2021A23 (HYDRAULICS)

Level 1: The version of Pascal's Law with replacements for force and area is the following:

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

Rearranging this gives the equation that we provided.

$$F_2 = A_2 \frac{F_1}{A_1}$$

Substitution into this equation with the appropriate values leads to the answer below.

$$(3.5\ ft^2)\frac{735\ lb}{0.75\ ft^2} = 3430\ lb$$

The hydraulic jack is exerting a force of 3430 pounds on the car when the mechanic exerts a force of only 735 pounds on it! We can use the force and area values for either side of the jack to find out the total pressure inside the hydraulic cylinder since they should both be equal.

$$P = \frac{F}{A} = \frac{3430\ lb}{3.5\ ft^2} = \frac{735\ lb}{0.75\ ft^2} = 980\ lbs\ per\ square\ foot$$

A hydraulic piston raises the boom of the crane that OE uses onsite for construction.

Level 2: We can set up Pascal's Law formula to show an increase in the area of side A by a factor of 3 to help us determine the factor of change in the force on side B. The x is the factor that the force of side B must decrease by in order to maintain equilibrium.

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$\frac{F_1}{3 \times A_1} = \frac{x \times F_2}{A_2}$$

$$x \times F_2 = A_2 \frac{F_1}{3 \times A_1}$$

$$3x \times F_2 = A_2 \frac{F_1}{A_1}$$

To balance the equation and get back to our original formula, x would have to be $^1/_3$ to multiply with the 3 and cancel out, once again giving us the original formula, $\frac{F_1}{A_1} = \frac{F_2}{A_2}$, just rearranged.