9

a. $x = \int v\,dt$

$= \int (3t^2 - 12t + 5)\,dt$

$= t^3 - 6t^2 + 5t + c$

$x = t^3 - 6t^2 + 5t$

$t(t^2 - 6t + 5)$

$t(t^2 - t - 5t + 5) = 0$

$t(t(t-1) - 5(t-1)) = 0$

$t((t-5)(t-1)) = 0$

$t = 0, 1 \text{ or } 5$

When $t = 2$:

$x = 2^3 - 6(2)^2 + 5(2)$

$= -6$

When $t = 3$:

$x = 3^3 - 6(3)^2 + 5(3)$

$= -12$

∴ Distance travelled by P in the interval $2 \le t \le 3 = 6m$.

10. $v = \int a\,dt$

$= \int (4t - 3)\,dt$

$= 2t^2 - 3t + c$

$t = 0, v = 4$

$\therefore c = 4.$

When $t = T$, $T \neq 0$:

$v = 4$

$4 = 2T^2 - 3T + 4$

$2T^2 - 3T = 0$

$T(2T - 3) = 0$

$T = 0$ or $T = 1.5$

$T \neq 0$, so $T = 1.5$ secs

(11a. $v = \int a\,dt$

$= \int (t - 3)\,dt$

$= \frac{t^2}{2} - 3t + c$

When $t = 0$, $v = 4$:

$\therefore c = 4.$

$v = \frac{t^2}{2} - 3t + 4$

(11b.) P at rest when $v = 0$.

$\therefore \frac{t^2}{2} - 3t + 4 = 0$

$t^2 - 6t + 8 = 0$

$t^2 - 2t - 4t + 8 = 0$

$t(t-2) - 4(t-2) = 0$

$(t-4)(t-2) = 0$

$t = 4$ or $t = 2$

(11c.) $s = \int_2^4 \left(\frac{t^2}{2} - 3t + 4\right) dt$

$= \left[\frac{t^3}{6} - \frac{3t^2}{2} + 4t\right]_2^4$