THEOREM 3. *Assume the hypotheses of the previous theorem, and let* $\mathbf{G}$ *be the collection of all G such that G is an algebraic complement in E of each member of* $\mathbf{F}$. *If* $k$, *the common dimension of the members of* $\mathbf{F}$, *is strictly between* 0 *and the dimension* $n$ *of E, then* $\mathbf{G}$ *is uncountable.*

*Proof.* Since the dimensions $k$ and $m = n - k$ of members of $\mathbf{F}$ and $\mathbf{G}$, respectively, are strictly less than $n = \dim(E)$, the members of $\mathbf{F} \cup \mathbf{G}$ are proper linear subspaces of $E$. If $\mathbf{G}$ is countable, then $\mathbf{F} \cup \mathbf{G}$ is countable, so there is a $v$ in $E \setminus \bigcup(\mathbf{F} \cup \mathbf{G})$. As $\mathbf{F}_0 = \{F + \operatorname{span}(\{v\}) \colon F \in \mathbf{F}\}$ satisfies the hypotheses of Theorem 2, there is a linear subspace $H$ of $E$ that is an algebraic complement to each member of $\mathbf{F}_0$. Now $H + \operatorname{span}(\{v\})$ is an algebraic complement to each member of $\mathbf{F}$, so $\operatorname{span}(\{v\}) + H \in \mathbf{G}$. Now $v \in \cup \mathbf{G}$ which is a contradiction of the choice of $v$, and so $\mathbf{G}$ is uncountable.

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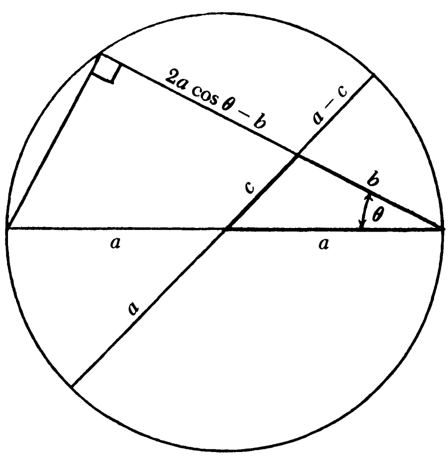
## Proof without Words: The Law of Cosines




$$(2a\cos\theta - b)b = (a - c)(c + a)$$
$$c^2 = a^2 + b^2 - 2ab\cos\theta$$

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