pg 39 (3-4)

(5) $x - 4y = -10$

(10) $x + y = 2$

(15) $4x + 4y = 7$

(20) $4x - 5y = -3$

(21) A) $3x - 4y = 20$
B) $4x + 3y = -15$

(22) A) $x - 4y = 3$
B) $4x + y = 12$

(23) A) $2x + 7y = -17$
B) $7x - 2y = 20$

(24) A) $x = -5$
B) $y = -1$

(33) $y = \frac{1}{4}x - 1$

(34) $y = 4x - 4$

(35) $y = -\frac{3}{4}x - 3$

(36) $y = -2$

(37) $y = 4$

(38) $x = -1$

---

pg 61 (4-5)

(1) $y(y+1)$

(3) $2a^2(4a^2 - 7b)$

(5) $5x^5(2x^3 + 3x^2 - 7)$

(7) $(x+5)^2$

(9) $(2y-3)^2$

(11) $(x+4)(x-4)$

(13) $(2k+5)(2k-5)$

(15) $(5x+2y)^2$

(17) $3(x+2)^2$

(19) $r(t+1)(t-1)$

(21) $(4n^2+1)(2n+1)(2n-1)$

(23) $(4-a)(16+4a+a^2)$

4-5 continued

(25) $(10c-3)(100c^2+30c+9)$

(26) $(a-3)(b+2)$ (27) $(n+1)(n-2)$

(28) $(5a^2+2)(4a-1)$ (29) $(10y^2+3)(y+1)$

(30) $(9b-8)(a+1)(a-1)$ (31) $(x^2+1)(5y-7)$

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pg 67 (4-8)

(1) -8 & -7 OR 7 & 8

(2) -14 & -12 OR 12 & 14

(3) -15 & 13 OR 13 & 15

(4) 6 OR -7

(5) 16 cm × 11 cm

(6) 18 ft × 4 ft

(7) 6 cm

(8) 16m and 12 m

(9) 25 ft × 14 ft

(10) 5 in & 12 in

pg 83 (5-7)

① 3 ② $2/3$ ③ $12/5$

④ $5/12$ ⑤ y/x ⑥ $\frac{m^2+4}{m+2}$

⑦ a ⑧ $c-1$ ⑨ 5

⑩ $\frac{z-1}{z+1}$ ⑪ $\frac{r^2+1}{r^2(r-1)}$ ⑫ $\frac{xy}{x-y}$

⑬ $3k+1$

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pg 85 (5-8)

① $\{-2\}$ ③ $\{h: h \le \frac{10}{3}\}$ ⑤ $\{2\}$

⑦ $\{y: y \ge -5\}$ ⑨ $\{-3, \frac{15}{2}\}$ ⑪ $\{-2, 2/3\}$

⑬ 5L ⑭ 1L

⑮ $1\frac{1}{2}$ gal of 23%
$28\frac{1}{2}$ gal of 3%

⑯

	x	5%	.05x
	1000-x	6.5%	.065(1000-x)

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6–1 Roots of Real Numbers *(continued)*

Simplify each expression that has a real root. If the expression does not represent a real number, say so.

All

	a.	b.	c.	d.
1.	$\sqrt{25}$ 5	$-\sqrt{25}$ -5	$\sqrt{-25}$ not real	$\sqrt{0.25}$ $.5$
2.	$\sqrt{100}$ 10	$\sqrt{-100}$ not real	$-\sqrt{100}$ -10	$\sqrt[4]{-100}$ not real
3.	$\sqrt{0.81}$ 0.9	$-\sqrt{0.81}$ -0.9	$\sqrt{-0.81}$ not real	$\sqrt[4]{0.0081}$ $.3$
4.	$\sqrt{8^2}$ 8	$\sqrt{-8^2}$ not real	$\sqrt[4]{(-8)^4}$ 8	$\sqrt[5]{(-8)^5}$ -8
5.	$\sqrt{\frac{1}{81}}$ $\frac{1}{9}$	$\sqrt{\frac{16}{81}}$ $\frac{4}{9}$	$\sqrt[4]{\frac{1}{81}}$ $\frac{1}{3}$	$\sqrt[4]{\frac{16}{81}}$ $2/3$
6.	$\sqrt{6^2}$ 6	$\sqrt{6^4}$ 6^2 or 36	$\sqrt{6^{12}}$ 6^6	$\sqrt{6^{24}}$ 6^{12}
7.	$\sqrt[5]{6^{-5}}$ $\frac{1}{6}$	$\sqrt[5]{6^{-10}}$ $\frac{1}{6^2}$	$\sqrt[5]{6^{-15}} \rightarrow \frac{1}{6^3}$	$\sqrt[5]{6^{-25}}$ $1/6^5$ or $\frac{1}{6^5}$
8.	$\sqrt{a^{12}}$ a^6	$\sqrt[4]{a^{12}}$ $\lvert a^3 \rvert$	$\sqrt[3]{a^{12}}$ a^4	$\sqrt[12]{a^{12}}$ $\lvert a \rvert$
9.	$\sqrt{-a^4}$ not real	$\sqrt{(-a)^4}$ a^2	$\sqrt[3]{(-a)^3}$ $-a$	$\sqrt[8]{a^8}$ $\lvert a \rvert$

Example 3 Find the real roots of each equation. If there are none, say so.

a. $x^2 = 16$ **b.** $x^2 + 25 = 0$ **c.** $4x^2 = 12$

Solution

a. $x^2 = 16$
$x = \pm\sqrt{16} = \pm 4$
The roots are 4 and -4.

b. $x^2 + 25 = 0$
$x^2 = -25$
There are no real roots.

c. $4x^2 = 12$
$x^2 = 3$
$x = \pm\sqrt{3}$
The roots are $\sqrt{3}$ and $-\sqrt{3}$.

Find the real roots of each equation. If there are none, say so.

10. $x^2 = 121$ $\{\pm 11\}$ **11.** $x^2 = 1$ $\{\pm 1\}$ **12.** $x^2 + 16 = 0$ None **13.** $x^2 - 11 = 0$ $\{\pm\sqrt{11}\}$

14. $16x^2 = 9$ $\{\pm 3/4\}$ **15.** $36x^2 = -49$ None **16.** $-9 = -25x^2$ $\{\pm\frac{3}{5}\}$ **17.** $25x^2 - 100 = 0$ $\{\pm 2\}$

18. $1 - 4x^2 = 0$ $\{\pm\frac{1}{2}\}$ **19.** $0 = 1 + 4x^2$ None **20.** $25 - 100x^2 = 0$ $\{\pm\frac{1}{2}\}$ **21.** $16x^2 + 8 = 9$ $\{\pm\frac{1}{4}\}$

Mixed Review Exercises

Solve. If an equation has no solution, say so.

1. $\dfrac{x}{x-1} = \dfrac{3x}{x+3}$ **2.** $-5y = y^2$ **3.** $\dfrac{2x+1}{2} + \dfrac{x-1}{6} = -2$

4. $|3 - 2x| = 7$ **5.** $4x^2 = 5x + 6$ **6.** $\dfrac{x^2 - x}{2} = \dfrac{x+1}{3}$

7. $5(2x - 3) = 6x + 5$ **8.** $2x + 6 = 2(x + 3)$ **9.** $\dfrac{1}{x+1} - \dfrac{1}{x} = \dfrac{1}{x^2 + x}$

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6–2 *Properties of Radicals* *(continued)*

Example 2 Simplify: **a.** $\sqrt[3]{16}\cdot\sqrt[3]{12}$ **b.** $\dfrac{\sqrt[3]{140}}{\sqrt[3]{60}}$

Solution Use the strategies shown in Example 1, but look for perfect cubes.

a. $\sqrt[3]{16}\cdot\sqrt[3]{12} = \sqrt[3]{(4\cdot 4)(4\cdot 3)} = \sqrt[3]{4^3}\cdot\sqrt[3]{3} = 4\sqrt[3]{3}$

b. $\dfrac{\sqrt[3]{140}}{\sqrt[3]{60}} = \sqrt[3]{\dfrac{140}{60}} = \sqrt[3]{\dfrac{7}{3}} = \sqrt[3]{\dfrac{7}{3}\cdot\dfrac{3^2}{3^2}} = \sqrt[3]{\dfrac{63}{27}} = \dfrac{\sqrt[3]{63}}{\sqrt[3]{27}} = \dfrac{\sqrt[3]{63}}{3}$

Simplify.

All

1. $\sqrt{56}$ $2\sqrt{14}$
2. $\sqrt{\dfrac{20}{9}}$ $\dfrac{2\sqrt{5}}{3}$
3. $\sqrt{\dfrac{25}{11}}$ $\dfrac{5\sqrt{11}}{11}$
4. $\dfrac{8}{\sqrt{6}}$ $\dfrac{4\sqrt{6}}{3}$
5. $\dfrac{\sqrt{104}}{\sqrt{13}}$ $2\sqrt{2}$
6. $\sqrt{70}\cdot\sqrt{21}$ $7\sqrt{30}$
7. $\sqrt{125}\cdot\sqrt{10}$ $25\sqrt{2}$
8. $\sqrt{21}\cdot\sqrt{\dfrac{3}{7}}$ 3
9. $\sqrt[3]{500}$ $5\sqrt[3]{4}$
10. $\sqrt[3]{\dfrac{3}{16}}$ $\dfrac{\sqrt[3]{12}}{4}$
11. $\dfrac{10\sqrt{6}}{\sqrt{24}}$ 5
12. $(5\sqrt{3})^2$ 75
13. $\sqrt[3]{15}\cdot\sqrt[3]{18}$ $3\sqrt[3]{10}$
14. $\dfrac{\sqrt[3]{120}}{\sqrt[3]{48}}$ $\dfrac{\sqrt[3]{20}}{2}$
15. $\sqrt[4]{81}$ 3

Example 3 Simplify. Assume that each radical represents a real number.

a. $\sqrt{18x^9}$ **b.** $\sqrt[3]{\dfrac{8a^3}{25b^5}}$

Solution

a. $\sqrt{18x^9} = \sqrt{9x^8\cdot 2x}$
$= \sqrt{9x^8}\cdot\sqrt{2x}$
$= 3x^4\sqrt{2x}$

Factor the radicand into two factors, one of which is a perfect square. Then, simplify by applying the product property of radicals.

b. $\sqrt[3]{\dfrac{8a^3}{25b^5}} = \dfrac{\sqrt[3]{8a^3}}{\sqrt[3]{25b^5}} = \dfrac{2a}{\sqrt[3]{25b^5}}$

Notice that the numerator is a perfect cube and simplify it.

$= \dfrac{2a}{\sqrt[3]{25b^5}}\cdot\dfrac{\sqrt[3]{5b}}{\sqrt[3]{5b}}$
$= \dfrac{2a\sqrt[3]{5b}}{\sqrt[3]{125b^6}}$
$= \dfrac{2a\sqrt[3]{5b}}{5b^2}$

Rationalize the denominator by multiplying the numerator and denominator by $\sqrt[3]{5b}$, making the radicand in the denominator a perfect cube.

Simplify. Assume that each radical represents a real number.

All

16. $\sqrt{48x^2}$ $4|x|\sqrt{3}$
17. $\sqrt{54x^7}$ $3x^3\sqrt{6x}$
18. $\sqrt[3]{128a^5}$ $4a\sqrt[3]{2a^2}$
19. $\sqrt{\dfrac{c^4}{d^3}}$ $\dfrac{c^2\sqrt{d}}{d^2}$
20. $\sqrt[3]{\dfrac{125x}{16y^8}}$ $\dfrac{5\sqrt[3]{4xy}}{4y^3}$