

Math Connections Worksheets

MAT0028C Developmental Math II

Chapter 9

Roots and Radicals

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Date:
Section:

Chapter 9 ROOTS AND RADICALS

9.1 Square Roots and Radical Expressions

KEY PROPERTIES, PROCEDURES, OR STRATEGIES

Rules for Square Roots

GUIDED EXAMPLE

1. Evaluate the square root.

a) $\sqrt{256}$

Solution

$$\sqrt{256} = \boxed{} \text{ because } \left(\boxed{}\right)^2 = 256.$$

b) $\sqrt{\frac{49}{225}}$

Solution

$$\sqrt{\frac{49}{225}} = \frac{\sqrt{\boxed{}}}{\sqrt{\boxed{}}} = \frac{\boxed{}}{\boxed{}}$$

c) $-\sqrt{100}$

Solution

$$-\sqrt{100} = -1 \cdot \sqrt{100} = \boxed{}$$

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GUIDED EXAMPLE

2. Ignoring air resistance, the velocity of an object, v , in meters per second can be found after the object has fallen h meters by using the formula $v = -\sqrt{19.6h}$. Find the velocity of a brick that has fallen 60 meters after being dropped from the roof of a construction site. Round to the nearest thousandth.

Solution

Understand We are to find the velocity of an object after it has fallen 60 meters.

Plan Use the formula $v = -\sqrt{19.6h}$, replacing h with 60.

Execute

$$v = -\sqrt{19.6h}$$

$$= \boxed{}$$

Replace h with 60.

$$= \boxed{}$$

Multiply within the radical.

$$= \boxed{}$$

Evaluate the square root, rounding to the nearest thousandth.

Answer After falling 60 meters, the brick is traveling at a velocity of _____ meters per second.

Check Verify the calculations.

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PRACTICE PROBLEMS

Find all square roots of the given number.

1. 49

1. _____

2. 144

2. _____

Evaluate the square root, if possible.

3. $\sqrt{484}$

3. _____

4. $\sqrt{-9}$

4. _____

5. $-\sqrt{\frac{81}{4}}$

5. _____

Classify each square root as rational or irrational.

6. $\sqrt{15}$

6. _____

7. $\sqrt{64}$

7. _____

Use a calculator or the Powers and Roots table to approximate the square root. Round to three decimal places.

8. $\sqrt{17}$

8. _____

9. $-\sqrt{5}$

9. _____

10. $\sqrt{68}$

10. _____

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Simplify. Assume that variables represent positive numbers.

11. $\sqrt{25x^{16}y^{34}}$

11. _____

12. $\sqrt{0.25x^6}$

12. _____

The speed of a car can be determined by the length of the skid marks after the car brakes by using the formula $S = \sqrt{30Dfn}$ where D represents the length of the skid mark in feet, f is the drag factor of the surface, n is the braking efficiency as a percent (written as a decimal), and S represents the speed of the car in miles per hour.

13. Find the speed of a car if the skid length measures 400 feet long, the drag factor of the surface is 0.5, and the braking efficiency is 60%.

13. _____

14. Find the speed of a car if the skid length measures 225 feet long, the drag factor of the surface is 0.4, and the braking efficiency is 75%.

14. _____

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9.2 Multiplying and Simplifying Square Roots

KEY PROPERTIES, PROCEDURES, OR STRATEGIES

Product Rule for Square Roots

In the Language of Math	In Your Own Words

Simplifying Square Roots with a Perfect Square Factor in the Radicand

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GUIDED EXAMPLES

Simplify. Assume that variables represent nonnegative numbers.

a) $\sqrt{6} \cdot \sqrt{216}$

Solution

$$\sqrt{6} \cdot \sqrt{216} = \boxed{}$$

Use the product rule for square roots to write the radicands under a common radical.

$$= \boxed{}$$

Multiply the radicands.

$$= \boxed{}$$

Evaluate the square root.

b) $\sqrt{108}$

Solution

$$\sqrt{108} = \boxed{}$$

Write the radicand in factored form so that one of the factors is the greatest perfect square factor.

$$= \boxed{}$$

Use the product rule for square roots to separate the factors into two radicals.

$$= \boxed{}$$

Find the square root of the perfect square factor and leave the other factor in a radical.

c) $\sqrt{288x^7y^4}$

Solution

$$\sqrt{288x^7y^4} = \boxed{}$$

Write the radicand in factored form so that one of the factors is the greatest perfect square factor.

$$= \boxed{}$$

Use the product rule for square roots to separate the factors into two radicals.

$$= \boxed{}$$

Find the square root of the perfect square factor and leave the other factor in a radical.

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PRACTICE PROBLEMS

Simplify. Assume that variables represent nonnegative numbers.

1. $\sqrt{5} \cdot \sqrt{125}$ 1. _____

2. $\sqrt{14jd^{11}} \cdot \sqrt{14jd}$ 2. _____

3. $\sqrt{2m^9} \cdot \sqrt{50m^{11}}$ 3. _____

4. $\sqrt{6x^3y^2z} \cdot \sqrt{216xy^4z^5}$ 4. _____

5. $\sqrt{10r} \cdot \sqrt{10r}$ 5. _____

6. $\sqrt{6n^7} \cdot \sqrt{150n^{13}}$ 6. _____

7. $\sqrt{54}$ 7. _____

8. $\sqrt{343}$ 8. _____

9. $\sqrt{80t^2}$ 9. _____

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10. $\sqrt{45a^2b}$

10. _____

11. $\sqrt{180x^8y^{19}}$

11. _____

12. $\sqrt{216x^4}$

12. _____

13. $\sqrt{252x^6y^{15}}$

13. _____

14. $\sqrt{448x^{10}y^7}$

14. _____

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9.4 Addition, Subtraction, and Mixed Operations with Square Roots

KEY VOCABULARY

Term	Definition	Example
Like radicals		

KEY PROPERTIES, PROCEDURES, OR STRATEGIES

Adding Like Radicals

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Rationalizing a Denominator Containing a Sum or Difference

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PRACTICE PROBLEMS

Simplify. Assume that variables represent nonnegative numbers.

1. $3\sqrt{3} + 6\sqrt{3}$ 1. _____

2. $7\sqrt{7} - 4\sqrt{7}$ 2. _____

3. $10\sqrt{3} + 7\sqrt{3} + 8\sqrt{3}$ 3. _____

4. $\sqrt{80} - \sqrt{45}$ 4. _____

5. $\sqrt{175} - 4\sqrt{7}$ 5. _____

6. $-8\sqrt{3} + 6\sqrt{12}$ 6. _____

7. $4\sqrt{8} + 2\sqrt{18}$ 7. _____

Multiply. Assume that variables represent nonnegative numbers.

8. $\sqrt{10}(\sqrt{11} - \sqrt{7})$ 8. _____

9. $\sqrt{2}(7\sqrt{5} - 2\sqrt{9})$ 9. _____

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10. $(\sqrt{3}-5)(\sqrt{3}-4)$

10. _____

11. $(\sqrt{8}-\sqrt{2})(\sqrt{8}+\sqrt{2})$

11. _____

12. $(\sqrt{7}+5\sqrt{3})(\sqrt{7}-5\sqrt{3})$

12. _____

Chapter 9 ROOTS AND RADICALS

9.1 Square Roots and Radical Expressions

1. ± 7 2. ± 12 3. 22 4. not a real number 5. $-\frac{9}{2}$
6. irrational 7. rational 8. 4.123 9. -2.236 10. 8.246
11. $5x^8y^{17}$ 12. $0.5x^3$ 13. 60 mph 14. 45 mph

9.2 Multiplying and Simplifying Square Roots

1. 25 2. $14jd^6$ 3. $10m^{10}$ 4. $36x^2y^3z^3$ 5. $10t$
6. $30n^{10}$ 7. $3\sqrt{6}$ 8. $7\sqrt{7}$ 9. $4t\sqrt{5}$ 10. $3a\sqrt{5b}$
11. $6x^4y^9\sqrt{5y}$ 12. $6x^2\sqrt{6}$ 13. $6x^3y^7\sqrt{7y}$ 14. $8x^5y^3\sqrt{7y}$

9.3 Dividing and Simplifying Square Roots

1. 2 2. 6 3. $4t^3$ 4. $\frac{3}{7}$ 5. $-\frac{3}{2}$ 6. $\frac{8}{9}$ 7. $\frac{2}{x^3}$
8. $\frac{5a}{b^3}$ 9. $\frac{\sqrt{7}}{7}$ 10. $\frac{3\sqrt{5}}{5}$ 11. $\frac{\sqrt{30}}{2}$ 12. $\frac{\sqrt{xy}}{y}$ 13. $\frac{y\sqrt{10}}{14}$
14. $\frac{\sqrt{cd}}{d^3}$

9.4 Addition, Subtraction, and Mixed Operations with Square Roots

1. $9\sqrt{3}$ 2. $3\sqrt{7}$ 3. $25\sqrt{3}$ 4. $\sqrt{5}$ 5. $\sqrt{7}$ 6. $4\sqrt{3}$
7. $14\sqrt{2}$ 8. $\sqrt{110} - \sqrt{70}$ 9. $7\sqrt{10} - 6\sqrt{2}$ 10. $23 - 9\sqrt{3}$
11. 6 12. -68