Math Diversion 1098

P. Reany

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In algebra problems, if you can arrange it, work
with "nice" quantities. — The Author

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Source: https://www.youtube.com/watch?v=V1_OAQSSU6k
Title:  x/4 + 8/x = 3 This Algebra Equation is NOT so simple!
 Presenter: TabletClass Math
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1 Problem

Given the relation

$$\frac{x}{4}+\frac{8}{x}=3\,, \tag{1}$$

solve for all values of x.

Of course this is merely a quadratic, but I want to demonstrate use of the adage at the top. One way to proceed is to multiply through by x, but I have something else in mind.

2 Solution

Let's begin by rewriting the Given to

$$\frac{x}{4}+\frac{2}{x/4}=3\,. \tag{2}$$

On setting $u\equiv x/4$, we get

$$u+2u^{-1}=3\,. \tag{3}$$

After multiplying through by u and rearranging, we have that

$$u^2-3u+2=(u-1)(u-2)=0\,. \tag{4}$$

Hence

$$u=1,2\,. \tag{5}$$

And lastly,

$$x=4,8\,. \tag{6}$$