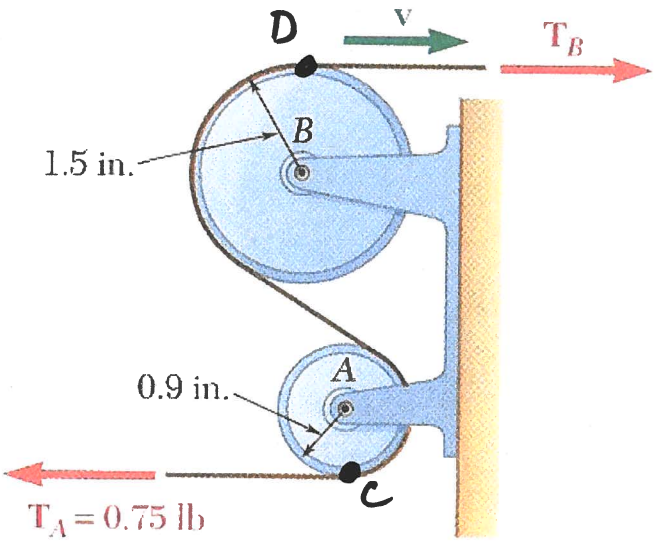
MUST CONVERT TO Ft

Problem 1: Impulse Momentum III

The computer tape moves over the two drums shown. Drum *A* weighs 1.4 lb and has a radius of gyration of 0.75 in., while drum *B* weighs 3.5 lb and has a radius of gyration of 1.25 in. In the lower portion of the tape the tension is constant and equal to T_A = 0.75 lb. Knowing the tape is initially at rest, determine (a) the required constant tension T_B if the velocity of the tape is to be v = 10 ft/s after 0.24 seconds, (b) the corresponding tension in the portion of the tape between the drums.



CLASSIFY MOTION

BOTH RAFA

PROPERTIES

$W_A = 1.4$ lb $\quad m_A = \frac{1.4}{32.2} = 0.0435$ SLUG

$W_B = 3.5$ lb $\quad m_B = \frac{3.5}{32.2} = 0.1087$ SLUG

$I_{GA} = mk^2 = 0.0435\left(\frac{0.75}{12}\right)^2 = 1.699\times10^{-4}$ SLUG-FT^2

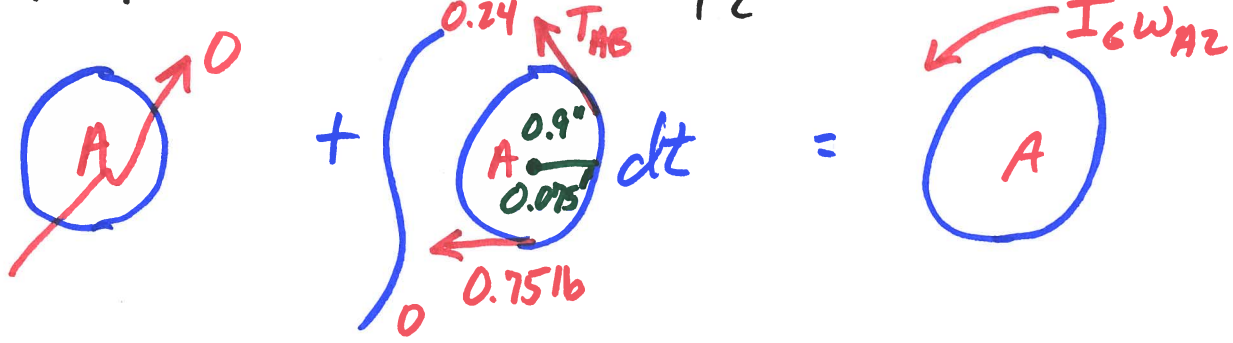
$I_{GB} = mk^2 = 0.1087\left(\frac{1.25}{12}\right)^2 = 1.179\times10^{-3}$ SLUG-FT^2

$V_{2\,TAPE} = 10$ FPS $= V_C = \omega_{A2}\left(\frac{.9}{12}\right)$ $\quad \omega_{A2} = 10\left(\frac{12}{.9}\right) = 133.3$ RPS

$V_{2\,TAPE} = 10$ FPS $= V_D = \omega_{B2}\left(\frac{1.5}{12}\right)$ $\quad \omega_{B2} = 10\left(\frac{12}{1.5}\right) = 80$ RPS

Problem 1: Impulse Momentum III

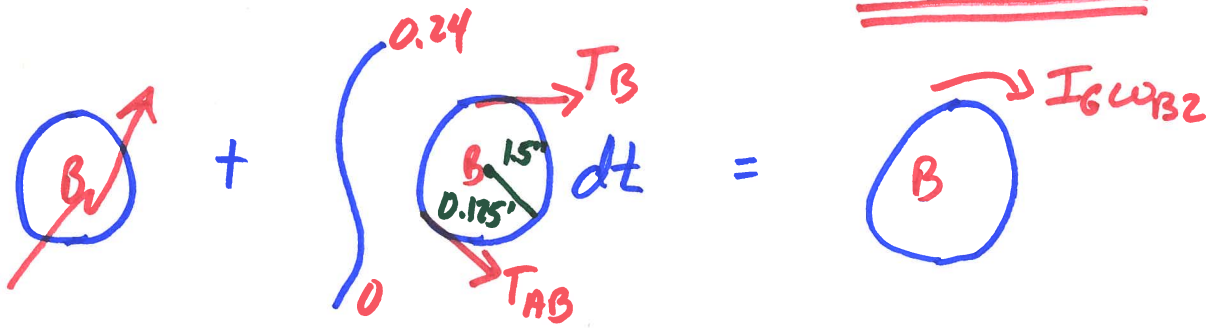
$$\text{Mom 1} + \text{Impulse}_{1\text{-}2} = \text{Mom 2}$$



$$\circlearrowleft \Sigma M_G \quad 0 + \int_0^{0.24} \left(0.075T_{AB} - 0.75(0.075)\right)dt = 1.699\times10^{-4}(133.3)$$

$$0.018T_{AB} - 0.014 = 0.0226$$

$$T_{AB} = 2.03 \text{ lb}$$



$$\circlearrowleft \Sigma M_G = 0 + \int_0^{0.24} \left(0.125T_{AB} - 0.125T_B\right)dt = -1.179\times10^{-3}(80)$$

(2.03 substituted for T_{AB})

$$0.061 - 0.03T_B = -0.0943$$

$$T_B = 5.18 \text{ lb}$$