{7}$ **or** 2, 2, 3, 5, 7 oe		2	M1for 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 $4.34\dot{9}$
	(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' ÷ 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		$6\times6+6\times2\sqrt{12}+6\times2\sqrt{12}+\left(2\times\sqrt{12}\right)^2$ or $36+12\sqrt{12}+12\sqrt{12}+4\sqrt{12}\sqrt{12}$ or $36+12\sqrt{12}+12\sqrt{12}+\left(4\times12\right)$ or $36+24\sqrt{3}+24\sqrt{3}+48$ or $36+2\times24\sqrt{3}+48$ or $36+6\times2\times2\sqrt{12}+48$		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 $\frac{\frac{1}{9}a^{-8}}{t^{-10}}$ 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 ≤ and > for ≥ 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 $x=\frac{-1\pm\sqrt{1^2-(4\times1\times-12)}}{2\times1}$ 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 $y=\frac{--3\pm\sqrt{(-3)^2-(4\times1\times-10)}}{2\times1}$ 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 $\overrightarrow{MA}$
	$(AP : PM =)\left\lvert\frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b}\right\rvert : \left\lvert\frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b}\right\rvert$ oe $(AP : AM =)\left\lvert\frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b}\right\rvert : \lvert 2\mathbf{a} + \mathbf{b}\rvert (= 3 : 4)$ oe $(AM : PM =)\lvert 2\mathbf{a} + \mathbf{b}\rvert : \left\lvert\frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b}\right\rvert (=$ 4 : 1) oe $AP = 3PM$ oe eg $\frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b} = 3(\frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b})$ oe $AM = \frac{4}{3}AP$ oe $AM = 4PM$ 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 $3\left(\sqrt{7}-1\right)$
					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