PROB. 11-48

$(v_B)_0 = 0, \quad (v_A)_0 = 0, \quad a_B = \text{CONSTANT}, \quad v_B \downarrow$

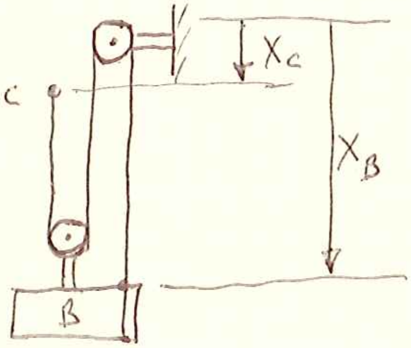
$v_A = 4\frac{m}{s} \rightarrow$ @ $x_A = 400^{mm} = 0.4^m$

FIND $a_A$ AND $a_B$ AND $x_B$ AFTER $t = 2^s$.

BLOCK A:

$$v_A^2 = (v_A)_0^2 + 2a_A[x_A - (x_A)_0]$$

$$a_A = \frac{v_A^2 - (v_A)_0^2}{2[x_A - (x_A)_0]} = \frac{(4\frac{m}{s})^2 - (0)}{2(0.4^m)} \boxed{= 20\frac{m}{s^2}}$$




LENGTH OF ROPE = CONSTANT

$$2x_B + (x_B - x_C) = \text{CONSTANT}$$

$$3x_B - x_C = \text{CONSTANT}$$

$$3\frac{dx_B}{dt} - \frac{dx_C}{dt} = 0$$

$3v_B - v_C = 0$ SINCE $v_C = v_A$,

$$3v_B - v_A = 0$$

$$3\frac{dv_B}{dt} - \frac{dv_A}{dt} = 0$$

$$3a_B - a_A = 0$$

$$a_B = \frac{1}{3}a_A = \frac{1}{3}\left(20\frac{m}{s^2}\right) \boxed{= 6.67\frac{m}{s^2} \downarrow}$$

AFTER $t = 2^s$,

$$v_B = (v_B)_0 + a_B \cdot t = (0) + \left(6.67\frac{m}{s^2}\right)(2^s) \boxed{= 13.3\frac{m}{s}}$$

PROB. 11-48 CONT.

LENGTH OF ROPE IS CONSTANT AT ALL TIMES:

$$3X_B - X_C = 3(X_B)_0 - (X_C)_0$$

$$[X_B - (X_B)_0] = \frac{1}{3}[X_C - (X_C)_0]$$

$$X_C - (X_C)_0 = X_A - (X_A)_0$$

$$[X_B - (X_B)_0] = \frac{1}{3}[X_A - (X_A)_0]$$

BLOCK A:

$$X_A - (X_A)_0 = (v_A)_0 \cdot t + \frac{1}{2} a_A \cdot t^2$$

$$[X_B - (X_B)_0] = \frac{1}{3}[(v_A)_0 \cdot t + \frac{1}{2} a_A \cdot t^2]$$

$$[X_B - (X_B)_0] = \frac{1}{3}[0 + \frac{1}{2}(20 \tfrac{m}{s^2})(2^s)^2] \boxed{= 13.3^m \downarrow}$$