47.9 The maximum pressure achieved in the cylinder of a car engine is $800psi$. How much force will be exerted on a $3.7in$ piston?

A. $700lb_f$

B. $2,200lb_f$

C. $4,300lb_f$

D. $8,600lb_f$

A useful representation of pressure is the amount of force applied over an area. This can be expressed through the formula below and rearranged to solve for the force, F.

$$P = \frac{F}{A}$$

$$F = PA$$

Determine the area of the piston.

$$A = \frac{\pi}{4}D^2 = \frac{\pi}{4}(3.7in)^2 = 10.75in^2$$

Solve for the force.

$$F = PA = \left(800\frac{lb_f}{in^2}\right)(10.75in^2) = 8600lb_f$$

Answer D

47.10 A spring with 10 coils has squared ends and a shear modulus of $10 \times 10^6 psi$. The diameter of the wire is $0.15in$ and the average coil diameter is $1in$. What is the spring constant?

A. $52\frac{lb_f}{in}$

B. $63\frac{lb_f}{in}$

C. $79\frac{lb_f}{in}$

D. $105\frac{lb_f}{in}$

The Spring Constant for a Helical Compression Spring can be determined using the following formula, where k is the spring constant, d is the diameter of the wire, G is the shear modulus, D is the coil diameter, and $N$is the number of *active* coils.

$$k = \frac{d^4G}{8D^3N}$$

Using the table Type of Spring Ends, note that for squared ends the total number of coils N_t is the number of active coils plus two. Solve for the number of active coils.