

Multiplying Complex Numbers using FOIL

by Sophia



WHAT'S COVERED

This tutorial covers how to multiply complex numbers, through the definition and discussion of:

1. Imaginary and Complex Numbers

2. Multiplying Complex Numbers using FOIL

1. Imaginary and Complex Numbers

To review, the square root of a negative number is non-real, or an imaginary number. The imaginary unit i is defined as the square root of -1.



FORMULA TO KNOW

Imaginary Number

$$i = \sqrt{-1}$$

If you were to square both sides of this equation, you would have i^2 on the left side, and -1 on the right side, so you also know that i^2 is equal to -1.

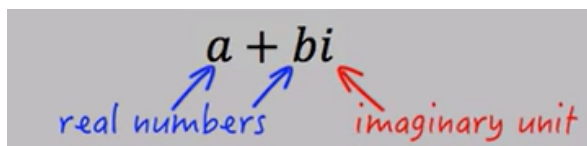


FORMULA TO KNOW

Imaginary Number

$$i^2 = -1$$

A complex number is a value in the form below, in which a and b are real numbers, and i is the imaginary unit.


$$a + bi$$

real numbers imaginary unit



DID YOU KNOW

Complex numbers are used in fields such as engineering and physics.

2. Multiplying Complex Numbers using FOIL

When multiplying complex numbers, use the FOIL method, because of the addition or subtraction that occurs between the real and imaginary parts of complex numbers. Therefore, multiplying complex numbers together is similar to multiplying binomials together.



HINT

You may recall that FOIL is an acronym to remember the steps for distributing factors in binomial multiplication:

First

Outside

Inside

Last

⇒ **EXAMPLE** Suppose you want to multiply the following complex numbers.

$$(8 - 4i)(2 + 6i)$$

Using FOIL, you start by multiplying according to the steps for distributing the factors.

$$(8)(2) + (8)(6i) + (-4i)(2) + (-4i)(6i)$$

Going in order, this provides:

$$16 + 48i - 8i - 24i^2$$

Recalling that i^2 is equal to -1, you can substitute -1 in for i^2 , then multiply negative 24 times -1.

$$\begin{aligned} 16 + 48i - 8i - 24(-1) &= \\ 16 + 48i - 8i - (-24) & \end{aligned}$$

To simplify your expression, you know that the real parts are like terms, so you can combine 16 minus -24, which equals 40. You also know that your imaginary parts are like terms so you can combine $48i$ minus $8i$, which equals $40i$, so your final answer is 40 plus $40i$. Note that this is in standard form.

$$40 + 40i$$



SUMMARY

Today you reviewed **imaginary numbers**, recalling that the square root of a negative number is non-real, or an imaginary number; the imaginary unit i is equal to the square root of -1. You also reviewed

the definition of a **complex number**, which is a value in the form a plus bi , where a is the real part and b times i is the imaginary part of the complex number. You also learned that when **multiplying two complex numbers** together, you use the FOIL method.

Source: This work is adapted from Sophia author Colleen Atakpu.



FORMULAS TO KNOW

Imaginary Number

$$i = \sqrt{-1}$$

$$i^2 = -1$$