ENDS 231: Practice Quiz 10

Note: A one page (one sided) crib sheet is allowed during the quiz, along with a silent, non-programmable calculator.

Clearly show your work and answer.

A 49 ft 8 in. tall W14x109 column in a three story frame building of A992 steel ($F_y = 50 \text{ ksi}$) is braced in the weak axis (y-y) at 15 ft 9 in. and 33 ft 4 in. from the base and at the top. The top is pinned while the bottom is pinned about the y axis and fixed about the x axis. Because there is an atrium space, the column is not braced in the strong axis (x-x). The cross section has the properties:

- $A = 32.0 \text{ in}^2$
- $I_x = 1240 \text{ in}^4$
- $I_y = 447 \text{ in}^4$
- $E = 29 \times 10^3 \text{ ksi}$
- $r_x = 6.22 \text{ in}$
- $r_y = 3.73 \text{ in}$

a) Find the critical allowable stress.

b) If the column is to support 450 k, is it adequate for Allowable Stress Design?

c) [some short question from the text material]

Answers:

- a) $F_a \approx 21.49 \text{ ksi}$ (by strong axis, $F_a$-weak $\approx 23.3 \text{ ksi}$)
- b) OK ($P_a = 688 \text{ k}$)