Probability and random variables assignment

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1 Q3

1.1. If $tan^{-1}a + tan^{-1}b + tan^{-1}c = \pi$ then prove that $a+b+c = abc$

Solution:
We know that $tan^{-1}x + tan^{-1}y = tan^{-1}(\frac{x+y}{1-xy})$

$tan^{-1}a = (\frac{\pi}{2} - tan^{-1}b) + (\frac{\pi}{2} - tan^{-1}c)$

$$\therefore tan^{-1}a = cot^{-1}b + cot^{-1}c$$

$$= tan^{-1}(\frac{1}{b}) + tan^{-1}(\frac{1}{c})$$

$$= tan^{-1}(\frac{\frac{1}{b} + \frac{1}{c}}{1 - \frac{1}{bc}})$$

$$\therefore a = \frac{\frac{1}{b} + \frac{1}{c}}{1 - \frac{1}{bc}}$$

$$= \frac{\frac{b+c}{bc}}{\frac{bc-1}{bc}}$$

$$= \frac{b+c}{bc-1}$$

Now, cross multiplying

$$a(bc-1) = b+c$$

$$\therefore abc - a = b + c$$

$$\therefore abc = a + b + c$$

HENCE PROVED