

CLASS 11 PHYSICS | FLUID MECHANICS

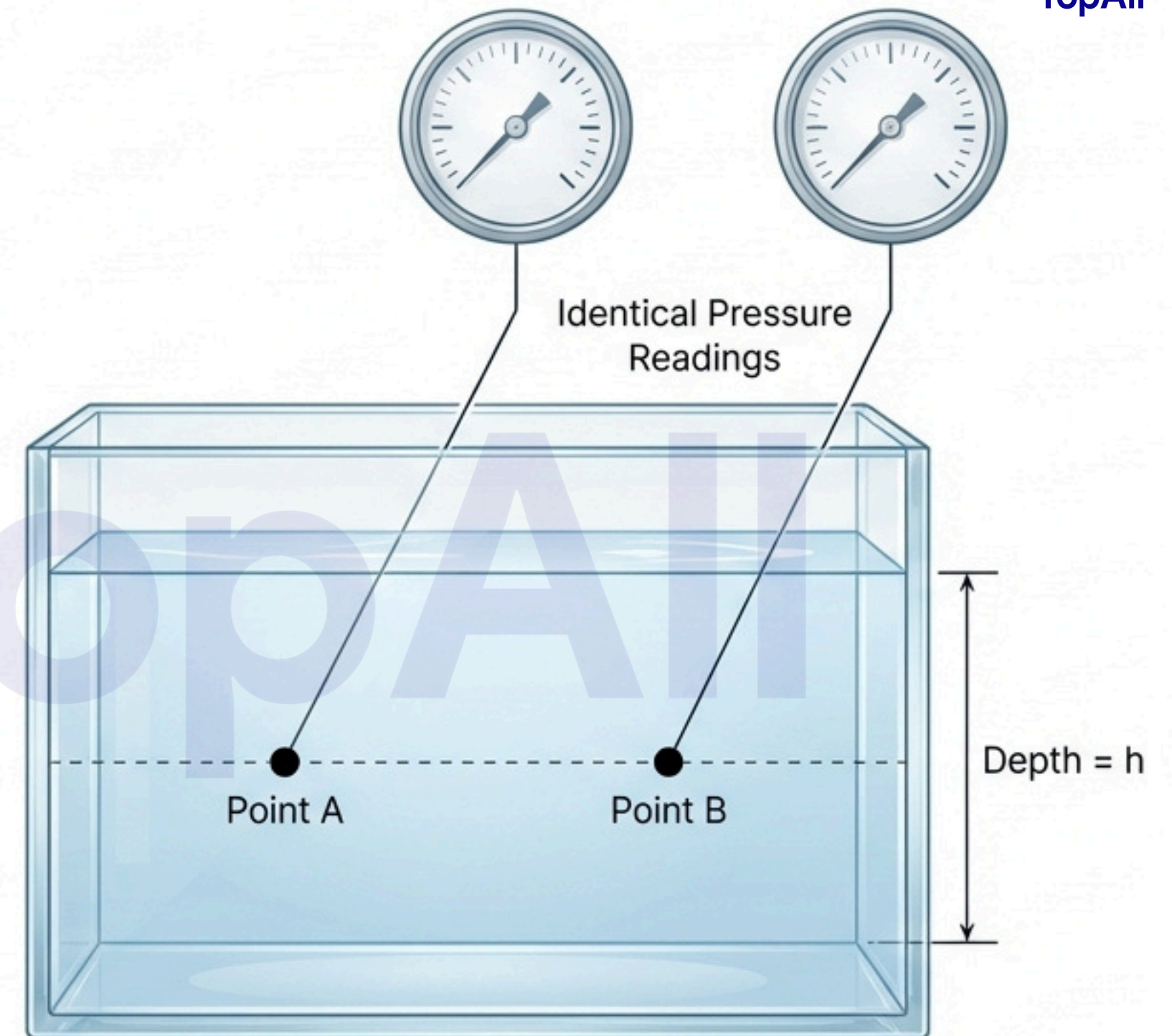
Pascal's Law

Pressure in a Fluid at Rest (Section 9.2.1)

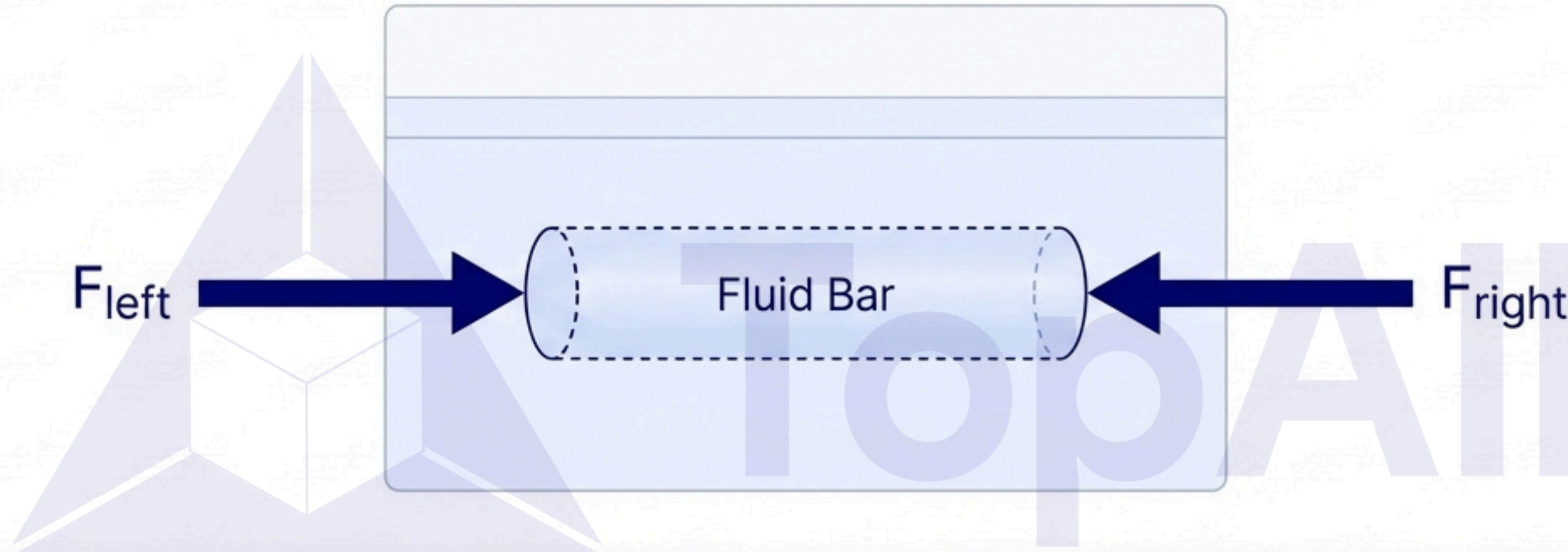
THE LAW

The Principle of Equal Pressure

The pressure in a fluid at rest is the same at all points if they are at the same height.



The Intuitive Check: Horizontal Equality



Imagine a horizontal bar of fluid inside a container.

If pressure at the two ends wasn't equal, a net force would cause the fluid to accelerate and flow.

Since the fluid is at rest (equilibrium), horizontal forces must perfectly cancel out.



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$$E=mc^2$$



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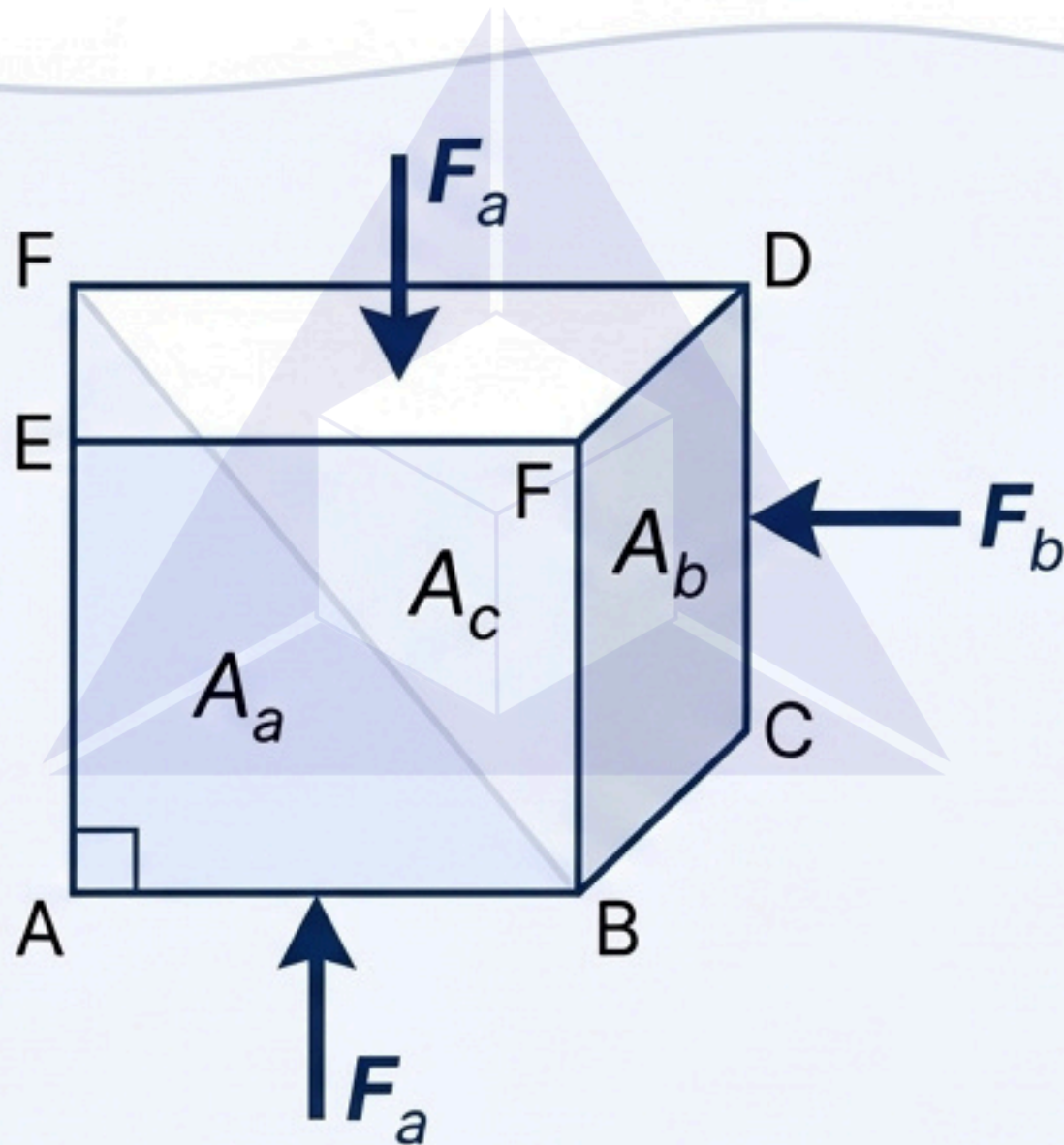
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Key Highlights

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- » Get Clear Explanations, Not Just Marks
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The Prism-Element Apparatus



- Imagine an infinitesimally small fluid prism (so small that gravity differences are ignored).
- The surrounding fluid exerts forces on the prism faces.
- Because the fluid is at rest, these forces act strictly perpendicular to the surfaces.

Resolving the Forces

Geometry

$$A_b \sin(\theta) = A_c$$

$$A_b \cos(\theta) = A_a$$

Equilibrium

$$F_b \sin(\theta) = F_c$$

$$F_b \cos(\theta) = F_a$$

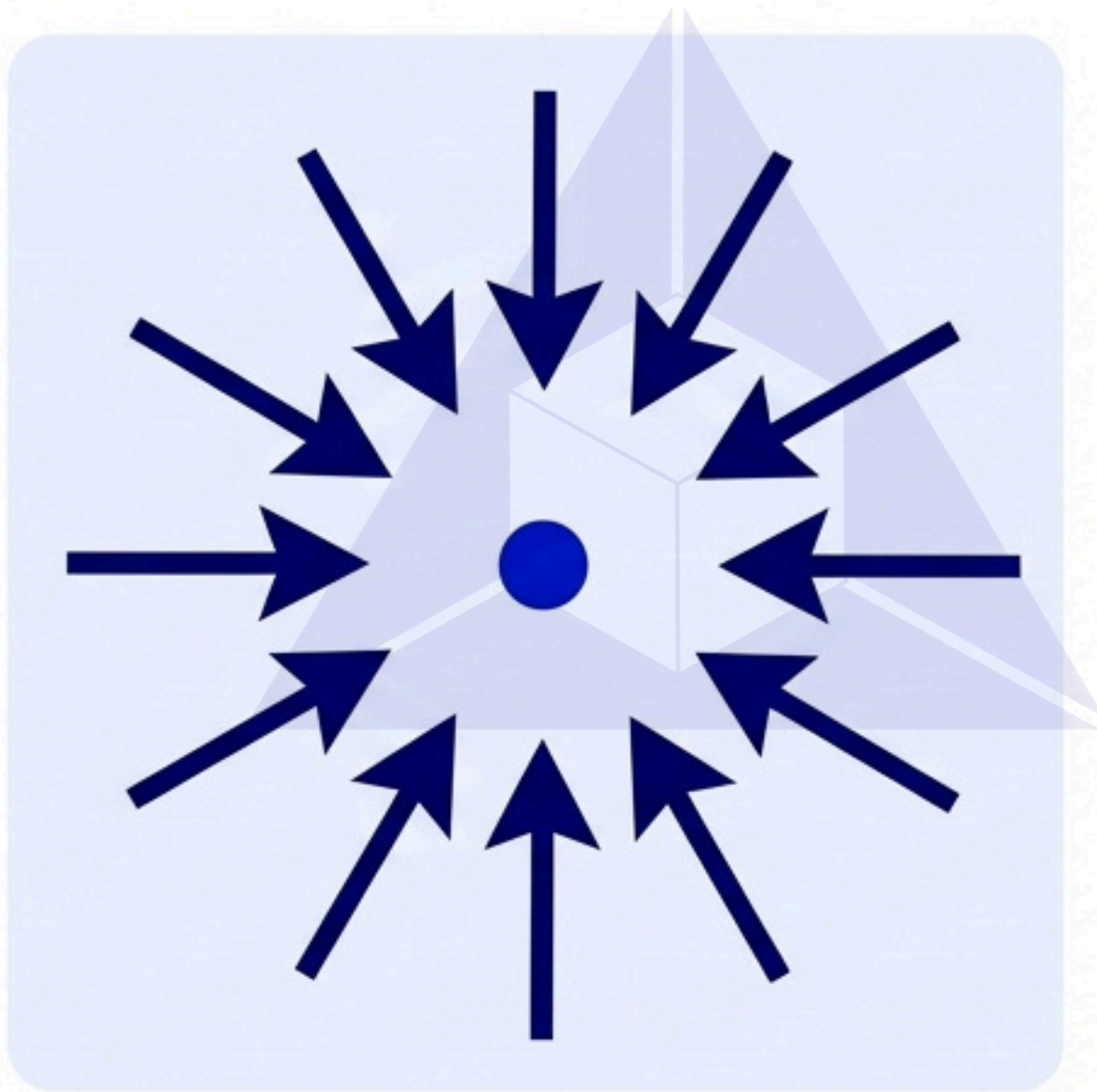


Dividing Force by Area yields Eq. (9.4):

$$\mathbf{P_a = P_b = P_c}$$

This mathematically proves pressure is identical in all directions at a point.

Pressure is a SCALAR Quantity



The Trap: Because Force is a vector, students often assume Pressure is too.

The Truth: Pressure has no specific direction of its own. It acts equally in all directions at a given point.

The Rule: Pressure simply acts normal (perpendicular) to any surface it touches, regardless of the surface's orientation.

Key Takeaways

- ✓ Fluid pressure is identical at the same horizontal height at rest.
- ✓ The prism proof confirms $P_a = P_b = P_c$ through geometric force balance.
- ✓ Pressure is a scalar quantity—it acts equally in all directions without a defined vector.

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