

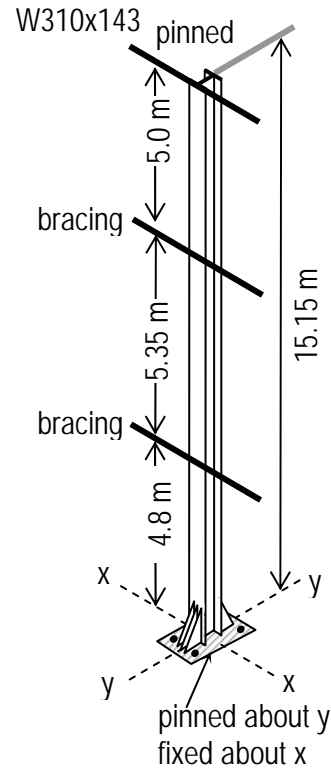
### ENDS 231: Practice Quiz 10

Clearly show your work and answer.

A 15.15 m tall W310x143 (metric) column in a three story frame building of A992 steel ( $F_y = 345$  MPa) is braced in the weak axis (y-y) at 4.8 m and 10.15 m 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:

$$\begin{aligned}
 A &= 18200 \text{ mm}^2 & E &= 200 \text{ kN/mm}^2 \\
 I_x &= 347 \times 10^6 \text{ mm}^4 & r_x &= 138 \text{ mm} \\
 I_y &= 112 \times 10^6 \text{ mm}^4 & r_y &= 78.5 \text{ mm}
 \end{aligned}$$

- Find the critical allowable stress.
- If the column is to support 2000 kN, is it adequate for Allowable Stress Design? (1 MPa = 1 N/mm<sup>2</sup>)
- [some short question from the text material]



Allowable stress with  $F_y = 345$  MPa

$\frac{KL}{r}$	$F_a$ (MPa)
61	119.5
62	118.9
63	118.2
64	117.5
65	116.8
66	116.1
67	115.4
68	114.7
69	114.0
70	113.3
71	112.6
72	111.8
73	111.1
74	110.4
75	109.6
76	108.9
77	108.2
78	107.4
79	106.7
80	105.9
81	105.1
82	104.3
83	103.6
84	102.7
85	102.0
86	101.1
87	100.4
88	99.6
89	98.7
90	97.9
91	97.2
92	96.3
93	95.4
94	94.6
95	93.8
96	92.9
97	92.0
98	91.2
99	90.3
100	89.5

Answers:

- $F_a = 108.2$  MPa (by strong axis,  $F_{a\text{-weak}} \approx 114.5$  MPa)
- Not OK ( $P_a = 1969$  kN)

**Disclaimer: Answers have NOT been painstakingly researched.**