Complex numbers

Thursday, February 23, 2017 2:03 PM

the big idea:

find the natural number solutions to

$x + 7 = 3$

no natural solutions

find the integer solutions to

$2x + 5 = 0$

no integer solutions

find the real solutions to

$x^2 = -1$

no real solutions

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but there are solutions to $x^2 = -1$, they're just not real

$i = \sqrt{-1}$

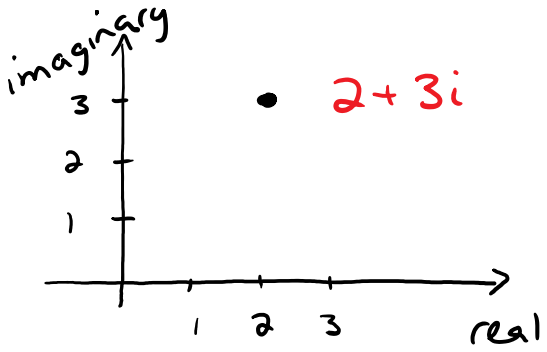
Washington and many engineering texts use j

complex numbers can be written as

$a + bi$ where a and b

real part + imaginary part

are real numbers and $i = \sqrt{-1}$



complex plane

adding and subtracting:

$$(1 + 3i) + (2 + 5i) = 3 + 8i$$
$$(1 + 3i) - (2 + 5i) = -1 - 2i$$

multiplication / simplification:

$$\sqrt{-1}\sqrt{-1} = -1 \qquad i^2 = -1$$

so $\sqrt{-4} = \sqrt{4}\sqrt{-1} = 2i$

which means that

$$x^2 = -9$$

$$x = \pm\sqrt{-9}$$
$$= \pm\sqrt{9}\sqrt{-1}$$
$$= \pm 3i$$

so if the auxiliary equation is

$$m^2 + 4m + 5 = 0$$

$$m = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-4 \pm \sqrt{16 - 20}}{2}$$

$$= \frac{-4 \pm \sqrt{-4}}{2}$$

$$= \frac{-4 \pm 2i}{2}$$

$$= -2 \pm i$$