

# Radicals and Rational Exponents: math practice, Grade 11 – download the PDF

24 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

## 1 Evaluating roots

★ ★ ★

Evaluate each expression without a calculator.

a.  $\sqrt{144}$

b.  $\sqrt[3]{125}$

c.  $\sqrt[4]{81}$

d.  $\sqrt[3]{-64}$

e.  $\sqrt{\frac{49}{25}}$

## 2 Radical form to exponent form

★ ★ ★

Rewrite with a radical sign: a)  $7^{1/2}$  b)  $5^{2/3}$  c)  $x^{3/4}$  d)  $(2y)^{1/5}$ .

## 3 Exponent form from radicals

★ ★ ★

Rewrite with a rational exponent: a)  $\sqrt{11}$  b)  $\sqrt[3]{a^5}$  c)  $\sqrt[5]{b^2}$  d)  $\frac{1}{\sqrt{z}}$ .

4

**Evaluating rational exponents**

Evaluate: a)  $9^{3/2}$  b)  $8^{4/3}$  c)  $32^{2/5}$  d)  $100^{-1/2}$ .

5

**Pulling out perfect squares**

Simplify: a)  $\sqrt{50}$  b)  $\sqrt{48}$  c)  $\sqrt{200}$  d)  $\sqrt{75}$ .

6

**True or false?**

Decide whether each statement is true or false, and justify.

a.  $\sqrt{x^2} = x$  for every real number  $x$ .

b.  $\sqrt[3]{-8} = -2$ .

c.  $\sqrt{9} + \sqrt{16} = \sqrt{25}$ .

d.  $16^{1/2} = 8$ .

7

**Where is it defined?**

Find all real numbers  $x$  for which each expression is a real number.

a.  $\sqrt{x-5}$

b.  $\sqrt{7-2x}$

c.  $\sqrt[3]{x+1}$

d.  $\sqrt[4]{3x+9}$

## 8 How far is the horizon?



From a lookout whose eyes are  $h$  feet above the water, the distance to the horizon is about  $d = 1.22\sqrt{h}$  miles.

- Find  $d$  for  $h = 36$  ft (about 11 m).
- Find  $d$  for  $h = 144$  ft.
- How high must the lookout be to see 12.2 miles?

## 9 Simplifying with variables



Simplify (assume all variables are non-negative): a)  $\sqrt{18x^5}$  b)  $\sqrt[3]{40a^4}$  c)  $\sqrt{12} \cdot \sqrt{27}$  d)  $\sqrt{5} \cdot \sqrt{20}$ .

## 10 Rationalizing denominators



Rationalize and simplify: a)  $\frac{6}{\sqrt{8}}$  b)  $\frac{4}{\sqrt{7} - \sqrt{3}}$  c)  $\frac{3}{\sqrt[3]{2}}$ .

## 11 Exponent rules



Simplify for  $x, y > 0$ , and write answers with positive exponents.

- $x^{2/3} \cdot x^{5/6}$
- $(x^{1/2}y^{-1/3})^6$
- $\frac{x^{3/4}}{x^{1/4}}$
- $(x^{-2/3})^{-3/2}$

## 12 Negative rational exponents



Evaluate: a)  $\left(\frac{27}{8}\right)^{-2/3}$  b)  $81^{-3/4}$  c)  $64^{5/6}$ .

## 13 A square root equation



Solve  $\sqrt{3x-5} = 4$  and check your answer.

## 14 A cube root equation



Solve  $\sqrt[3]{x+4} = -2$ .

## 15 Isolate first



Solve  $\sqrt{x-3} + 5 = 9$ .

## 16 Domain, range and table



Let  $f(x) = \sqrt{x+2} - 3$ .

- Give the domain and the range.
- Complete a table of values for  $x = -2, -1, 2, 7$ .
- Describe how the graph is obtained from  $y = \sqrt{x}$ .

## 17 An extraneous solution



Solve  $\sqrt{2x+15} = x$ . Identify any extraneous solution.

**18 Both candidates survive**

★★★

Solve  $\sqrt{5x+1} = x+1$ . Is there an extraneous solution?

**19 Two radicals**

★★★

Solve  $\sqrt{x+6} - \sqrt{x-1} = 1$ .

**20 Equations with rational exponents**

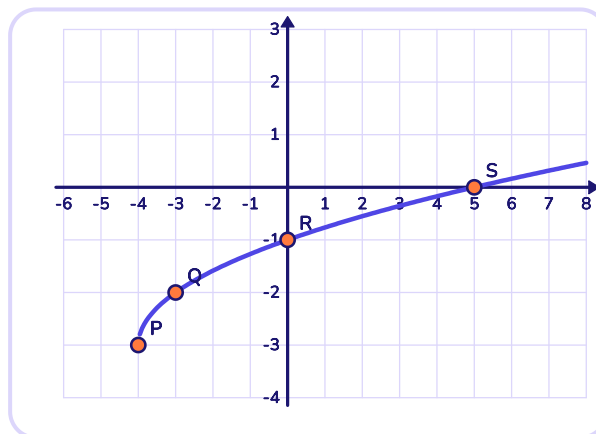
★★★

Solve: a)  $x^{2/3} = 25$  b)  $(x+2)^{3/2} = 64$ .

**21 Find the equation from the graph**

★★★

The curve below passes through  $P(-4, -3)$ ,  $Q(-3, -2)$ ,  $R(0, -1)$  and  $S(5, 0)$ . It is a radical function of the form  $f(x) = a\sqrt{x-h} + k$ .

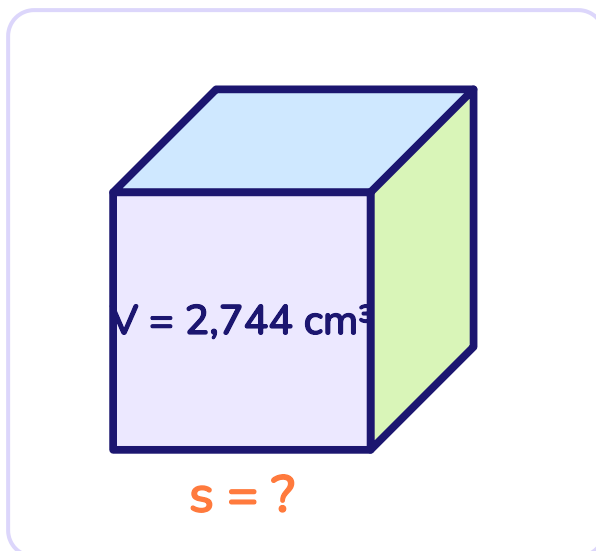


- Find  $h$ ,  $k$  and  $a$ , then write  $f(x)$ .
- Give the domain and range.
- Solve  $f(x) = 1$ .

## 22 The storage cube

★★★

A cube-shaped storage box holds  $2,744 \text{ cm}^3$ .



- Find the edge length  $s$ .
- Find the total surface area of the box.
- Express  $s$  as a power of the volume  $V$ .

## 23 A growing colony

★★★

The number of bacteria in a dish is  $N(t) = 200 \cdot 4^{t/2}$ , where  $t$  is the time in hours.

- Compute  $N(1)$ ,  $N(3)$  and  $N(5)$ .
- After how many hours are there **3,200** bacteria?
- Explain why the colony doubles every hour.

## 24 Find the student's error

★★★

A student solved  $\sqrt{x-2} = x-4$  like this: "Square both sides:  $x-2 = x^2 - 8x + 16$ . So  $x^2 - 9x + 18 = 0$ , i.e.  $(x-3)(x-6) = 0$ . The solutions are  $x = 3$  and  $x = 6$ ." Find and correct the mistake.



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