

Problem 12.11 (Page 15)

The acceleration of a particle as it moves along a straight line is given by $a = 2t - 1$ (m/s^2), where t is in seconds. If $s = 1$ m and $v = 2$ m/sec when $t = 0$, determine a) the particle's velocity and position when $t = 6$ seconds, and b) the total distance the particle travels during this time period.

$$a = \frac{dv}{dt} = 2t - 1$$

$$\int_2^v dv = \int_0^t (2t - 1) dt$$

$$v = 2 + t^2 - t = \frac{ds}{dt}$$

$$\int_1^s ds = \int_0^t (2 + t^2 - t) dt$$

$$s = 1 + 2t + \frac{t^3}{3} - \frac{t^2}{2}$$

When $t = 6$ sec

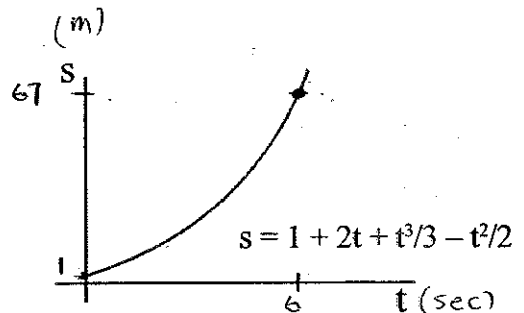
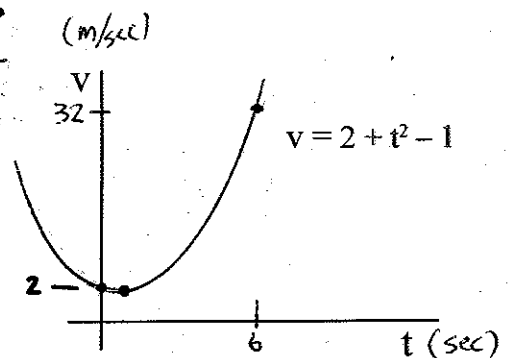
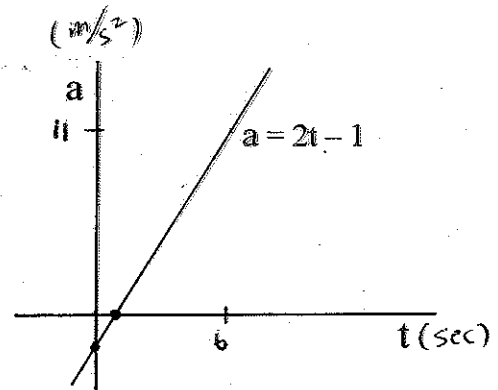
$$v = 32 \text{ m/s}$$

$$s = 67 \text{ m}$$

Since $v \neq 0$

$$d = 67 - 1 = 66 \text{ m}$$

Particle starts at $s = 1$ m



Problem 12.26 (Page 17)

Ball A is released from rest at a height of 40 ft. at the same time that a second ball B is thrown upward 5 ft. from the ground. If the balls pass one another at a height of 20 ft., determine the speed at which ball B was thrown upward.

For ball A: (Dropped from the top)

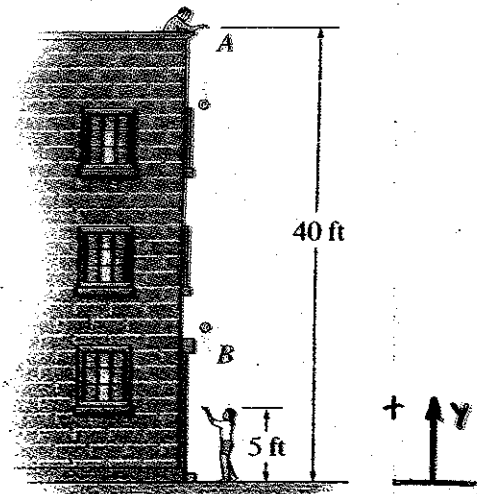
$$+ \uparrow a_y = -g = \frac{dv_y}{dt}$$

$$\int_0^t -g dt = \int_0^{v_y} dv_y$$

$$v_y = \frac{dy}{dt} = -gt$$

$$\int_{40}^{20} dy = -g \int_0^t t dt = -20 = -\frac{1}{2}gt^2$$

$$t = 1.115 \text{ sec}$$



For ball B: (Thrown up)

$$a_y = -g = \frac{dv_y}{dt}$$

$$v_y = \frac{dy}{dt} = v_0 - gt$$

$$\int_0^t (v_0 - gt) dt = \int_5^{20} dy$$

$$v_0 t - \frac{1}{2}gt^2 = 15 = v_0(1.115) - \frac{1}{2}(32.17)(1.115)^2$$

$$v_0 = 31.4 \text{ f/s } \uparrow$$

Problem 12.50 (Page 27)

The v-t graph for the motion of a car as it moves along a straight road is shown. Draw the s-t graph and determine the average speed and the distance traveled for the 30-second time interval. The car starts from rest at $s = 0$.

From $t = 0 \rightarrow 10$ sec

$$v = 0.4t^2 = \frac{ds}{dt}$$

$$\int_0^s ds = \int_0^t 0.4t^2 dt$$

$$s = 0.133t^3$$

at $t = 10$ sec $s = 133.33$ ft

From $t = 10 \rightarrow 30$ Sec

$$v = t + 30 = \frac{ds}{dt}$$

$$\int_{133.33}^s ds = \int_{10}^{30} (t + 30) dt$$

$$s = \frac{t^2}{2} + 30t - 216.67$$

at $t = 30$ sec

$$s = 1133.33 \text{ ft}$$

