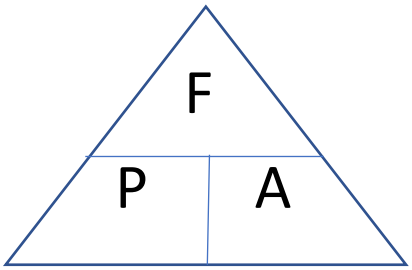
S03 – Hydraulic Bore Pupil Extension

Scientists use the formula “Force = Pressure x Area” to calculate the forces in a hydraulic system. It can be written inside a triangle which helps to identify the calculation to find the third value if any two are known.



F = Force, measured in Newtons. (N)
P = Pressure, measured in Pounds per Square Inch (psi)
A = Area, measured in squared inches (in^2)

Using the triangle above we can cover up the value we wish to know, and it will tell us how to calculate it.
To calculate Force, cover F. You are left with PA, or P x A.
To calculate Pressure, cover P. You are left with F over A, or F ÷ A.
To calculate Area, cover A. You are left with F over P, or F ÷ P.

We can use this to figure out the force given out by a piston, for example:

A piston is powered by a 300psi pump. The area of the piston is 5 in^2. What force can this piston generate?

We want to know force. Using the triangle, we can see that F = P x A.
P = 300psi, A = 5 in^2.
300 x 5 = 1500.

The piston can generate 1500 Newtons.

We can use this to figure out the pressure in a piston, for example:

A piston is powered by a pump. The area of the piston is 5 in^2. The force of this piston is 500 Newtons. What is the pump’s pressure?

We want to know pressure. Using the triangle, we can see that P = F ÷ A.
F = 500, A = 5 in^2.
500 ÷ 5 = 100

The pump is running at 100psi.

We can use this to figure out the area of a piston, for example:

A piston is powered by a 1000psi pump. The force of this piston is 700 Newtons. What is the piston area?

We want to know pressure. Using the triangle, we can see that A = F ÷ P.
F = 700N, P = 1000psi.
700 ÷ 1000 = 0.7

The piston area is 0.7 in^2.