

5.2D Operations with Radical Expressions

1. Simplify each expression.

a) $\sqrt{20}$
 $\sqrt{4 \cdot 5}$
 $2\sqrt{5}$

b) $\sqrt{48}$
 $\sqrt{16 \cdot 3}$
 $4\sqrt{3}$

c) $\sqrt{200}$
 $\sqrt{100 \cdot 2}$
 $10\sqrt{2}$

d) $3\sqrt{20}$
 $3\sqrt{4 \cdot 5}$
 $3 \cdot 2\sqrt{5}$
 $6\sqrt{5}$

e) $5\sqrt{24}$
 $5\sqrt{4 \cdot 6}$
 $5 \cdot 2\sqrt{6}$
 $10\sqrt{6}$

f) $6\sqrt{98}$
 $6\sqrt{49 \cdot 2}$
 $6 \cdot 7\sqrt{2}$
 $42\sqrt{2}$

2. Add or subtract each expression.

a) $(5 - \sqrt{3}) + (4 + \sqrt{3})$
 9

b) $(4 + 5\sqrt{2}) + (2 + 6\sqrt{2})$
 $6 + 11\sqrt{2}$

c) $(6 - 8\sqrt{7}) - (4 + 2\sqrt{7})$
 $2 - 10\sqrt{7}$

d) $8 - (3 + 5\sqrt{2})$
 $5 - 5\sqrt{2}$

e) $-2\sqrt{5} + (3 + \sqrt{5})$
 $3 - \sqrt{5}$

f) $(6 + 5\sqrt{12}) + (5 - \sqrt{12})$
 $11 + 4\sqrt{12}$
 $11 + 4\sqrt{4 \cdot 3}$
 $11 + 4 \cdot 2\sqrt{3}$
 $11 + 8\sqrt{3}$

5.2D Operations with Radical Expressions7. Verify that the given answer (value of x) is a solution to the equation.

a) $x^2 + 7 = 25$; $x = 3\sqrt{2}$
 $(3\sqrt{2})^2 + 7 = 25$
 $18 + 7 = 25 \checkmark$

yes

b) $x^2 - 14x + 50 = 3$; $x = (6 + \sqrt{2})$
 $(6 + \sqrt{2})(6 + \sqrt{2}) - 14(6 + \sqrt{2}) + 50 = 3$
 $36 + 12\sqrt{2} + 2 - 84 - 14\sqrt{2} + 50 = 3$
 $38 + 12\sqrt{2} - 84 - 14\sqrt{2} + 50$
 $4 - 2\sqrt{2} \neq 3$
 $6 + \sqrt{2}$ is not a solution

c) $\frac{2x^2 - 20x}{2} = \frac{40}{2}$; $x = (5 - 3\sqrt{5})$

$$x^2 - 10x = 20$$

$$x^2 - 10x - 20 = 0$$

$$(5 - 3\sqrt{5})(5 - 3\sqrt{5}) - 10(5 - 3\sqrt{5}) - 20 = 0$$

$$25 - 30\sqrt{5} + 45 - 50 + 30\sqrt{5} - 20 = 0$$

$$70 - 70 + 30\sqrt{5} + 30\sqrt{5}$$

$$0 = 0 \checkmark$$

yes

8. Simplify each expression.

a) $\frac{6a + 15}{3}$

$$2a + 5$$

b) $\frac{6 + 15\sqrt{2}}{3}$

$$2 + 5\sqrt{2}$$

c) $\frac{-14 - 10\sqrt{6}}{2}$

$$-7 - 5\sqrt{6}$$

d) $\frac{-25 + 15\sqrt{40}}{5}$

$$-5 + 3\sqrt{40}$$

$$3\sqrt{4 \cdot 10}$$

$$-5 + 6\sqrt{10}$$

9. Verify that the given answer (value of x) is a solution to the equation.

$2x^2 - 3x - 6 = 0$; $x = \frac{3 + \sqrt{57}}{4}$
 $2\left(\frac{3 + \sqrt{57}}{4}\right)^2 - 3\left(\frac{3 + \sqrt{57}}{4}\right) - 6 = 0$

$$\frac{9 + 6\sqrt{57} + 57}{16}$$

$$\left(\frac{66 + 6\sqrt{57}}{16}\right)$$

$$2\left(\frac{33 + 3\sqrt{57}}{8}\right)$$

$$\frac{33 + 3\sqrt{57}}{4} - \frac{9 + 3\sqrt{57}}{4}$$

$$\frac{24}{4} - 6 = 0$$

$$0 = 0 \checkmark$$

Section 5.2D

5.2G Operations with Complex Expressions

1. Simplify each expression.

a) $i^2 = -1$

b) $i^4 = 1$

c) $i^{17} = i$

d) $-i^{10} = -(-1) = 1$

e) $i^{101} = i$

f) $i^{87} = -i$

g) $\sqrt{-25} = 5i$

h) $4\sqrt{-9} = 4(3i) = 12i$

i) $5\sqrt{-28} = 5i\sqrt{4 \cdot 7} = 5i \cdot 2\sqrt{7} = 10i\sqrt{7}$

j) $7\sqrt{-8} = 7i\sqrt{8} = 7i\sqrt{4 \cdot 2} = 7i \cdot 2\sqrt{2} = 14i\sqrt{2}$

k) $-4\sqrt{-10} = -4i\sqrt{10} = -4i\sqrt{10}$

l) $5\sqrt{-100} = 5i\sqrt{100} = 5i \cdot 10 = 50i$

2. Add or subtract each expression.

a) $(5-3i) + (4+7i) = 9+4i$

b) $(4-8i) + (9+2i) = 13-6i$

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

d) $6 - (-5 - \sqrt{-9}) = 11 + 3i$

e) $8i + (9 - 11i) = 9 - 3i$

f) $(7 - \sqrt{-81}) + (5 - \sqrt{-100}) = 7 - 9i + 5 - 10i = 12 - 19i$

3. Simplify each expression.

a) $3i \cdot 2i = 6i^2 = 6(-1) = -6$

b) $-6i \cdot 2i = -12i^2 = -12(-1) = 12$

c) $4\sqrt{-6} \cdot 2\sqrt{3} = 4i\sqrt{6} \cdot 2\sqrt{3} = 8i\sqrt{18} = 8i\sqrt{9 \cdot 2} = 8i \cdot 3\sqrt{2} = 24i\sqrt{2}$

d) $-3\sqrt{-20} \cdot 2\sqrt{5} = -6i\sqrt{4 \cdot 5} \cdot \sqrt{5} = -6i \cdot 2 \cdot \sqrt{5} \cdot \sqrt{5} = -6i \cdot 2 \cdot 5 = -60i$

e) $8\sqrt{-2} \cdot 3\sqrt{2} = 24i\sqrt{2} \cdot \sqrt{2} = 24i \cdot 2 = 48i$

f) $-2\sqrt{-6} \cdot 3\sqrt{-3} = -6i\sqrt{6} \cdot i\sqrt{3} = -6i^2\sqrt{18} = -6(-1)\sqrt{9 \cdot 2} = 6 \cdot 3\sqrt{2} = 18\sqrt{2}$

5.2G Operations with Complex Expressions9. Verify that the given answer (value of x) is a solution to the equation.

a) $-2x^2 + 6 = 56$; $x = 5i$

$$\begin{aligned} -2(5i)^2 + 6 &= 56 \\ -2(25i^2) & \\ -2(-25) & \\ 50 + 6 &= 56 \checkmark \end{aligned}$$

b) $x^2 - 8x + 30 = 5$; $x = (4 + 3i)$

$$\begin{aligned} (4+3i)^2 - 8(4+3i) + 30 &= 5 \\ 16 + 24i + 9i^2 & \\ 16 + 24i - 9 & \\ 7 + 24i - 32 - 24i & + 30 = 5 \\ 5 &= 5 \checkmark \end{aligned}$$

c) $x^2 - 2x + 48 = 2$; $x = (1 - 3i\sqrt{5})$

$$\begin{aligned} (1-3i\sqrt{5})^2 - 2(1-3i\sqrt{5}) + 48 &= 2 \\ 1 - 6i\sqrt{5} + 9i^2 5 & \\ 1 - 6i\sqrt{5} - 45 & \\ -44 - 6i\sqrt{5} - 2 + 6i\sqrt{5} + 48 &= \\ -46 + 48 & \\ 2 &= 2 \checkmark \end{aligned}$$

10. Simplify each expression (no decimal values allowed).

a) $\frac{6+8i}{2}$

$$\boxed{3+4i}$$

b) $\frac{6+10i\sqrt{2}}{2}$

$$\boxed{3+5i\sqrt{2}}$$

c) $\frac{-15-21i\sqrt{6}}{3}$

$$\boxed{-5-7i\sqrt{6}}$$

d) $\frac{-30+\sqrt{-75}}{5}$

$$\begin{aligned} \frac{-30+5i\sqrt{3}}{5} &= \\ \boxed{-6+i\sqrt{3}} \end{aligned}$$

11. Verify that the given answer (value of x) is a solution to the equation.

$2x^2 - 6x + 8 = 3$; $x = \frac{3+i}{2}$

$$\begin{aligned} 2\left(\frac{3+i}{2}\right)^2 - 6\left(\frac{3+i}{2}\right) + 8 &= 3 \\ 2\left(\frac{9+6i+i^2}{4}\right) - 3(3+i) + 8 & \\ 2\left(\frac{8+6i}{4}\right) - 9-3i + 8 & \\ \frac{8+6i}{2} & \\ 4+3i-9-3i & \\ 3 &= 3 \checkmark \end{aligned}$$

Section 5.2G