WARM-UP CALC

Total read $= (\text{warmup period} \times \text{warmup temp}) + (\text{steady period} \times \text{target temp})$

$\text{warm-up temp} = \frac{(\text{target temp} + \text{current temp})}{2}$

$\text{warm-up period} = \frac{(\text{target temp} - \text{current temp})}{\text{warm-up rate}}$

Total read $\rightarrow h$; Target temp $\rightarrow x$;
Start temp $\rightarrow s$; warm-up rate $\rightarrow w$

$$h = \frac{x-s}{w} \times \frac{x+s}{2} + x\left(p - \frac{(x-s)}{w}\right)$$

$$= \frac{x^2-s^2}{2w} + xp - \frac{x^2-sx}{w}$$

$$= \frac{x^2-s^2}{2w} + xp - \frac{2x^2+2sx}{2w}$$

$$\therefore 2hw = x^2 - s^2 + 2xwp - 2x^2 + 2sx$$

$$\Rightarrow = -x^2 + 2sx + 2xwp - 2hw - s^2$$

$$= -x^2 + 2x(swp) - 2hw - s^2$$

$$\therefore -x^2 + 2(swp)x - 2hw - s^2 = \phi$$

$$\therefore x = \frac{-2(swp) \pm \sqrt{2(swp)^2 - 4(2hw+s^2)}}{-2}$$

→

$$x = s+up \pm \frac{\sqrt{4(s+up)^2 - 8hw - 4s^2}}{-2}$$

$$x = s+up \pm \sqrt{(s+up)^2 - 2hw - s^2}$$

The -ve root seems to be the one we need here.