Is the converse true?

If $\sum_{i=1}^{n} \lambda_i = n$ then, from (1), $\mathbf{a}.\mathbf{a} = \mathbf{a}.\mathbf{g}$ so that $|\mathbf{a} - \frac{1}{2}\mathbf{g}|^2 = \frac{1}{4}|\mathbf{g}|^2$. From this we see that $\sum_{i=1}^{n} \lambda_i = n$ holds not just for G but for any point on the circle with diameter OG.

It would be good to have further geometric insight into this perhaps surprising conclusion.

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