Step-1

Since $a_2 - ka_1$ is orthogonal to a_1, their dot product (that is, inner product) must be zero. Consider the following:

$$(a_2 - ka_1)\cdot a_1 = 0$$
$$a_2 \cdot a_1 - ka_1 \cdot a_1 = 0$$
$$k = \frac{a_2 \cdot a_1}{a_1 \cdot a_1}$$

This can also be written as $\boxed{k = \frac{a_2{}^{\mathrm{T}} a_1}{a_1{}^{\mathrm{T}} a_1}}$.

Therefore, $a_2 - \frac{a_2{}^{\mathrm{T}} a_1}{a_1{}^{\mathrm{T}} a_1} a_1$ is orthogonal to a_1.