1) Write Re in terms of q

$$Re = \frac{\rho V d}{\mu}, \qquad q = \frac{1}{2}\rho V^2$$

$V = \sqrt{2q/\rho}$, substitute into Re

$$Re = \frac{\rho\sqrt{2q/\rho}\ d}{\mu}$$

$$Re = \frac{\sqrt{2q\rho}\, d}{\mu}$$

$$\boxed{Re = \frac{\sqrt{2\rho}\, d}{\mu}\sqrt{q}}$$

2) Find Cd from D and Re

$$C_D \equiv \frac{D}{qS}, \qquad S = \pi r^2 \text{ or } \frac{\pi}{4}d^2$$

from Re

$$Re = \frac{\sqrt{2\rho}\, d}{\mu}\sqrt{q}$$

$$\boxed{C_D = \left(\frac{8\rho}{\pi\mu^2}\right)\left(\frac{D}{Re^2}\right)}$$

$$\frac{Re\,\mu}{d\sqrt{2\rho}} = \sqrt{q}$$

$$q = \frac{\mu^2}{2d^2\rho}Re^2$$

Substitute into C_D

$$C_D = D \Big/ \left(\frac{\mu^2}{2d^2\rho}Re^2\right)\frac{\pi}{4}d^2$$

$$C_D = D \Big/ \left(\frac{\pi}{8}\right)\left(\frac{\mu^2}{\rho}\right)Re^2$$

$$C_p \equiv \frac{P - P_\infty}{q}$$

$$C_{p,f} - C_{p,r} = \frac{(P_f - P_\infty) - (P_r - P_\infty)}{q}$$

$$C_{p(f-r)} = \frac{P_f - P_r}{q} = \frac{\Delta P}{q}$$

Remember that $q = \frac{u^2}{2d^2\rho} Re^2$

$$C_{p(f-r)} = \frac{2d^2\rho}{u^2} \frac{\Delta P}{Re^2}$$