# Warmup:

1. $\sqrt{-16}$ $= \sqrt{-1 \cdot 16}$ $\sqrt{-1}$ $\sqrt{16}$ $i \cdot 4 = 4i$

2. $\sqrt{-28}$ $= i\sqrt{28} = 2i\sqrt{7}$ ($4 \cdot 7$, $2 \cdot 2$)

3. $\sqrt{-5}$ $= i\sqrt{5}$

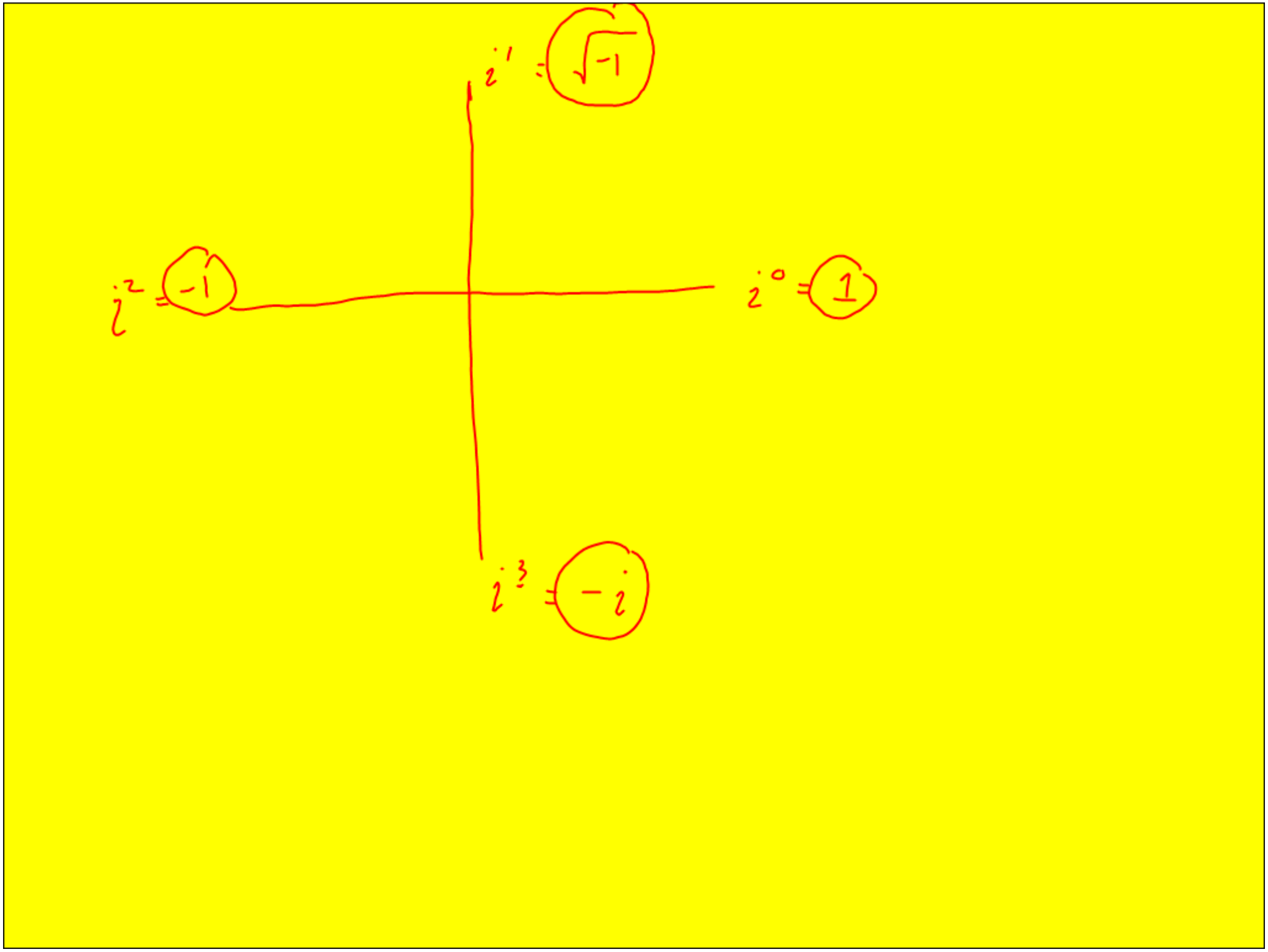
4. $i^{15} = -i$ $15 \div 4 = 3$ Rem. 3

5. $i^{26} = -1$ $26 \div 4 = 6.5$

6. $i^{39} = -i$ $39 \div 4 = 9.75$

7. $i^{112} = 1$ $112 \div 4 = 28$

| Answer | | Dec |
|---|---|---|
| 1 | R 0 | — |
| $\sqrt{-1}$ | R 1 | .25 |
| $-1$ | R 2 | .5 |
| $-i$ | R 3 | .75 |


$i^1 = \sqrt{-1}$
$i^2 = -1$
$i^0 = 1$
$i^3 = -i$

Add or subtract the following expressions:

$2x + 5x =$ $7x$

$(4 + 3x) + (2 + 6x) =$

$9x + 6$

$7 - 3y - 4 =$ $-3y + 3$

$11 - 3y$

$-3y + 3$ ✡

$3 - 3y$ ✡

$3y - 3$

$(10 + 5y) - (6 + 2y) =$

$10 - 6 = 4$

$5y - 2y = 3y$

$3y + 4$

$(10 + 5y) - (6 + 2y)$

$10 + 5y + -6 + -2y$

# HW #2 Answer Key

1. $i^6$ $6/4 = 1\ R\ 2$ $i^6 = i^2 = \boxed{-1}$
2. $i^8$ $8/4 = 2\ R\ 0$ $i^8 = i^0 = \boxed{1}$
3. $i^3$ $3/4 = 0\ R\ 3$ $i^3 = \boxed{-i}$
4. $i^5$ $5/4 = 1\ R\ 1$ $i^5 = i^1 = \boxed{\sqrt{-1}}$ or $i$
5. $i^7$ $7/4 = 1\ R\ 3$ $i^7 = i^3 = \boxed{-i}$

$3 \div 4 = .75$

6. $i^9$ $9/4 = 2$ R1 $i^9 = i^1 = \boxed{\sqrt{-1}}$ or $i$

7. $i^{12}$ $12/4 = 3$ R0 $i^{12} = i^0 = \boxed{1}$

8. $i^{15}$ $15/4 = 3$ R3 $i^{15} = i^3 = \boxed{-i}$

9. $i^{20}$ $20/4 = 5$ R0 $i^{20} = i^0 = \boxed{1}$

10. $i^{26}$ $26/4 = 6$ R2 $i^{26} = i^2 = \boxed{-1}$

**11.** $i^{31}$ $31/4 = 7\ R3$ $i^{31} = i^3 = -i$

**12.** $i^{33}$ $33/4 = 8\ R1$ $i^{33} = i^1 = \sqrt{-1}$

**13.** $i^{41}$ $41/4 = 10\ R1$ $i^{41} = i^1 = \sqrt{-1}$

**14.** $i^{48}$ $48/4 = 12\ R0$ $i^{48} = i^0 = 1$

**15.** $i^{55}$ $55/4 = 13\ R3$ $i^{55} = i^3 = -i$

**16.** $i^{61}$ $61/4 = 15\ R1$ $i^{61} = i^1 = \sqrt{-1}$

**17.** $i^{75}$ $75/4 = 18\ R3$ $i^{75} = i^3 = -i$

**18.** $i^{89}$ $89/4 = 22\ R1$ $i^{89} = i^1 = \sqrt{-1}$

**19.** $i^{106}$ $106/4 = 26\ R2$ $i^{106} = i^2 = -1$

**20.** $i^{225}$ $225/4 = 56\ R1$ $i^{225} = i^1 = \sqrt{-1}$

# Complex Numbers

Complex Numbers consist of all sums a + b*i*, where a and b are real numbers and *i* is the imaginary unit.
The real part is a and the imaginary part is b*i*.

ex: $4 + 2i$

$0 + 0i$

$-3 + 5i$

$0 + 4i \Rightarrow 4i$

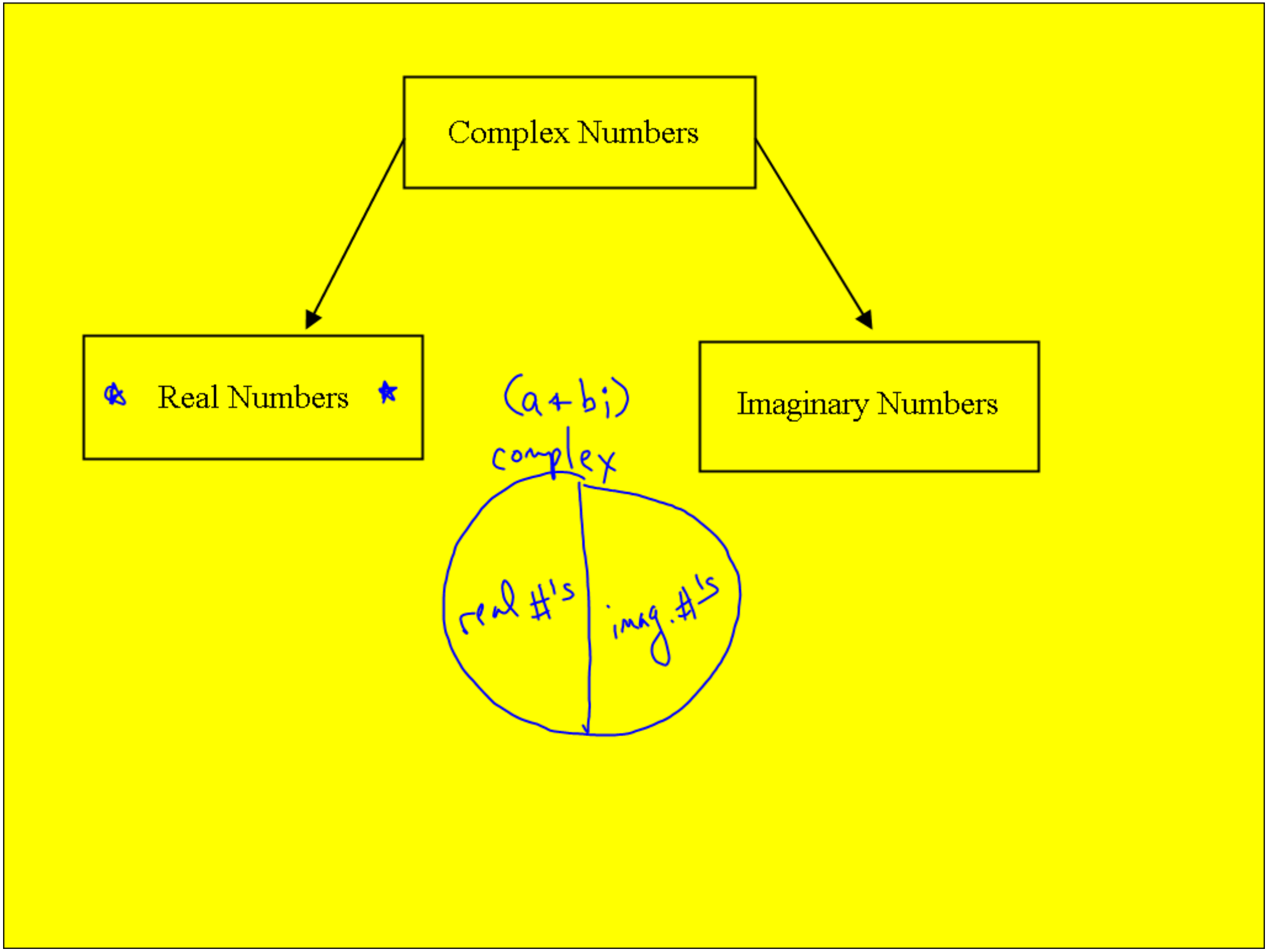
$-7 + 0i \Rightarrow -7$

Every real number a is a complex number because $a = a + 0i$.

Example: 4 is a complex number because $4 = 4 + 0i$

Every imaginary number $bi$ is a complex number because $bi = 0 + bi$.

Example: $2i$ is a complex number because $2i = 0 + 2i$


Complex Numbers
Real Numbers
(a + bi)
complex
real #'s
imag. #'s
Imaginary Numbers

We assume that $i$ acts like a real number, obeying the commutative, associative and distributive properties.

Therefore, to add and subtract complex numbers, we can treat $i$ as we would treat a variable.

$2x + 5x = 7x$

$2i + 5i = 7i$

$7i + 9i =$ $16i$

$a + bi$

$(-5 + 6i) + (2 - 11i) =$ $-5 + 2 = -3$

$6i + -11i = -5i$

$-3 - 5i$

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

$2 + 3i + -4 - 2i =$

$2 + -4 = -2$

$3i - 2i = i$

$-2 + i$

# You try:

simplify

$(-2 + 3i) + (2 - 3i) =$ 0

express as a complex #

$0 + 0i$

$-2 + 2 = 0$

$3i + -3i = 0i$

# You try:

$3i - 4i =$ $-2i$ or $-1i$

# You try:

$(-4 + 10i) - (-2 + 3i) =$

$-4 + 10i + 2 - 3i = -2 + 7i$

Add or subtract:

1) $-7i + 10i$

$3i$

2) $4i + (-10i)$

$-6i$

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

$8 + i$

4) $(-2 + 3i) + (7 + 8i)$

$5 + 11i$

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

$-5i + 9$

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

$5i + -4$

$-4 + 5i$

7) $3i - (5 - 2i)$

$-5 + 5i$

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

$-2 - 3i$

9) $(-2 + 8i) - (7 + 3i)$

$5i + -9$

$-9$

$-9 + 5i$

$-2 - 7 = -9$

# HW #3: Adding and Subtracting Complex Numbers