# Answer to Question #68962

**Question:** Find the shortest length L for a steel column with pinned ends having a cross sectional area of 60 x 100 mm, for which the elastic Euler formula applies. Let E= 200 GPa and assume proportional limit to be 250MPa

$a = 60mm = 0.06m$

$b = 100mm = 0.1m$

$\sigma_c = 250MPa = 250 * 10^6 Pa$

$K = 1$ – column effective lengths factor for a 2 side pinned case

**Solution:** The critical force load on the column

$$F = S\sigma_c = ab\sigma_c$$

On the other hand

$$F = \frac{\pi^2 EI}{(KL)^2}$$

Where $I$ is minimum area moment of inertia of the cross section of the column, in our case

$$I = \frac{a^3 b}{12}$$

In the end

$$ab\sigma_c = \frac{\pi^2 E \frac{a^3 b}{12}}{(KL)^2} \rightarrow \boldsymbol{L = \frac{\pi^2 E a^2}{12\sigma_c} = 2.37m}$$