

7a i) ~~The series~~ The series has a limiting sum because ~~the~~ each term becomes progressively smaller ~~but~~ (≤ 1) but is still > 0 .

$$\text{ii) } S_{\infty} = \frac{1}{\sqrt{5}-3}$$

$$= \frac{1}{\sqrt{5}-3} \times \frac{\sqrt{5}+3}{\sqrt{5}+3}$$

$$= \frac{\sqrt{5}+3}{5-9} = \frac{\sqrt{5}+3}{-4}$$

$$\text{b i) } t=0; \quad V = 25(1-t)^2$$
$$\boxed{V=25}$$

$$\text{ii) } \frac{25}{4} = 25\left(1 - \frac{t}{60}\right)^2$$

$$1 - \frac{2t}{60} + \frac{t^2}{3600} = \frac{1}{4}$$

$$t^2 - 120t + 2700 = 0$$

$$t^2 - 30t - 90t + 2700 = 0$$

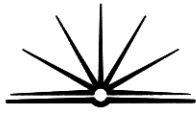
$$t(t-30) - 90(t-30) = 0$$

$$(t-30)(t-90) = 0$$

$$\begin{aligned} P &= 2700 \\ S &= 120 \\ F &= 30, 90 \end{aligned}$$

$$\therefore t = 30, 90$$

~~at~~ cooler is $\frac{1}{4}$ full at 30 seconds



$$\text{iii) } \frac{dV}{dt} = \frac{-50}{60} \left(1 - \frac{t}{60}\right)^2$$
$$= \frac{-5}{6} \left(1 - \frac{t}{60}\right)$$

$$\text{at } t = 30,$$

$$\frac{dV}{dt} = \frac{-5}{6} \left(1 - \frac{1}{2}\right)$$

$$\boxed{= \frac{-5}{12}}$$

(i) The probability of getting ~~two~~ ~~socks~~ matching socks is:

$$P(RR) + P(WW) + P(YY) + P(BB)$$

$$= \frac{\binom{4}{8} + \binom{4}{2}}{\binom{4}{56}} = \frac{50625}{9834496}$$