Continuum Mechanics, Spring 2018 CMI
Problem set 8
Due at the beginning of lecture on Monday Apr 9, 2018
Bending of a cantilever beam

1. $\langle \mathbf{17} \rangle$ We showed that the drop $\eta(x)$ of the neutral surface of a cantilever beam (clamped at one end) from its undisturbed height satisfies a 4th order differential equation with appropriate BCs.

    (a) $\langle \mathbf{6} \rangle$ Solve this equation and find $\eta(x)$ as a function of the weight per unit length W, length l and flexural rigidity D of the beam.

    (b) $\langle \mathbf{4} \rangle$ Verify that $\eta'' \geq 0$ and find the drop at the extreme end $\eta(l)$.

    (c) $\langle \mathbf{7} \rangle$ Consider a beam of length l, width w and thickness t with $l \gg t > w$. Would the free end sag more or less (and by what factor?) if it were laid 'sideways' (with width and thickness exchanged). Draw a picture illustrating the two cases.