

5a) assuming factor of safety of 4

$$\tau = \frac{\sigma_y}{2 \cdot n} \quad \text{the force is a shear force } 2000 \text{ MPa}$$

yield strength for carbon steel is 415 MPa

$$\tau = \frac{F}{A} \quad \text{assuming single shear}$$

$$F = 386.2 \quad \text{the maximum force on the pins occurs at point C}$$

$$A = \frac{d^2 \pi}{4}$$

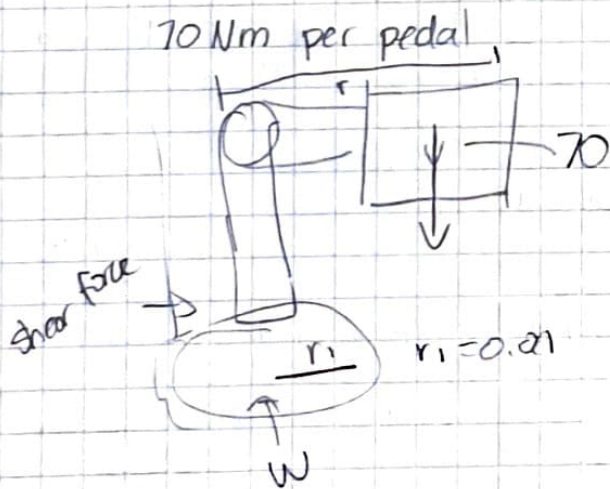
$$\tau = \frac{386.2}{d^2}$$

$$4 = \frac{415 \cdot 10^6}{2 \cdot \frac{386.2}{\frac{d^2 \pi}{4}}}$$

$$3100^2 = 415 \cdot 10^6 \cdot d^2 / 4$$

$$d^2 = 9.5 \cdot 10^{-6} \quad \boxed{d = 0.0031 \text{ m}}$$

I selected 4 which is a relatively higher factor of safety because people might be heavier, the weight of material is not included and safety is really important for the person using the bicycle.



$$T = 28 \text{ Nm}$$

$$= F r$$

$$r = 0.17 \text{ m}$$

$$\frac{28 \text{ Nm}}{0.17 \text{ m}} = 164 \text{ N}$$

$$F = 164 \text{ N}$$

spreading it out between two pedals, $F = \boxed{82 \text{ N}}$ per pedal