1(a)	$\dfrac{30}{x}\times 60[=]\dfrac{1800}{x}$		**1**	e.g. $\dfrac{30\times 60}{x}[=]\dfrac{1800}{x}$ or $\dfrac{30}{\left(\dfrac{x}{60}\right)}[=]\dfrac{1800}{x}$
1(b)	$\dfrac{600}{x-25}-\dfrac{1800}{x}=8$		**M1**	or $\dfrac{600}{x-25}=\dfrac{1800}{x}+8$ or $\dfrac{600}{x-25}-8=\dfrac{1800}{x}$
	$600x-1800x+45000=8x^2-200x$ or better		**M1**	**Strict FT** correct elimination of fractions and brackets
	Correct rearrangement to $x^2+125x-5625=0$		**A1**	**A0** if any errors or omissions in working
1(c)	$\dfrac{-125\pm\sqrt{125^2-4\times(-5625)}}{2\times 1}$ oe or $-62.5\pm\sqrt{9531.25}$		**B2**	**B1** for $\sqrt{125^2-4\times(-5625)}$ oe or $\dfrac{-125\pm\sqrt{their\,38125}}{2\times 1}$ or $(x+62.5)^2$
	$35.1,\ -160.1$		**B1**	
2a	$\dfrac{x}{12}\times\dfrac{x-1}{11}=\dfrac{14}{33}$	**M1**		
	$x^2-x-56=0$ oe Alternative: $x(x-1)=56$ cao	**A1**		
	$(x-8)(x+7)\ [=0]$ or $[x=]\ \dfrac{-(-1)\pm\sqrt{(-1)^2-4\times 1\times -56}}{2\times 1}$ Alternative: $8(8-1)=56$ soi	**M1**	Dep on M1 **FT** factorisation/use of formula for *their* 3-term quadratic	
3(a)	$[W=]\ x+5$ $[L=]\ 2(x+5)$ oe final answers		**2**	**B1** for $[W=]\ x+5$ or **B1FT** for $[L=]\ 2\times their$ algebraicW
3(b)	$(x+5)\times 2(x+5)\ +\ 2\big(x\times(x+5)\big)$ $+\ 2\big(x\times 2(x+5)\big)$ oe		**M2**	**FT** *their* algebraic expressions in x for length and width **B1FT** for two different areas seen e.g. two of $(x+5)\times 2(x+5)$, $x(x+5)$, $x\times 2(x+5)$ or $2((x+5)\times 2(x+5)+x(x+5)+x\times 2(x+5))$
	$2x^2+20x+50+2x^2+10x+4x^2+20x=210$		**M1**	Set equal to 210 and expansion of brackets. Must have three different areas from width and length of form $ax+b$, a and $b\neq 0$
	Correct simplification to $4x^2+25x-80=0$		**A1**	

3(c)	$\dfrac{-25 \pm \sqrt{25^2 - 4 \times 4 \times -80}}{2 \times 4}$ oe or $\dfrac{-25}{8} \pm \sqrt{\left(\dfrac{25}{8}\right)^2 - \dfrac{-80}{4}}$	**B2**	**B1** for $\sqrt{25^2 - 4 \times 4 \times -80}$ oe or $\dfrac{-25 \pm [...]}{2 \times 4}$ oe or $\left(x + \dfrac{25}{8}\right)^2$
	2.33 and –8.58	**B1**	
4(a)(i)	$\dfrac{12 \times 60}{x}$ oe	**1**	
4(a)(ii)	$\dfrac{8 \times 60}{x - 1.5}$ oe	**1**	After 0 in (i) and (ii), **SC1** for $\dfrac{8}{x - 1.5}$ <u>and</u> (a)(i) $\dfrac{12}{x}$
4(a)(iii)	$\dfrac{720}{x} + \dfrac{480}{x - 1.5} = 110$ oe	**M1**	**FT** *their* (a)(i) and (a)(ii) if functions of x
	$\dfrac{720(x - 1.5) + 480x}{x(x - 1.5)} = 110$ or $720(x - 1.5) + 480x = 110x(x - 1.5)$	**M1**	**Dep** on equation of form $\dfrac{c}{px} + \dfrac{d}{qx + r} = e$ where p, q, r, c, d and e are numeric and non zero, AND either correctly uses a common denominator for *their* fractions or correctly removes *their* fractions
	$720x - 1080 + 480x = 110x^2 - 165x$	**A1**	Correct elimination of correct brackets
	With a minimum of one intermediate step establishes $22x^2 - 273x + 216 = 0$	**A1**	
4(a)(iv)	$\dfrac{-(-273) \pm \sqrt{(-273)^2 - 4 \times 22 \times 216}}{2 \times 22}$ or $\dfrac{273}{44} \pm \sqrt{\left(\dfrac{273}{44}\right)^2 - \left(\dfrac{216}{22}\right)}$	**B2**	**B1** for $\sqrt{(-273)^2 - 4 \times 22 \times 216}$ or for $\dfrac{-(-273) \pm \sqrt{their\,55521}}{2 \times 22}$ or for $\left(x - \dfrac{273}{44}\right)^2$
	11.56 and 0.85 cao	**B1**	
5	$\dfrac{v}{2v + 3}$ final answer nfww	**3**	**B1** for $v(v - 8)$ seen **B1** for $(2v + 3)(v - 8)$ seen

6(a)	$3x^2 + 16x - 460 = 0$ correctly derived	**4**	
			B1 for $(x+4)(3x+4)$ oe **and**
			M1 for expanding brackets and collecting like terms **and**
			M1 for *their* area = 476 **and**
			A1 for correct simplification leading to $3x^2 + 16x - 460 = 0$
6(b)	10 and $-\dfrac{46}{3}$ oe (-15.3)	**3**	
			B2 for $(x-10)(3x+46)$ **Or**
			M1 for such as $(x+a)(3x+b)$ with $ab = -460$ or $3a + b = 16$
			A1FT for solutions from their factors
6(c) .	[Height =] 14 [Length =] 34	**2FT**	
			B1FT for either, or for **both** correct but in the wrong places
7	–4 or 1.5 oe	**3**	
			B1 for $2x^2 + 5x - 12$ [= 0] **and**
			M1 for $(2x - 3)(x + 4)$ [= 0]
			OR
			M1 for FT factorising their 3-term quadratic equation
			Or for correct FT substitution into formula oe
			and
			A1FT for solutions from their quadratic equation
8(b) (i)	$(PQ =) \dfrac{17}{x+5}$	**1**	
(ii)	$3x^2 + 15x - 85$ (=0) oe shown	**3**	M1 for $(AB =)$their$(PQ) + 3$ and
			M1 for (their$(PQ + 3) \times x = 17$ or

(iii)	3.38 −8.38	**3**	B1 for $\sqrt{15^2 - 4 \times 3 \times (-85)}$ soi and
			B1 for $\dfrac{-15 \pm \sqrt{their\,1245}}{2 \times 3}$ soi and
			M1 for both real values of $\dfrac{p \pm \sqrt{q}}{r}$
(iv)	20.8	**2ft**	M1 for their(*PQ*) and *x* + 5 evaluated using *x* = the positive root from (b)(iii). or for their perimeter in algebraic form

9	**(i)**	EITHER Width = $\dfrac{18 - 4x}{2}$ oe	OR Width = $\dfrac{10}{2x}$ oe	**M1**	
		$\dfrac{18 - 4x}{2} \times 2x = 10$ oe	$4x + \dfrac{20}{2x} = 18$ oe	**A1**	isw
	(ii)	3.85 and 0.65 cao		**3**	**B2** for 3.850 to 3.851 and 0.649 to 0.650 or one correct answer or 3.9 and 0.6 Or if in form $\dfrac{p \pm \sqrt{q}}{r}$ or $\dfrac{p + \sqrt{q}}{r}$ or $\dfrac{p - \sqrt{q}}{r}$ **B1** for *p* = 9 and *r* = 4 or *q* = 41
	(iii)	6.35 to 6.45 or – 6.45 to – 6.35 oe		**1**	

| **10** | **(a)** | **(i)** | –4.62 –2.38 final answer | **2** | **B1** for one value
SC1 for both –4.6 and –2.4 |
| | | **(ii)** | (*B* =) 7 (*C* =) 11 | **3** | **M1** for $(x + \dfrac{7}{2})^2 = \dfrac{5}{4}$ and

B1 for one correct value |

11	**(c)**	**(i)**	$h^2 + (h + 7)^2 = 23^2$ leading to correct rearrangement	2	**M1** for $h^2 + (h + 7)^2 = 23^2$
		(ii)	$\dfrac{h}{2}(h + 7)$ oe isw	1	
		(iii)	120 cao	1	
		(iv)	12.4, –19.4	3	**B2** for one correct solution, or for 12.38 to 12.40 and –19.38 to –19.40 Or if in form $\dfrac{p \pm \sqrt{q}}{r}$, **B1** for *p* = –7 and *r* = 2 and **B1** for *q* = 1009 or $\sqrt{q}$ = 31.7 to 31.8
		(v)	54.76 to 54.8	1FT	

12(a) (i) $\dfrac{320}{x}$ isw **1**

(ii) $2x^2 + 5x - 20 \ (= 0)$ correctly found **3** **M2** for *their* $\dfrac{320}{x} - $ *their* $\dfrac{320}{x+2\frac{1}{2}} = 80$ oe

M2 for *their* $\dfrac{320}{x} - $ *their* $\dfrac{320}{x+2\frac{1}{2}} = -80$ oe

SC1 after 0 for $\dfrac{320}{x+2\frac{1}{2}}$ seen.

(iii) 2.15 -4.65 **3** **B1** for $\sqrt{5^2 - 4 \times 2 \times (-20)}$ soi and

B1 for $\dfrac{-5 \pm \sqrt{their\,185}}{2 \times 2}$ soi

If **B1** or **B0** at this stage, allow **M1** for both

values of $\dfrac{p \pm \sqrt{q}}{r}$

(iv) 69 **2** **M1** for $\dfrac{320}{their + ve \ x + 2.5}$ oe

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13 **(a) (i)** $40 - x$ **1**

(ii) $(y =)\ 2x^2 - 80x + 1600$ correctly obtained **2** **M1** for ½ × x × **(b)(i)** or $\sqrt{(40-x)^2} + x^2$ seen

(b) (i) $x^2 - 40x + 250 = 0$ **1**

(ii) 7.8   32.2 **3** **B2** for 7.8 and 32.2 or better or
B1 for $\sqrt{(-40)^2 - 4 \times 1 \times 250}$ soi and

B1 for $\dfrac{-(-40) \pm \sqrt{their\,600}}{2 \times 1}$ soi and

After **B0 B1**, allow **SC1** for a correct ft for both roots or **B1** for one correct solution or both 8 and 32.