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Theorem:

If n is any odd integer, then $(-1)^n = -1$

Proof:

$n = 2k+1$ for k is some integer // Def. of odd

$$(-1)^n = (-1)^{2k+1} \quad // \text{Substitution}$$

$$(-1)^n = (-1)^{2k} * (-1)^1 \quad // \text{Laws of exponents}$$

$$(-1)^n = -1 * (-1)^{2k} \quad // \text{Laws of exponents}$$

$$(-1)^n = -1 * ((-1)^2)^k \quad // \text{Laws of exponents}$$

$$(-1)^n = -1 * (-1 * -1)^k \quad // \text{Expanded exponent}$$

$$(-1)^n = -1 * (1)^k \quad // \text{Basic Algebra}$$

$$(-1)^n = -1 * 1 \quad // \text{Basic Math}$$

$$(-1)^n = -1$$

QED