Let’s begin with a regular octagon:

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$$V + F - E = 2$$
$$6 + 8 - 12 = 2$$

The result of this truncation belongs to the family of pyramidal polyhedra.

$$V + F - E = 2$$
$$5 + 5 - 8 = 2$$

If we were to remove another vertex, the result would be a degenerate image. As by removing 1 vertex we would remove 3 edges, and have only 2 faces, which doesn't satisfy the definition of a polyhedron.

$$V + F - E = 2$$
$$4 + 4 - 6 = 2$$