NAME

Module 18 Solving Radical Equations
Lesson 3 Solving Problems Using Radical Equations

Solve using radical equations.

1. The radius of a circle can be found by $r = \sqrt{\frac{A}{\pi}}$ when A is the area of the circle. Find the approximate radius of a circle whose area is 8 cm^2.

1.60 cm

2. Use the formula $r = \sqrt{\frac{A}{\pi}}$ to find the approximate area of a circle whose radius is 124 in.

48,305 in^2

3. The speed s of a roller coaster in a loop depends on radius r in feet of the loop. The equation $s = 8\sqrt{100 - 2r}$ gives the speed of the coaster in the loop. An amusement park is building a new roller coaster. They want the roller coaster to have a speed of 45 ft/s. What is the approximate radius of the loop?

34.2 ft

4. The amusement park also is considering a second set of plans for a smaller roller coaster which include a loop that has a diameter d of 38 ft. Use the equation $s = 8\sqrt{64 - d}$ to find the speed of the coaster.

40.79 ft/s

5. The time elapsed during one complete swing of a pendulum can be found using the formula $t = 6.28\sqrt{\frac{l}{32}}$. In this formula, t is the time in seconds, and l is the length in feet of the pendulum. What is the approximate length of a pendulum that makes one swing in five seconds?

20.28 ft

6. A pendulum makes one swing in two seconds. Use the formula $t = 6.28\sqrt{\frac{l}{32}}$ to find the approximate length of the pendulum?

3.25 ft

7. Use the formula $v = 20\sqrt{t + 273}$. In this formula, v is the speed of sound in meters per second, and t is the air temperature in degrees Celsius. What is the air temperature when the speed of sound is 360 meters per second?

51°C

8. Use the formula $v = 20\sqrt{t + 273}$ to find the air temperature when the speed of sound is 300 meters per second.

–48°C

9. Under certain conditions, an equation relating a car's speed and the length in feet of a skid mark is given by $s = 5.5\sqrt{0.75m}$, where s is the speed when the car goes into a skid and m is the length of the skid mark in feet. Find the approximate length of a skid mark when a car goes into a skid at 70 miles per hour.

216 ft

10. When Alicia skidded off the road into the ditch, she told the police officer she had been traveling no more than 52 miles per hour. Use the formula $s = 5.5\sqrt{0.75m}$ to find the approximate length of the skid mark she left at this speed?

119.2 feet

11. A right triangle has a leg which measures 12 inches and a hypotenuse measuring 25 inches. Find the approximate length of the other leg.

21.9 inches

12. A right triangle has leg measurements of 8 cm and 17 cm. Find the approximate length of the hypotenuse.

18.8 cm

13. Robby rides his bicycle three miles due north from his house and then, turns and rides due east to reach the park. The distance of a straight line from Robby's house to the park is 4.5 miles. Approximately how much further did he have to ride by taking this path?

1.85 miles

14. The distance r between any two objects is related to their masses m_1 and m_2 and the force f between them in such a way that $r = \sqrt{\frac{(6.67 \times 10^{-11})m_1m_2}{f}}$. If the mass of an object in space is 120,000 kg and the force between that object and a second object is 32 Newtons, find the approximate mass of the second object if the objects are 24,000 meters apart.

2.30×10^{15} kg

Journal

1. Ernie skidded 60 feet before rear ending the car in front of him. How can Officer Rodriguez show Ernie was driving faster than the speed limit of 30 miles per hour?

2. Alisa found the length of a pendulum using the formula $t = 6.28\sqrt{\frac{l}{32}}$. If the pendulum takes 12.56 seconds to complete one swing, then the pendulum is about 45 feet long. This answer is incorrect. Find and correct Alisa's calculations below.

$$t = 6.28\sqrt{\frac{l}{32}}$$
$$12.56 = 6.28\sqrt{\frac{l}{32}}$$
$$2 = \sqrt{\frac{l}{32}}$$
$$\sqrt{2} = \frac{l}{32}$$
$$32\sqrt{2} = l$$

The pendulum is $32\sqrt{2}$ or about 45.3 ft long.

3. Use the formula $r = \sqrt{\frac{V}{\pi h}}$ to explain why the volume of a cylinder increases more when the radius is doubled than when the height is doubled.

4. Explain how the equation $T = \sqrt{\frac{2\pi^2 r}{F}}$ could be solved for force F.

Cumulative Review

Write in simplest radical form.

1. $\sqrt{20}$ $2\sqrt{5}$

2. $40 + 3\sqrt{90}$ $11\sqrt{10}$

3. $3(\sqrt{5} - 6\sqrt{12})$ $3\sqrt{5} - 36\sqrt{3}$

4. $\frac{5 - \sqrt{7}}{\sqrt{6}}$ $\frac{5\sqrt{6} - \sqrt{42}}{6}$

Solve each radical equation.

5. $6 - 2x\sqrt{3} = 10$ $-\frac{2\sqrt{3}}{3}$

6. $4x\sqrt{6} = \sqrt{3}$ $\frac{\sqrt{2}}{8}$

7. The variable y varies directly as x: y is 2 when x is 6. Find y when x is 21.

   7

8. The variable y varies inversely as x: y is 13 when x is 4. Find the constant of variation.

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Possible Journal Answers

1. Officer Rodriguez would use the formula $s = 5.5\sqrt{0.75m}$ with $m = 60$. This would show Ernie was traveling at approximately 37 miles per hour.
2. Alisa should have squared both sides of the equation. Starting with the third line of the calculation gives:

   $2 = \sqrt{\frac{l}{32}}$

   $4 = \frac{l}{32}$

   $128 \text{ ft} = l$

   The pendulum is 128 ft long.
3. When the equation $r = \sqrt{\frac{v}{\pi h}}$ is solved for v, it becomes $v = \pi r^2 h$. Doubling the radius will increase the volume by four times, because $(2r)^2 = 4r^2$. Doubling the height only increases the volume by two times.
4. To solve the equation $T = \sqrt{\frac{2\pi^2 r}{F}}$ for F, begin by squaring both sides to the equation to get $T^2 = \frac{2\pi^2 r}{F}$. Multiply both sides of the equation by F to obtain $FT^2 = 2\pi^2 r$. Then, divide by T^2. The equation is $F = \frac{2\pi^2 r}{T^2}$.