2022Q7

IMAGINARY NUMBERS

QUESTIONS

When counting with our fingers, we can count any number of things from 0 to 10. We can continue to count from there with 11, 12, and so on. These numbers make it very easy to count items, like the number of apples in a grocery bag or the number of wind turbine blades in a construction yard. This group, or set, of numbers is called the counting numbers. However, we know that more numbers exist. Sometimes, we have half an hour to finish a project, or a math problem asks us to add negative one to a number. These values are all within different sets of numbers. Below are some examples of these sets of numbers, though there are many more sets of numbers as well!

SETS OF NUMBERS		
NAME OF SET	**DEFINITION**	**EXAMPLES**
Counting Numbers	Numbers without fractions or decimal places, above and including one	1, 2, 3, 4, 5, 6, 7…
Whole Numbers	Numbers without fractions or decimal places, above and including zero	0, 1, 2, 3, 4, 5, 6, 7…
Integers	Numbers without fractions or decimal places including negative numbers	-10, -9, 8, 7, 4, 328
Irrational Numbers	Numbers that cannot be expressed as a fraction or a decimal	Π, √2
Real Numbers	Any number without an imaginary component	1.23458, 1.2 billion, -3.68492, $\frac{5}{7}$
Imaginary numbers	Numbers with an imaginary component	i, 2 + i, 2i, 5 + 16.7i

Yes, there are some numbers called imaginary numbers! Just because they're "imaginary" does not mean they're fake or unhelpful. For example, we only use some numbers when counting apples: 0, 1, 2, 3, 4, etc. We will not see 0.45 apples or π apples or √2 apples, but those numbers are still helpful! They have lots of other applications.

We define i as √-1. Therefore, $i^2 = -1$. If we know this definition, we can do math with i like we do with many other numbers. Some examples are below.

EQUATION EXAMPLES	
EQUATION	**SOLUTION**
$2 * i$	$2i$
$3 + i$	$3 + i$

$2 + i + 7 + 5i$	$9 + 6i$
$i * i$	-1

Imaginary numbers come in use in a lot of places. In fact, last week's Wind Study could've used imaginary numbers! The reactance of a capacitor is a real number, but when we combine reactance with resistance, we get impedance, which uses reactance as an imaginary number.

Level 1: Find the answer to the following equations. The last one is a little tricky!

a) $2 * 3i$
b) $3 + 4i$
c) $(6 + i) * 2 + 3i$
d) $(6i)^2$

Level 2: Find the answer to the following equations. The last one is even trickier!

a) $(4.5 + 6i) * 2i$
b) $3i * (99 + 4)$
c) $5.6i * 7.5i$
d) $12i - 8i$
e) i^3

Lots of power engineering uses imaginary numbers, so One Energy considers them all the time when working through a *Wind For Industry®* project!