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)	$(x+5) \times 2(x+5) + 2(x \times (x+5))$ $\qquad + 2(x \times 2(x+5))$ 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)	$\dfrac{-25\pm\sqrt{25^2-4\times4\times-80}}{2\times4}$ oe or $\dfrac{-25}{8}\pm\sqrt{\left(\dfrac{25}{8}\right)^2-\dfrac{-80}{4}}$	B2	**B1** for $\sqrt{25^2-4\times4\times-80}$ oe or $\dfrac{-25\pm[...]}{2\times4}$ oe or $\left(x+\dfrac{25}{8}\right)^2$
	2.33 and –8.58	B1	
4(a)(i)	$\dfrac{12\times60}{x}$ oe	1	
4(a)(ii)	$\dfrac{8\times60}{x-1.5}$ 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)	$\dfrac{-(-273)\pm\sqrt{(-273)^2-4\times22\times216}}{2\times22}$ or $\dfrac{273}{44}\pm\sqrt{\left(\dfrac{273}{44}\right)^2-\left(\dfrac{216}{22}\right)}$	B2	**B1** for $\sqrt{(-273)^2-4\times22\times216}$ or for $\dfrac{-(-273)\pm\sqrt{their\,55521}}{2\times22}$ 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 $\frac{1}{2} \times x \times$ **(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.