

ANSWER TO CRACK PROBLEM (53)

The given equation is $2\cos^2x = \sin x + \sin 3x - 5\cos x$
(1)

Now on simplifying $\sin x + \sin 3x$, we get

$$\sin x + \sin 3x = 4\sin x (\cos^2x) = 2\sin 2x \cos x \quad \text{[given]}$$

Therefore, the given equation can be reduced to:

$$2\cos^2x = 2\sin 2x \cos x - 5\cos x \quad \text{..... (2)}$$

THIS IMPLIES either $\cos x = 0$ or $2\cos x = 2\sin 2x - 5$

Now, if $\cos x = 0$ then $x = \pi/2$ is a solution of the original equation.
The other roots are non-real.

Thus, the fallacy is that we cannot divide the simplified equation (2) by $\cos x$ as it can be 0 also and division by 0 is undefined. So, we have to take two separate cases,

1. If $\cos x = 0$ and,
2. If $\cos x$ is not = 0.

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