

Note: \oint is an integral over a surface area.

Newton's Law of Universal Gravitation is

- A) $\oint g ds = \frac{M}{G}$.
- B) $\oint g ds = \frac{4\pi M}{G}$.
- C) $\oint g dA = GM$.
- D) $\oint g dA = 4\pi GM$.

A high school physical science textbook uses $F = G \frac{Mm}{r^2}$.

To check to see if this is correct, for a spherical shell (surface area is $4\pi r^2$) about a point mass M , we have

$$\oint g dA = 4\pi GM$$

$$g \oint dA = 4\pi GM, \quad g \text{ is constant}$$

$$g 4\pi r^2 = 4\pi GM$$

$$g r^2 = GM$$

$$g = G \frac{M}{r^2}, \quad \text{so}$$

$$F = mg = G \frac{Mm}{r^2}, \quad \text{Q.E.D.}$$

Answer **D**.