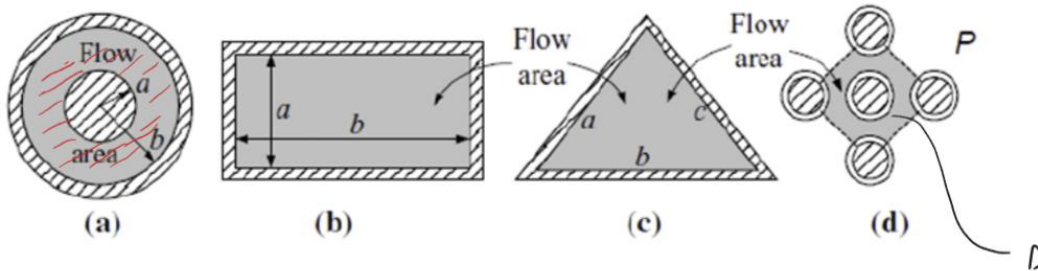


QUESTION 2

Find the hydraulic diameter for the conduits shown in Figures (a) - (d) in terms of a , b , c and P . For Figure (d) the rod pitch (P) is the distance between the centreline of the neighbouring rods and the sides of the square do not constitute solid boundaries. Dashed areas are considered the solid boundaries whereas grey areas are the flow areas.



$$D_h = \frac{4 A_c}{P}$$

↖ Cross sectional Area
↘ Wetted perimeter

$$a) D_h = \frac{4 A_c}{P} = \frac{4 (\pi (b^2 - a^2))}{2\pi (b + a)} = \frac{2b^2 - a^2}{b + a}$$

$$b) D_h = \frac{4 A_c}{P} = \frac{4 (a \times b)}{2 (a + b)} = \frac{2ab}{a + b}$$

$$c) D_h = \frac{4 A_c}{P} = \frac{4 (\frac{1}{2} ab)}{a + b + c} = \frac{2ab}{a + b + c}$$

$$d) D_h = \frac{4 A_c}{P} = \frac{4 \left(P^2 - \pi \frac{D^2}{4} \right)}{\pi D}$$