Problem

If the ratio of three sides of a triangle is a:b:c = 7:8:9 then show that cosA:cosB:cosC = 14:11:16

Solution

Use cosine theorem for side a, b and c in same order

$$a2 = b2 + c2 - b * c * cosA$$
$$b2 = a2 + c2 - a * c * cosB$$
$$c2 = b2 + a2 - b * a * cosC$$

Putting values:

$$49 = 64 + 81 - 144\cos A$$
$$-96 = -144\cos A$$
$$\cos A = \frac{96}{144} = \frac{2}{3}$$

Do in same way with other equations we get

$$cosB = \frac{66}{126} = \frac{11}{21}$$

And

$$cosC = \frac{32}{112} = \frac{2}{7}$$

So, there is ratio

$$cosA: cosB: cosC = \frac{2}{3}:\frac{11}{21}:\frac{2}{7}$$

Multiply it with 21 we get

cosA: cosB: cosC = 14: 11: 6

P.S. There is a mistake in problem condition

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