Calculus Worksheet: Motion Problems (1)

A particle moving along a straight line has an acceleration $a = 4t$. When $t = 0$, the velocity v of the particle and its position s are respectively equal to 3 and 4. Find its position s as a function of time t.

$$V(t) = \int a\,dt = \int (4t)\,dt = 4\frac{t^2}{2} + C.$$

$$V(0) = 3 \Rightarrow 4(0) + C = 3 \Rightarrow \underline{C = 3}.$$

$$V(t) = 2t^2 + 3.$$

$$S(t) = \int (2t^2 + 3)\,dt = 2 \cdot \frac{t^3}{3} + 3t + K.$$

$$S(0) = 4 \Rightarrow 2 \cdot (0) + 3(0) + K = 4$$

$$\Rightarrow \underline{K = 4}.$$

$$S(t) = \frac{2}{3}t^3 + 3t + 4$$