## ENGR 3311: DYNAMICS

## Quiz 03: Chapter 13

## Due: Tuesday 30 Jan 24

Examine the solved problem below. There are four errors in the solution below. Your task is to locate and identify those errors, then correct them and calculate the proper result. If the same error occurs more than once, only count it as a single error, even if you have to correct it in more than one instance.

Each correctly identified error is worth 4 points, and the re-calculated result is worth 4 points as well. You must save your work in pdf format and submit via the Quiz 03 Assignment in the Chapter 13 folder in the Quizzes folder of the Online Classroom in Blackboard. Please do not use any other file format than pdf.

The The winding drum D is drawing in the cable with an acceleration  $a_A = 3.5 \frac{m}{s^2}$ . Determine the cable tension if the suspended crate has a mass m = 750kg.

- A) Draw the free body diagram for the crate. See the diagram on the right.
- B) Write the equation of motion for the crate:

$$\sum_{T} F = T - mg = ma$$
$$T = m(g + a)$$

- C) Write the expression for the total length of the cable:  $l = 2s_A + s_B + s_D = \text{constant}$
- D) Take the time derivatives:

$$\dot{l} = 2\dot{s}_A + \dot{s}_B + 0$$
  
$$\ddot{l} = 2\ddot{s}_A + \ddot{s}_B = 0$$

E) Write the velocity and acceleration relationships:

$$v_B = -2v_A$$
$$a_B = -2a_A$$

F) Solve for  $a_B$  and tension T:

$$a_B = -2a_A = -2\left(3.5\frac{m}{s^2}\right) = -7\frac{m}{s^2}$$
  
$$T = m(g+a) = (750\text{kg})(9.8-7)\frac{m}{s^2} = 2.8N$$

