4.5 – Solve Quadratic Equations by finding Square Roots

Properties of Square Roots

Product Property $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$

Quotient Property $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

Example 1 Simplify the expression

a. $\sqrt{80}$

$= \sqrt{16} \cdot \sqrt{5} = 4\sqrt{5}$

c. $\sqrt{\frac{4}{81}} = \frac{\sqrt{4}}{\sqrt{81}} = \frac{2}{9}$

b. $\sqrt{5}\sqrt{20}$

$= \sqrt{100} = 10$

d. $\sqrt{\frac{7}{16}} = \frac{\sqrt{7}}{\sqrt{16}} = \frac{\sqrt{7}}{4}$

Simplifying Radicals – A square root expression is simplified if:

-no radicand has a perfect square factor other than 1

-there is no radical in a denominator

Example 2 Simplify the expression

a. $\sqrt{\frac{5}{2}} = \frac{\sqrt{5}}{\sqrt{2}}\left(\frac{\sqrt{2}}{\sqrt{2}}\right) = \frac{\sqrt{10}}{2}$

b. $\frac{3}{7+\sqrt{2}}\left(\frac{7-\sqrt{2}}{7-\sqrt{2}}\right) = \frac{21-3\sqrt{2}}{49-2} = \frac{21-3\sqrt{2}}{47}$

Solving Quadratic Equations – From standard form $(ax^2 + bx + c)$ when b is zero, some quadratic equations can be solved by square roots

Example 3 Solve **(a)** $3x^2 + 5 = 41$ and **(b)** $2(x+2)^2 - 4 = 8$

(a) $3x^2 + 5 = 41$
$\quad -5 \quad -5$

$\frac{3x^2}{3} = \frac{36}{3}$

$x^2 = 12$

$\sqrt{x^2} = \sqrt{12}$

$x = \sqrt{4}\sqrt{3}$

$x = \pm 2\sqrt{3}$

(b) $2(x+2)^2 - 4 = 8$
$\quad +4 \quad +4$

$\frac{2(x+2)^2}{2} = \frac{12}{2}$

$(x+2)^2 = 6$

$\sqrt{(x+2)^2} = \sqrt{6}$

$x + 2 = \sqrt{6}$
$\quad -2 \quad -2$

$x = -2 \pm \sqrt{6}$

HW: 4-34 even

SIMPLIFYING RADICAL EXPRESSIONS **Simplify the expression.**

3. $\sqrt{28}$
4. $\sqrt{192}$
5. $\sqrt{150}$
6. $\sqrt{3} \cdot \sqrt{27}$
7. $4\sqrt{6} \cdot \sqrt{6}$
8. $5\sqrt{24} \cdot 3\sqrt{10}$
9. $\sqrt{\frac{5}{16}}$
10. $\sqrt{\frac{35}{36}}$
11. $\frac{8}{\sqrt{3}}$
12. $\frac{7}{\sqrt{12}}$
13. $\sqrt{\frac{18}{11}}$
14. $\sqrt{\frac{13}{28}}$
15. $\frac{2}{1-\sqrt{3}}$
16. $\frac{1}{5+\sqrt{6}}$
17. $\frac{\sqrt{2}}{4+\sqrt{5}}$
18. $\frac{3+\sqrt{7}}{2-\sqrt{10}}$

SOLVING QUADRATIC EQUATIONS **Solve the equation.**

22. $s^2 = 169$
23. $a^2 = 50$
24. $x^2 = 84$
25. $6z^2 = 150$
26. $4p^2 = 448$
27. $-3w^2 = -213$
28. $7r^2 - 10 = 25$
29. $\frac{x^2}{25} - 6 = -2$
30. $\frac{t^2}{20} + 8 = 15$
31. $4(x-1)^2 = 8$
32. $7(x-4)^2 - 18 = 10$
33. $2(x+2)^2 - 5 = 8$

34. ★ **MULTIPLE CHOICE** What are the solutions of $3(x+2)^2 + 4 = 13$?

Ⓐ $-5, 1$ Ⓑ $-1, 5$ Ⓒ $-2 \pm \sqrt{3}$ Ⓓ $2 \pm \sqrt{3}$