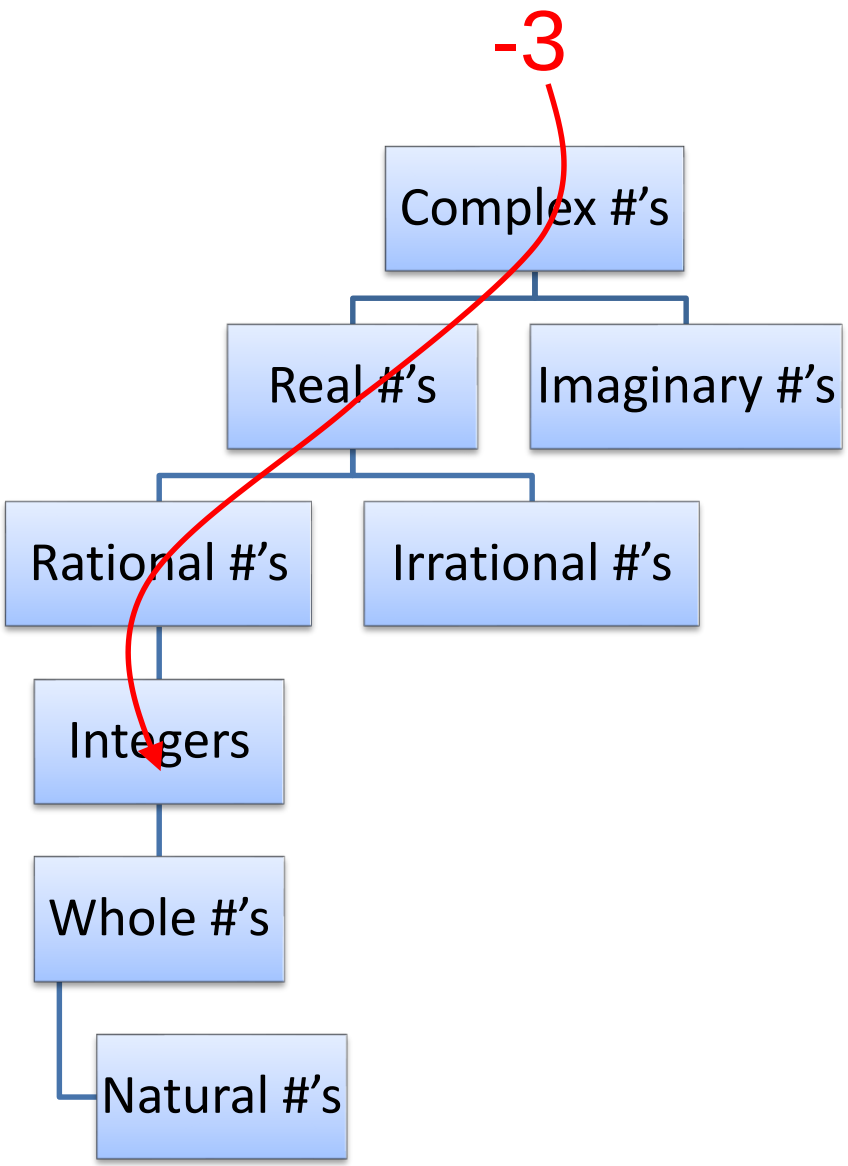
# Math-2A
# Lesson 2-2

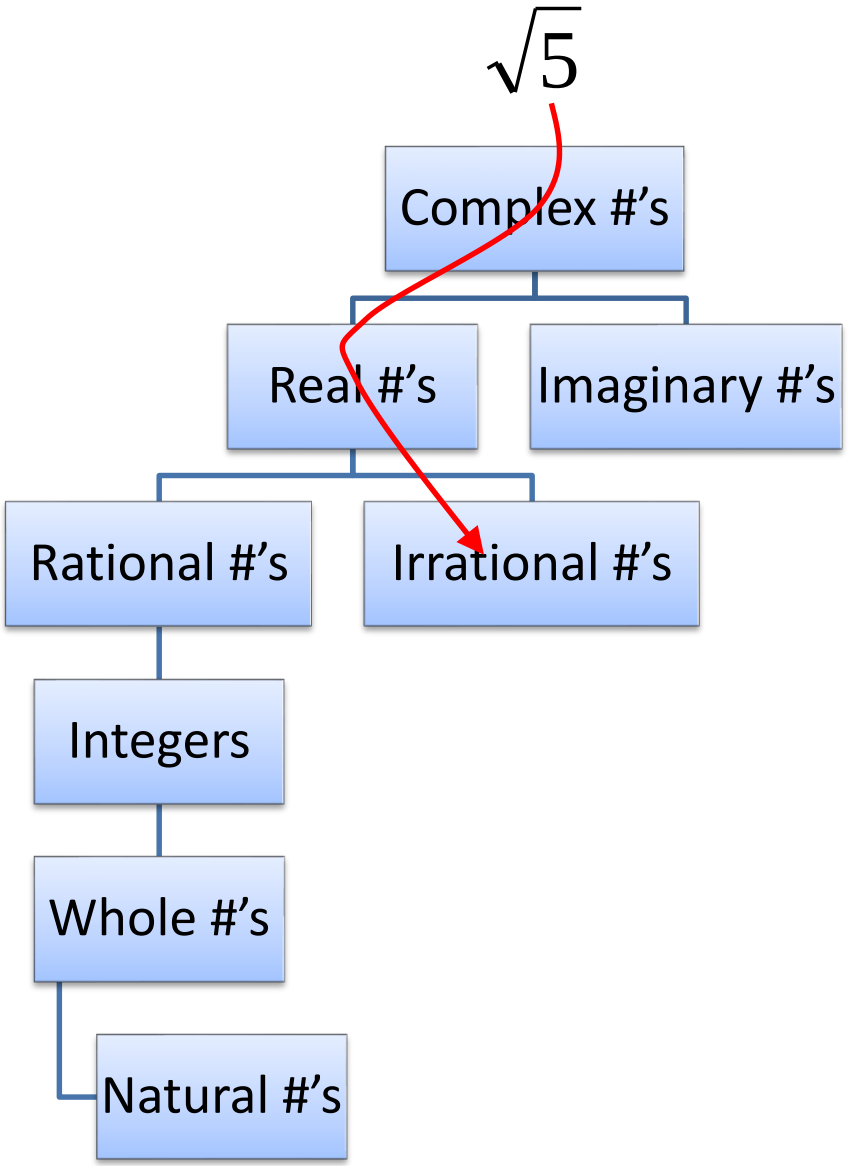
## Imaginary Numbers

# What number systems does -3 belong to?



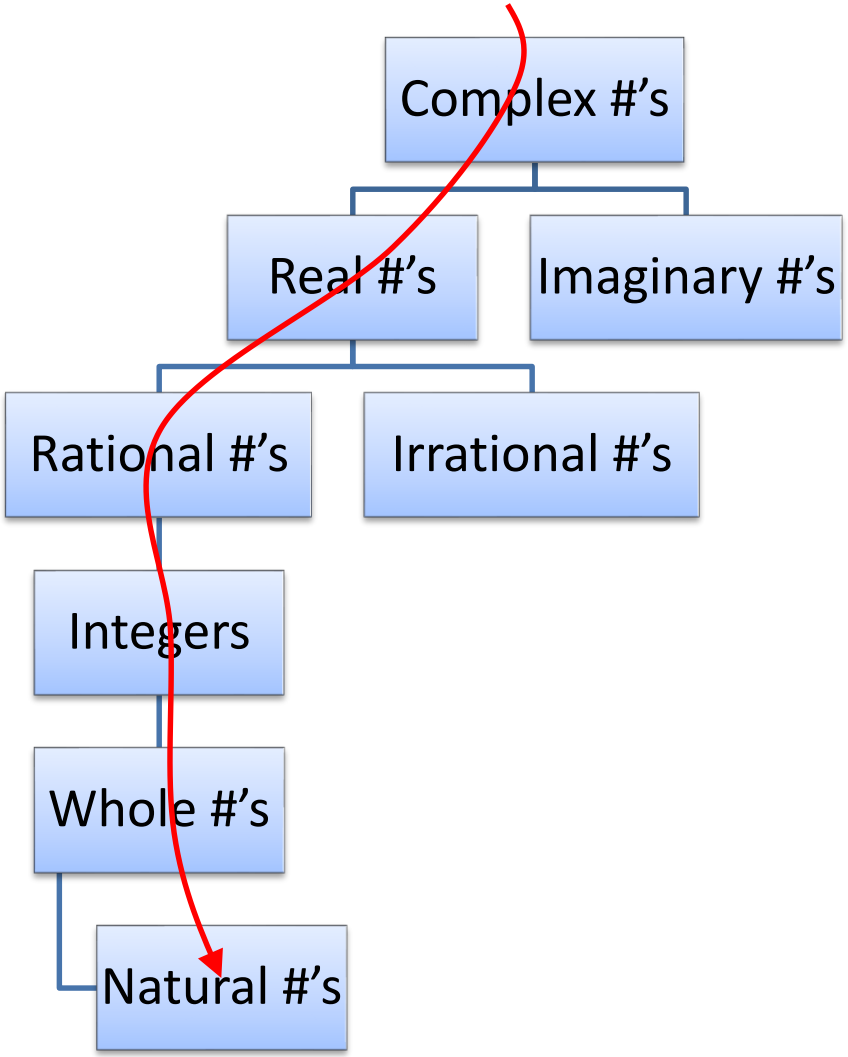

What "path" and "how far down" will -3 go?

What number systems does $\sqrt{5}$ belong to?



What number systems does $\frac{6}{2}$ belong to?

$6/2$

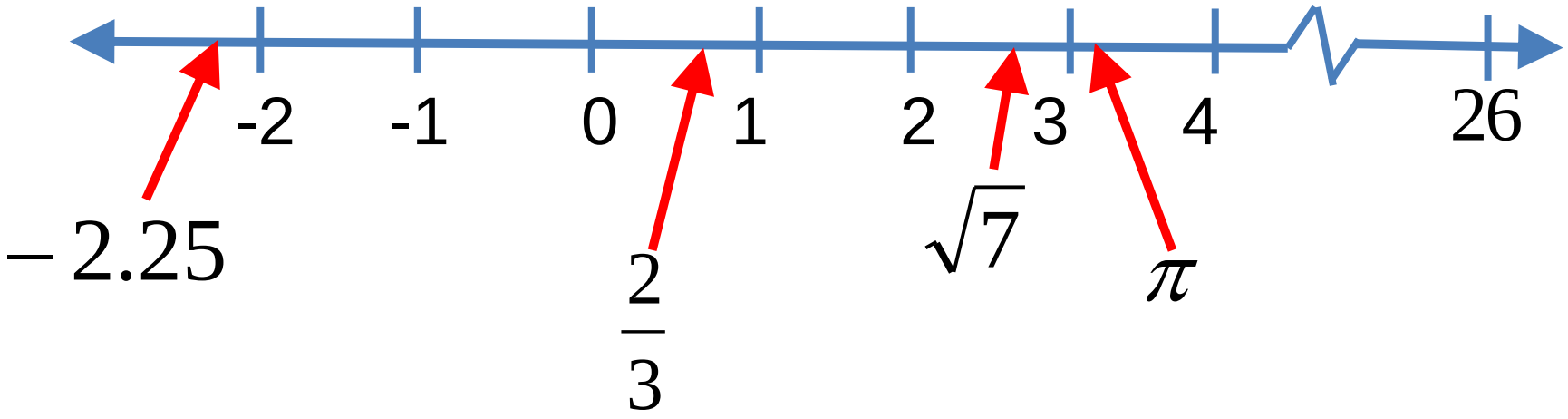


# Vocabulary

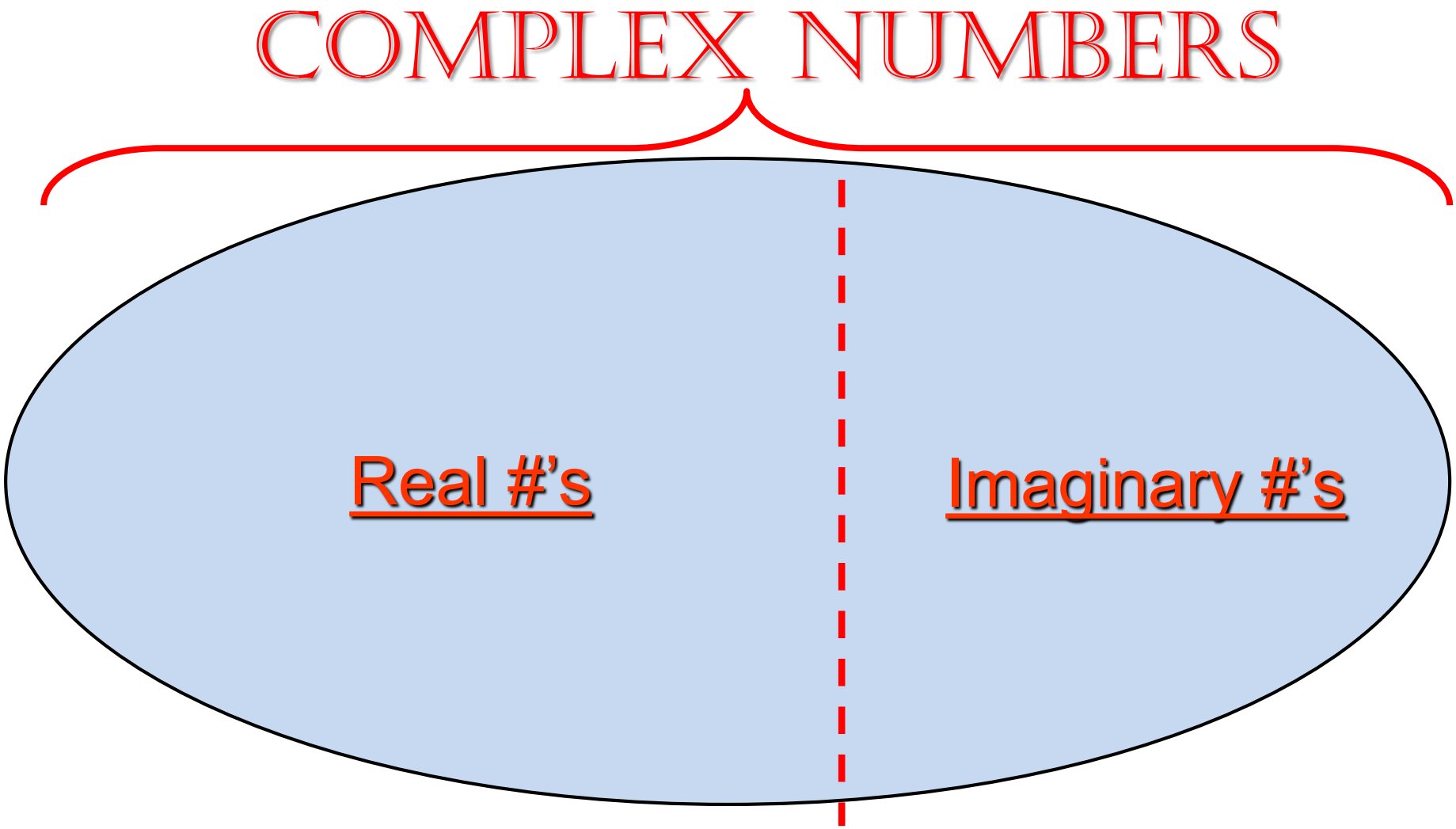
imaginary numbers: a number that includes the square root of a negative number. They are not on the number line!

$$\sqrt{-1} \qquad i\sqrt{3} \qquad \sqrt{-2}$$

real numbers: a number that can be found on the number line.



Think of the complex numbers as the “universe of numbers”.



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

If we apply the Property of Equality (square both sides)

$$i^2 = -1$$

ALWAYS replace $i^2$ with -1. Why?

Rewrite the following so that there are NO negatives under the square root symbol and NO $i^2$ 's .

$\sqrt{-5} \rightarrow i\sqrt{5}$

$3\sqrt{-5} \rightarrow 3i\sqrt{5}$

$-4\sqrt{-5} \rightarrow -4i\sqrt{5}$

$5 - 2\sqrt{-3} \rightarrow 5 - 2i\sqrt{3}$

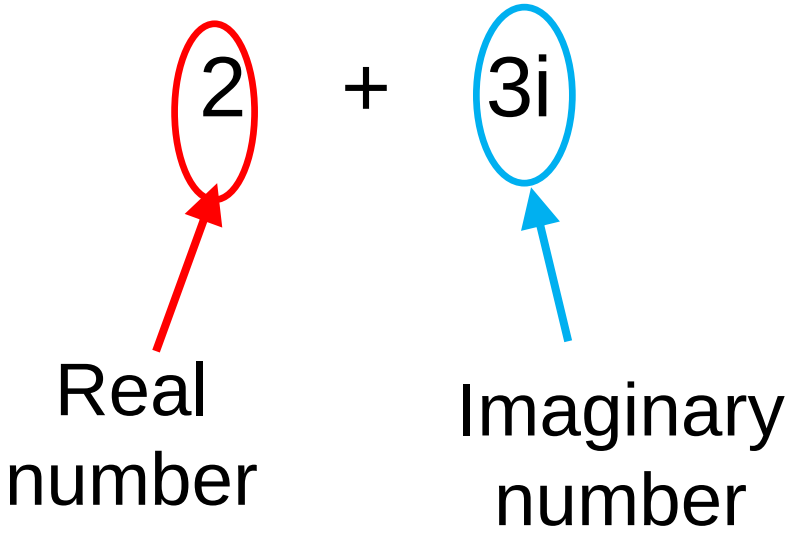
$-2i^2\sqrt{-3} \rightarrow -2(-1)\sqrt{3}$

$\rightarrow 2\sqrt{3}$

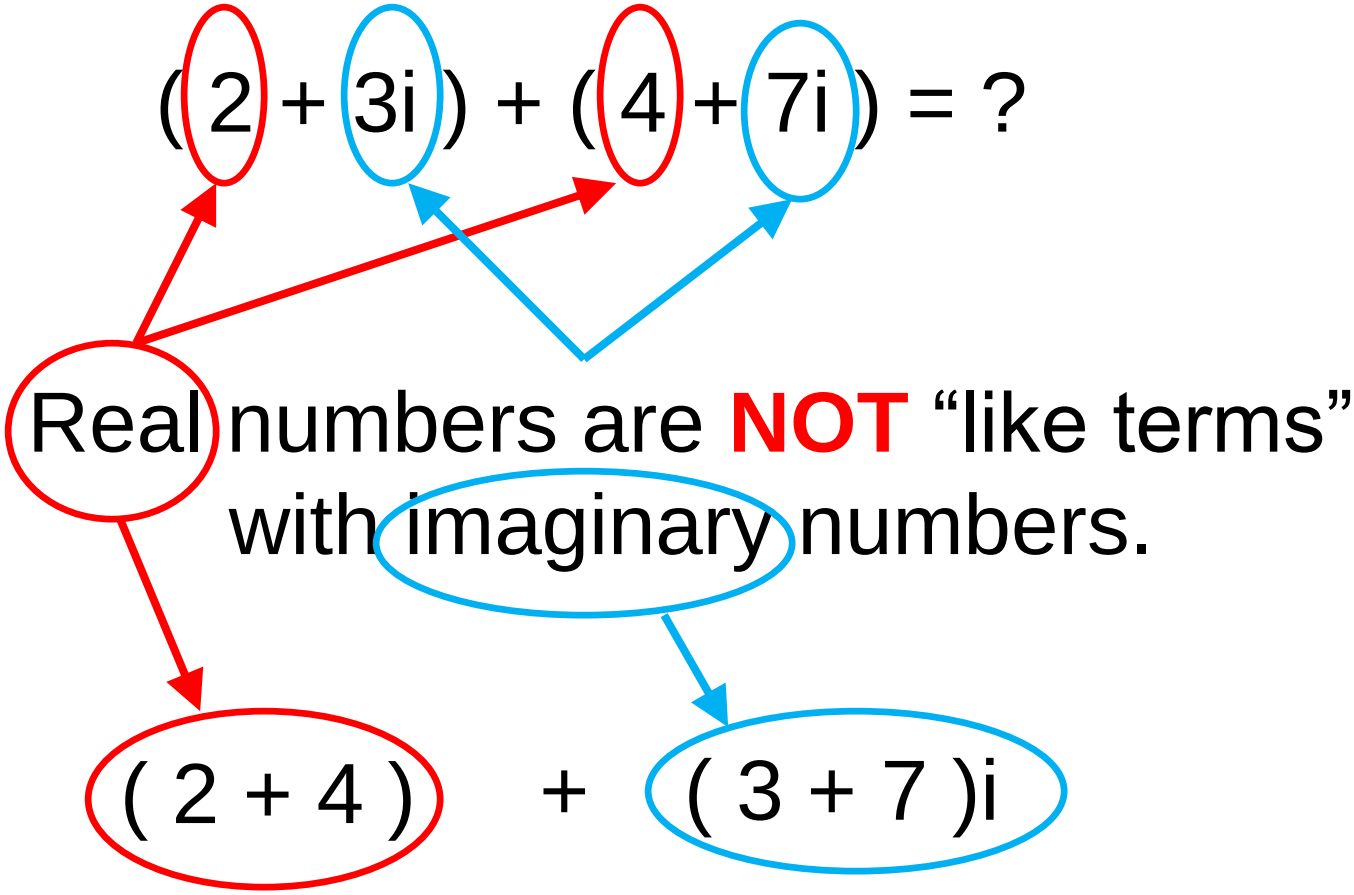
New number systems are needed when a number system is not "closed" for a particular operation (the square root of -1)

What number system is closed for all operations?

The Complex Number System. $a + bi$



# Adding and Subtracting Complex #'s



$(2 - 3i) - (-4 - 5i) = ?$ $6 + 2i$

$7i - (2 - 3i) = ?$ $-2 + 10i$

$a - 3i = 4 + bi$ $a = 4,\ b = -3$

$a = ?,\ b = ?$

# Multiplying Complex Numbers

$3i * 4i = 3 * i * 4 * i$

$= 3 * 4 * i * i$

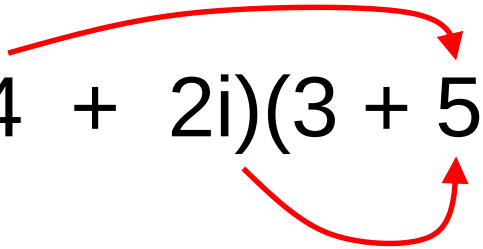
$= 12i^2 \qquad i^2 = -1$

$= -12$

# Multiplying Complex Numbers

$2(4 + 3i) = 8 + 6i$

The distributive property repeated two times.



$(4 + 2i)(3 + 5i) = 4(3 + 5i) + 2i(3 + 5i)$

$= 12 + 20i + 6i + 10i^2$

$= 12 + 26i + 10(-1)$

$= 2 + 26i$