Math Diversion Problem 264

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> You will never plough a field if you only turn
> it over in your mind.
> — Irish Proverb

The YouTube video is found at:

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Source: https://www.youtube.com/watch?v=9s9D5NZjVMc
Title: A Highly Complex Exponential  |
       Problem 257
 Presenter: aplusbi
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1 The Problem

Given the relation

$$e^{e^i} = a + bi = z\,, \tag{1}$$

find the values of

$$\phi = a^2 + b^2 = r^2 = z\overline{z}\,. \tag{2}$$

2 The Solution

If we multiply (1) by its complex conjugate, we get

$$e^{e^i} e^{e^{-i}} = z\overline{z} = \phi\,. \tag{3}$$

Hence,

$$\phi = e^{e^i + e^{-i}} = e^{2\frac{e^{i\cdot 1} + e^{-i\cdot 1}}{2}}\,. \tag{4}$$

Then

$$\phi = e^{2\cos 1}\,. \tag{5}$$