Name ______________________ Date __________ Class __________

LESSON 5-9

Practice C
Operations with Complex Numbers

Find each absolute value.

1. $|-12 + 6i|$ ____________

2. $|-7 - 4i|$ ____________

3. $\left|\frac{1}{2} + \frac{1}{2}i\right|$ ____________

Add or subtract. Write the result in the form *a* + *bi*.

4. $(8 - i) - (-5 - 4i)$ ____________

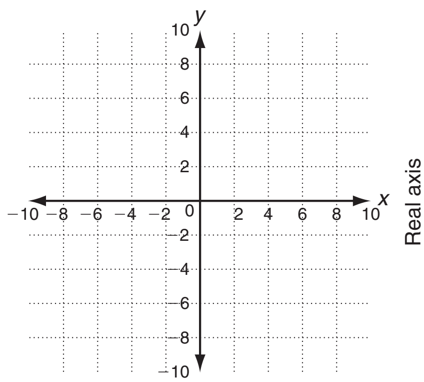
5. $(2 - 11i) - (10 + 6i)$ ____________

6. $\left(\frac{1}{2} + \frac{3}{4}i\right) + \left(-\frac{1}{4} - \frac{5}{4}i\right)$ ____________

Find each sum by graphing on the complex plane.

7. $(-6 - i) + (1 + 3i)$ ____________

8. $(-2 - 2i) + (8 - 6i)$ ____________



Multiply or divide. Write the result in the form *a* + *bi*.

9. $\frac{-3 + 7i}{1 + 8i}$ ____________

10. $(-4 - 9i)(8 + 2i)$ ____________

11. $\frac{5 + i}{2 - i}$ ____________

Simplify.

12. $i^{24} - i^{13} + i^{12}$ ____________

13. $-4i^{13}$ ____________

14. $6 - 4i^{18}$ ____________

Solve.

15. In a circuit, the voltage, *V,* is given by the formula $V = IZ$, where *I* is the current and *Z* is the impedance. Both the current and impedance are represented by complex numbers. Find the voltage if the current is $3 + 2i$ and the impedance is $4 - i$.

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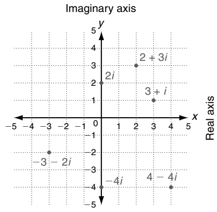
LESSON 5-9

Practice A
Operations with Complex Numbers

Graph each complex number.

1. $2i$
2. $-4i$
3. $3 + i$
4. $-3 - 2i$
5. $2 + 3i$
6. $4 - 4i$



Find each absolute value.

7. $|6 + 2i|$ — $2\sqrt{10}$
8. $|3 + i|$ — $\sqrt{10}$
9. $|3 - 4i|$ — 5

Add or subtract. Write the result in the form $a + bi$.

10. $6i + 4i$ — $10i$
11. $-i - 3i$ — $-4i$
12. $(4i) + (2 + 8i)$ — $2 + 12i$
13. $(1 + 2i) + (3 + 4i)$ — $4 + 6i$
14. $(2 - 7i) - (5 - 3i)$ — $-3 - 4i$
15. $(7 - 4i) + (3 - i)$ — $10 - 5i$

Multiply. Write the result in the form $a + bi$.

16. $2(3i)$ — $6i$
17. $-4(5i)$ — $-20i$
18. $2(6 + 8i)$ — $12 + 16i$
19. $2i(3 + 5i)$ — $-10 + 6i$
20. $(3 + i)(1 - 4i)$ — $7 - 11i$
21. $(1 + 2i)(2 + 5i)$ — $-8 + 9i$

Simplify.

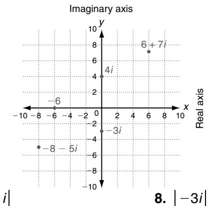
22. i^7 — $-i$
23. $\frac{2 + 5i}{3i}$ — $\frac{5}{3} - \frac{2}{3}i$
24. $\frac{8 + 2i}{1 - 3i}$ — $\frac{1}{5} + \frac{13}{5}i$

LESSON 5-9

Practice B
Operations with Complex Numbers

Graph each complex number.

1. -6
2. $4i$
3. $6 + 7i$
4. $-8 - 5i$
5. $-3i$



Find each absolute value.

6. $|4 + 2i|$ — $2\sqrt{5}$
7. $|5 - i|$ — $\sqrt{26}$
8. $|-3i|$ — 3

Add or subtract. Write the result in the form $a + bi$.

9. $(-1 + 2i) + (6 - 9i)$ — $5 - 7i$
10. $(3 - 3i) - (4 + 7i)$ — $-1 - 10i$
11. $(-5 + 2i) + (-2 + 8i)$ — $-7 + 10i$

Multiply. Write the result in the form $a + bi$.

12. $3i(2 - 3i)$ — $9 + 6i$
13. $(4 + 5i)(2 + i)$ — $3 + 14i$
14. $(-1 + 6i)(3 - 2i)$ — $9 + 20i$

Simplify.

15. $\frac{2 + 4i}{3i}$ — $\frac{4}{3} - \frac{2}{3}i$
16. $\frac{3 + 2i}{4 + i}$ — $\frac{14}{17} + \frac{5}{17}i$
17. $2i^{11}$ — $-2i$

Solve.

18. In electronics, the total resistance to the flow of electricity in a circuit is called the impedance, Z. Impedance is represented by a complex number. The total impedance in a series circuit is the sum of individual impedances. The impedance in one part of a circuit is $Z_1 = 3 + 4i$. In another part of a circuit, the impedance is $Z_1 = 5 - 2i$. What is the total impedance of the circuit?

$8 + 2i$

LESSON 5-9

Practice C
Operations with Complex Numbers

Find each absolute value.

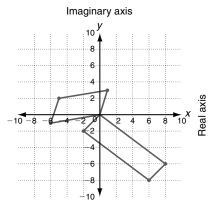
1. $|-12 + 6i|$ — $6\sqrt{5}$
2. $|-7 - 4i|$ — $\sqrt{65}$
3. $\left|\frac{1}{2} + \frac{1}{2}i\right|$ — $\frac{\sqrt{2}}{2}$

Add or subtract. Write the result in the form $a + bi$.

4. $(8 - i) - (-5 - 4i)$ — $13 + 3i$
5. $(2 - 11i) - (10 + 6i)$ — $-8 - 17i$
6. $\left(\frac{1}{2} + \frac{3}{4}i\right) + \left(-\frac{1}{4} - \frac{5}{4}i\right)$ — $\frac{1}{4} - \frac{1}{2}i$

Find each sum by graphing on the complex plane.

7. $(-6 - i) + (1 + 3i)$ — $-5 + 2i$
8. $(-2 - 2i) + (8 - 6i)$ — $6 - 8i$



Multiply or divide. Write the result in the form $a + bi$.

9. $\frac{-3 + 7i}{1 + 8i}$ — $\frac{53}{65} + \frac{31i}{65}$
10. $(-4 - 9i)(8 + 2i)$ — $-14 - 80i$
11. $\frac{5 + i}{2 - i}$ — $\frac{9}{5} + \frac{7i}{5}$

Simplify.

12. $i^{24} - i^{13} + i^{12}$ — $2 - i$
13. $-4i^{13}$ — $-4i$
14. $6 - 4i^{18}$ — 10

Solve.

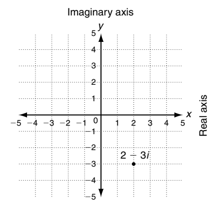
15. In a circuit, the voltage, V, is given by the formula $V = IZ$, where I is the current and Z is the impedance. Both the current and impedance are represented by complex numbers. Find the voltage if the current is $3 + 2i$ and the impedance is $4 - i$.

$14 + 5i$

LESSON 5-9

Reteach
Operations with Complex Numbers

Graphing complex numbers is like graphing real numbers. The real axis corresponds to the x-axis and the imaginary axis corresponds to the y-axis.



To find the **absolute value** of a complex number, use $|a + bi| = \sqrt{a^2 + b^2}$.

$|7i|$
$= \sqrt{(0)^2 + (7)^2}$
$= \sqrt{49}$
$= 7$

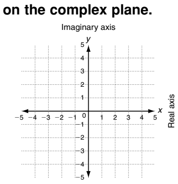
Think: $7i = 0 + 7i$; so $a = 0$ and $b = 7$.

$|3 - i|$
$= \sqrt{(3)^2 + (-1)^2}$
$= \sqrt{9 + 1}$
$= \sqrt{10}$

Think: $3 - i = 3 - 1i$; so $a = 3$ and $b = -1$.

Graph and label each complex number on the complex plane.

1. $1 + i$
2. $4i$
3. $-2 + 0i$
4. $2 - i$
5. $-1 - 3i$



Find each absolute value.

6. $|-8i|$
$|0 - 8i|$
$\sqrt{(0)^2 + (-8)^2}$
8

7. $|2 + i|$
$|2 + 1i|$
$\sqrt{5}$

8. $|3|$
$|3 + 0i|$
3

9. $|5 - 2i|$ — $\sqrt{29}$
10. $|9i|$ — 9
11. $|-4 + 3i|$ — 5