

# Warmup:

$$\sqrt{-32}$$

$$= i\sqrt{32} = 4i\sqrt{2}$$

$$i^{46}$$

$$i^{46} = i^2 = -1$$

$$\frac{46}{4} = 12.5$$

$$(10 - 6i) + (3 + 4i)$$

$$13 - 2i$$

$$(12 - 3i) - (10 - 2i)$$

$$2 - i$$

# Multiply the following:

1.  $5(7n - 2)$

$$35n - 10$$

2.  $-4m^3(-3m)$

$$\frac{12m^3}{\cancel{(12)^3} m}$$

$$(-4 \cdot -3)(m^3 \cdot m)$$

$$12m^{(3+1)}$$

$$12m^4$$

~~1728m~~

3.  $(3x+3)(x+2)$

F.O.I.L.

i	r	s	+
n	+	e	r
a	n	r	+

F:  $3x \cdot x = 3x^2$

O:  $3x \cdot 2 = 6x$

I:  $3 \cdot x = 3x$

L:  $3 \cdot 2 = \underline{\underline{6}}$

$$3x^2 + 9x + 6$$

$$3x + 3$$

x	$3x^2$	$3x$
+2	$6x$	6

$$= 3x^2 + 9x + 6$$

4.  $(x+3)(x+3)$

F:	$x^2$
O:	$3x$
I:	$3x$
L:	9

$$x^2 + 6x + 9$$

# Multiplying Complex Numbers

We multiply complex numbers as we would multiply monomials or binomials, treating the imaginary parts as like terms.

Multiply:

$$3i \times 4i$$

$$(3i)(4i) =$$

$$3i \cdot 4 = \underline{12i}$$

~~$$12i$$~~

$$12i^2$$

$$12(-1)$$

$$\underline{-12}$$

# Multiply

$$i^2 = -1$$

$$(7i)^2 \neq 7i^2$$

$$(7i)^2$$

$$= (7i)(7i) = 49i^2$$

$$49(-1)$$

$$-49$$

$$49i$$

$$-49$$

$$-49i$$

$$49i^3$$

# You try:

$$7i \cdot 6i$$

$$42(i^2) = 42(-1) = -42$$

$$3i \cdot i$$

$$3i \cdot 1i = 3i^2 = 3(-1) = -3$$

$$(9i)^2$$

$$9i \cdot 9i = 81i^2 = 81(-1) = -81$$

$$(-5i)^2$$

$$-5i \cdot -5i = 25i^2 = 25(-1) = -25$$

Multiply

$$-80$$

$$-80i$$

$$(4i)(2i)(10i)$$

$$i^3 = \boxed{-i}$$

$$(4 \cdot 2 \cdot 10)(i \cdot i \cdot i)$$

$$80 i^3$$

$$80(-i) = \boxed{-80i}$$



You try:

$$60i$$

$$~~-60i~~$$

$$(-3i)(4i)(5i)$$

$$-3 \cdot 4 \cdot 5 \cdot i^3$$

$$-60 \cdot -i$$



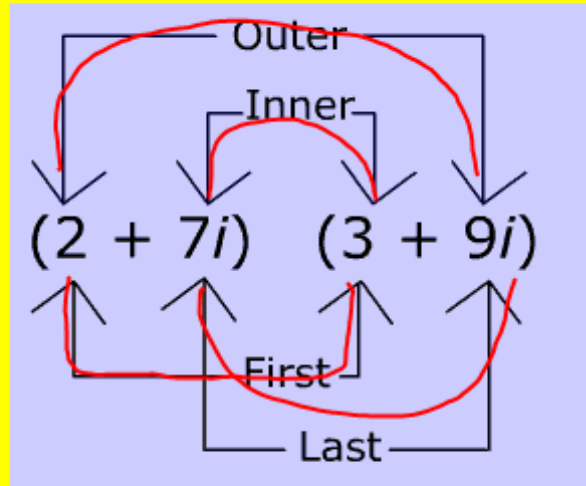
# Multiplying

## To Multiply Complex Numbers

- Change all imaginary numbers to  $bi$  form.
- Multiply the complex numbers as you would multiply polynomials. **F.O.I.L.**
- Substitute **-1** for each  $i^2$ .
- Combine the real parts and the imaginary parts.  
Write the answer in  $a + bi$  form.

# Multiply:

$$(2 + 7i)(3 + 9i)$$



$$2 \cdot 3 = 6$$

$$2 \cdot 9i = 18i$$

$$7i \cdot 3 = 21i$$

$$7i \cdot 9i = 63i^2 = 63 \cdot -1 = -63$$

Note: the  $i^2$  simplifies to  $-1$ .

*So, now that we've multiplied, what is next?*

Add up each term!

$$\begin{array}{r} 6 \\ 18i \\ 21i \\ \underline{-63} \end{array}$$

$$\star (-57 + 39i) \star$$

# Multiply

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

MULTIPLY

$$(3 + 2i) \cdot (4 + 5i)$$

$$= 12 + 15i + 8i + 10i^2$$

$$= 12 + 15i + 8i - 10$$

$$= 2 + 23i$$

~~23~~  $\sqrt{-1}$

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

$$i^2 = -1$$

10(-1)

# Multiply

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

	4	5i	
2	8	10i	
-3i	-12i	-15i <sup>2</sup>	

$$8 - 2i - 15(-1)$$

$$8 + 15 - 2i$$

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

$$4 \cdot 2 - 12i + 10i - 15i^2$$

$$8 - 2i + 15$$

$$23 - 2i$$

# Multiply

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

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

$$16 + 4i - 32i - 8i^2$$

$$16 - 28i - 8i^2$$

$$16 - 28i - 8(-1)$$

$$16 - 28i + 8$$

$$24 - 28i$$

# You try:

$$\text{a) } (3 + i)(4 + 2i)$$

$$12 + 6i + 4i + 2i^2$$

$$12 + 10i - 2$$

$$= 10 + 10i$$

$$\text{c) } (-7 + 5i)(1 - 2i)$$

$$-7 + 14i + 5i - 10i^2$$

$$-7 + 19i + 10$$

$$= 3 + 19i$$

$$\text{5) } (2 + 4i)(2 - 4i)$$

$$4 - 8i + 8i - 16i^2$$

$$4 + 16$$

$$= 20$$

$$\text{b) } (8 + 3i)(6 - 2i)$$

$$48 - 16i + 18i - 6i^2$$

$$48 + 2i + 6$$

$$= 54 + 2i$$

$$\text{d) } (-3 - 5i)(3 - i)$$

$$-9 + 3i - 15i + 5i^2$$

$$-9 - 12i - 5$$

$$= -14 - 12i$$

*conjugate*

# HW #4

## Multiplying Complex Numbers