Name: _____ Date: _____

## Complex Numbers Review

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

An imaginary number is a number expressed in terms of the _____ of a negative number, represented by _____.

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

A complex number is a number that has a _____ part and an _____ part. It is written in the form _____.

$$3 + \frac{1}{2}i, 12 - 5i, 1 - i$$

### Conjugates

A conjugate is the complex number with the _____ sign in the middle.

$$5 - 3i \Rightarrow 5 + 3i$$

### Addition

To add complex numbers, combine the imaginary terms and the real terms.

$$(-3 + 7i) + (5 - 4i) = 2 + 3i$$

| | | |
|---|---|---|
| $(3 + 2i) + (1 + 7i)$ | $(3 + 5i) + (4 - 3i)$ | $(18 - 6i) + (12 - 10i)$ |

### Subtraction

To subtract complex numbers, combine the imaginary terms and the real terms, but remember to distribute the negative.

$$(4 - 2i) - (5 + 3i) = 1 - 5i$$

| | | |
|---|---|---|
| $(3 - 2i) - (-4 + 6i)$ | $(-1 - i) - (-3 - 4i)$ | $(16 - 4i) - (12 - 3i)$ |

## Multiplication

To multiply complex numbers, use FOIL as you would multiply normal binomials.

$$(3 + 2i)(1 + 7i) = 3 + 21i + 2i + 14i^2 = 3 + 23i - 14 = -11 + 23i$$

| | | |
|---|---|---|
| $(2 + 3i)(1 - 4i)$ | $(1 + i)^2$ | $(3 - 4i)(4 + 5i)$ |

## Division

To divide complex numbers, multiply both the top and the bottom by the conjugate of the bottom, then solve.

$$\frac{2 + 3i}{4 - 5i} \times \frac{4 + 5i}{4 + 5i} = \frac{8 + 10i + 12i + 15i^2}{16 + 20i - 20i - 25i^2} = \frac{-7}{41} + \frac{22}{41}$$

| | | |
|---|---|---|
| $\frac{1 + i}{3 + 2i}$ | $(6 + 3i) / (5 + 2i)$ | $(3 - 7i) / (2 + 6i)$ |

## Practice

| | |
|---|---|
| $(4 + 5i) + (2 - 3i)$ | $(7 - 5i) - (1 - 5i)$ |
| $(2 - 3i)^2$ | $\frac{2 + i}{1 - 3i}$ |

Miya Haynes

Name: Answer Key Date: _____

## Complex Numbers Review

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

An imaginary number is a number expressed in terms of the Square root of a negative number, represented by i.

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

A complex number is a number that has a real part and an imaginary part. It is written in the form a+bi.

$$3 + \frac{1}{2}i, 12 - 5i, 1 - i$$

### Conjugates

A conjugate is the complex number with the opposite sign in the middle.

$$5 - 3i \Rightarrow 5 + 3i$$

### Addition

To add complex numbers, combine the imaginary terms and the real terms.

$$(-3 + 7i) + (5 - 4i) = 2 + 3i$$

| | | |
|---|---|---|
| $(3 + 2i) + (1 + 7i)$<br>4+9i | $(3 + 5i) + (4 - 3i)$<br>7+2i | $(18 - 6i) + (12 - 10i)$<br>30-16i |

### Subtraction

To subtract complex numbers, combine the imaginary terms and the real terms, but remember to distribute the negative.

$$(4 - 2i) - (5 + 3i) = 1 - 5i$$

| | | |
|---|---|---|
| $(3 - 2i) - (-4 + 6i)$<br>3-2i+4-6i<br>7-8i | $(-1 - i) - (-3 - 4i)$<br>-1-i+3+4i<br>2+3i | $(16 - 4i) - (12 - 3i)$<br>16-4i-12+3i<br>4-i |

## Multiplication

To multiply complex numbers, use FOIL as you would multiply normal binomials.

$$(3 + 2i)(1 + 7i) = 3 + 21i + 2i + 14i^2 = 3 + 23i - 14 = -11 + 23i$$

| | | |
|---|---|---|
| $(2 + 3i)(1 - 4i)$<br>$2 - 8i + 3i - 12i^2$<br>$2 - 5i - 12(-1)$<br>$14 - 5i$ | $(1 + i)^2$<br>$1 + i + i + i^2$<br>$1 + 2i + (-1)$<br>$2i$ | $(3 - 4i)(4 + 5i)$<br>$12 + 15i - 16i + 20i^2$<br>$12 - i + 20(-1)$<br>$-8 - i$ |

## Division

To divide complex numbers, multiply both the top and the bottom by the conjugate of the bottom, then solve.

$$\frac{2 + 3i}{4 - 5i} \times \frac{4 + 5i}{4 + 5i} = \frac{8 + 10i + 12i + 15i^2}{16 + 20i - 20i - 25i^2} = \frac{-7}{41} + \frac{22}{41}$$

| | | |
|---|---|---|
| $\frac{1+i}{3+2i} \times \frac{3-2i}{3-2i}$<br>$\frac{3-2i+3i-2i^2}{9-6i+6i-4i^2}$<br>$\frac{3+i-2(-1)}{9-4(-1)} = \frac{5+i}{13} = \frac{5}{13} + \frac{1}{13}i$ | $(6 + 3i) / (5 + 2i) \times \frac{5-2i}{5-2i}$<br>$\frac{30-12i+15i-6i^2}{25-10i+10i-4i^2}$<br>$\frac{30+3i-6(-1)}{25-4(-1)}$<br>$\frac{36+3i}{29} = \frac{36}{29} + \frac{3}{29}i$ | $(3 - 7i) / (2 + 6i) \times \frac{2-6i}{2-6i}$<br>$\frac{6-18i-14i+42i^2}{4+12i-12i-36i^2}$<br>$\frac{6-32i+42(-1)}{4-36(-1)}$<br>$\frac{-36-32i}{40} = \frac{-36}{40} - \frac{32}{40}i$ |

## Practice

| | |
|---|---|
| $(4 + 5i) + (2 - 3i)$<br>$6 + 2i$ | $(7 - 5i) - (1 - 5i)$<br>$7 - 5i - 1 + 5i$<br>$6$ |
| $(2 - 3i)^2$<br>$4 - 6i - 6i + 9i^2$<br>$4 - 12i + 9(-1)$<br>$-5 - 12i$ | $\frac{2+i}{1-3i} \times \frac{1+3i}{1+3i}$<br>$\frac{2+6i+i+3i^2}{1-3i+3i-9i^2}$<br>$\frac{2+7i+3(-1)}{1-9(-1)} = \frac{-1+7i}{10} = \frac{-1}{10} + \frac{7}{10}i$ |