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The complete is a graph with all possible edges. Use induction to show that an n-vertex complete graph has $\frac{n(n-1)}{2}$ edges.

Proof | Let P(n) be " n-vertex complete graph has $\frac{n(n-1)}{2}$ edges "

Base Case | P(1) : • 1-vertex complete graph has $\frac{1(1-1)}{2} = 0$ edge which is true.

IH : | Assume P(k) : " k-vertex complete graph has $\frac{k(k-1)}{2}$ edges " is true ※

IS : | $P(k) \Rightarrow P(k+1)$: $0 + 1 + 2 + \ldots + (k-1) + k = \frac{k(k-1)}{2} + k$

Note: Every time the vertex increases the number of edge increases by n−1 (n−1 is from n−1 more edges created). ∴ If increase to k+1 nodes, number of edge will be increased by k

$$= \frac{k^2 - k + 2k}{2}$$

$$= \frac{k^2 + k}{2}$$

$$= \frac{(k+1)(k)}{2} = \frac{(k+1)((k+1)-1)}{2}$$ ※

∴ " n-vertex complete graph has $\frac{n(n-1)}{2}$ edges." is true by Mathematical Induction. ※