

$$\frac{dP}{dt} = 2\sqrt{Pt} \Rightarrow dP/\sqrt{P} = 2\sqrt{t} dt \Rightarrow \int P^{-1/2} dP = 2 \int t^{1/2} dt \Rightarrow$$

$$2P^{1/2} = \frac{4}{3}t^{3/2} + C.$$

$$P(1) = 5 \Rightarrow 2\sqrt{5} = \frac{4}{3} + C \Rightarrow C = 2\sqrt{5} - \frac{4}{3}, \text{ so } 2P^{1/2} = \frac{4}{3}t^{3/2} + 2\sqrt{5} - \frac{4}{3}$$

$$\Rightarrow \sqrt{P} = \frac{2}{3}t^{3/2} + \sqrt{5} - \frac{2}{3} \Rightarrow P = \left(\frac{2}{3}t^{3/2} + \sqrt{5} - \frac{2}{3}\right)^2.$$