Do one of the following:

- Use integration by parts to calculate $\int \dfrac{\ln x}{x^2}\, dx$

- A 20 foot chain which weighs 60 pounds is hanging from the top of a building. How much work is required to lift it to the top of the building?

$$\int \frac{\ln x}{x^2}\, dx = -\frac{\ln x}{x} + \int \frac{1}{x^2}\, dx = \boxed{-\frac{\ln x}{x} - \frac{1}{x} + C}$$

$u = \ln x \qquad du = \frac{1}{x}\, dx$

$dv = \frac{1}{x^2}\, dx \qquad v = \frac{-1}{x}$

$$\frac{60\ \text{lb}}{20\ \text{ft}} = 3\ \frac{\text{lb}}{\text{ft}}$$

Segment of length $dx$
weighs $3\, dx$ lb
To be lifted $x$ ft, so

$$\text{Work} = \int_0^{20} 3x\, dx = \frac{3}{2}x^2 \Big|_0^{20}$$

$$= \frac{3}{2}(400) = 600$$