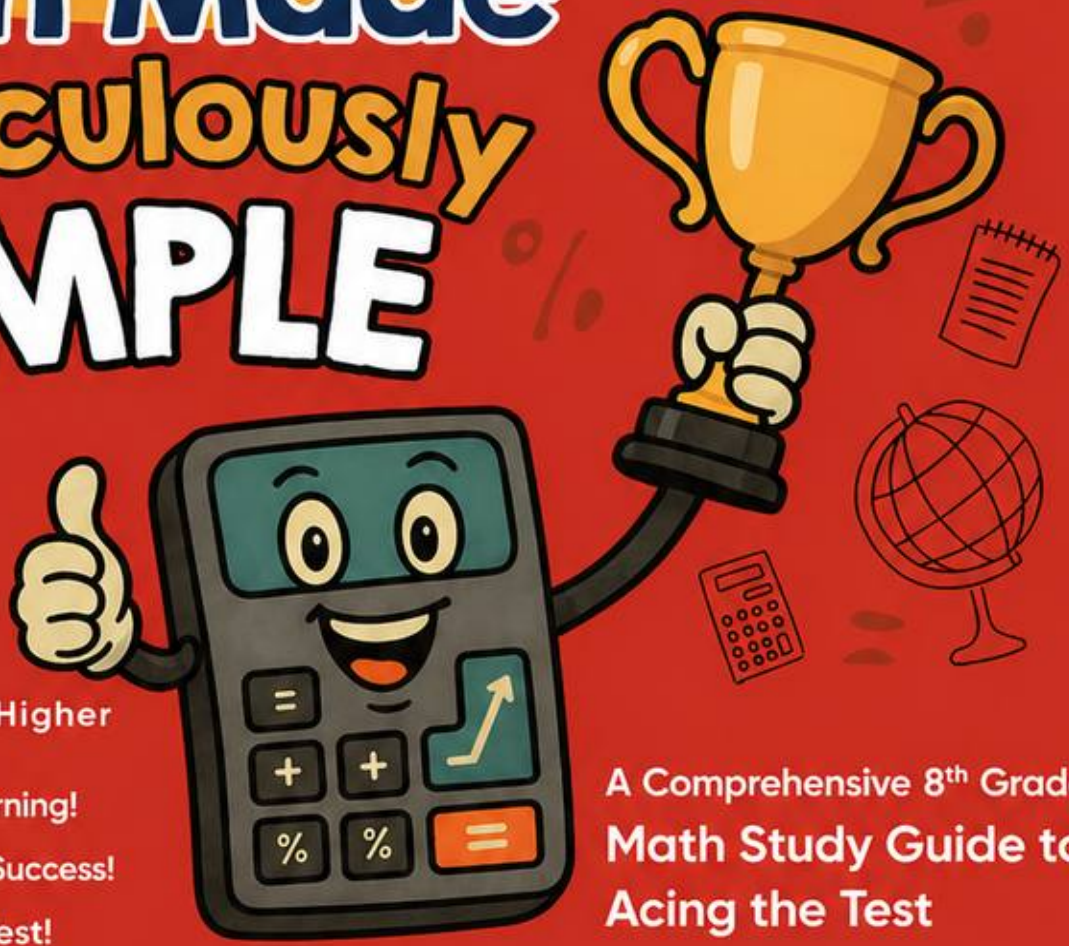
North Dakota NDSA Grade 8

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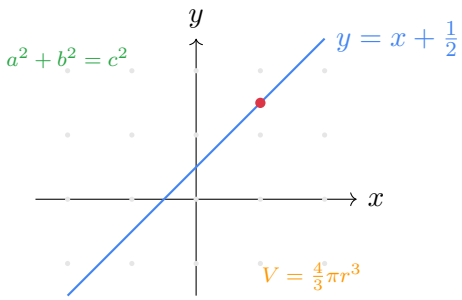
A Comprehensive 8th Grade Math Study Guide to Acing the Test

Learn Faster · Understand Deeper · Succeed with Confidence

North Dakota NDSA Grade 8 Math

Made Ridiculously Simple

A Comprehensive 8th Grade Math Study Guide to Acing the NDSA Test



Reza Nazari

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8.DPS.D.4	Construct and interpret a two-way table summarizing bivariate categorical data collected from the same subjects

8.GM | Geometry and Measurement

Apply geometric reasoning and measurement to solve problems

8.GM.AV	Solve problems involving area and volume of geometric figures
8.GM.AV.1	Apply given formulas to solve problems involving the volume of cones, cylinders, and spheres, including authentic problems
8.GM.GF	Analyze properties of two- and three-dimensional geometric figures
8.GM.GF.1	Perform single transformations to a figure on the coordinate plane and determine whether the figures are congruent or similar
8.GM.GF.2	Describe the characteristics of transformations on the coordinate plane using transformation language
8.GM.GF.3	Name the type of transformation needed to map a pre-image to its image
8.GM.GF.4	Describe the following angle-pair relationships: interior and exterior angles of triangles and angles formed when a transversal cuts parallel lines or intersecting lines. Solve for an unknown angle in a figure by applying facts about these angles
8.GM.GF.5	Describe the relationship between the leg lengths and the hypotenuse length of a right triangle. Determine whether a triangle is a right triangle using this relationship
8.GM.GF.6	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in two and three dimensions on and off a coordinate plane, including authentic problems

8.NO | Number and Operations

Understand and apply properties of rational and irrational numbers

8.NO.NS	Understand and apply concepts of rational and irrational numbers
8.NO.NS.1	Compare and classify real numbers within the real number system

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8.NO.NS.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them on a number line diagram, and estimate the value of irrational expressions involving one operation
8.NO.NS.3	Use scientific notation to represent very large or very small quantities. Interpret scientific notation generated by technology. Compare and order numbers in both scientific and standard notation
8.NO.O	Apply operations with rational numbers and integer exponents
8.NO.O.1	Evaluate mentally the square roots of perfect squares up to 225 and cube roots of perfect cubes up to 1000
8.NO.O.2	Add, subtract, multiply, and divide rational numbers using strategies or procedures

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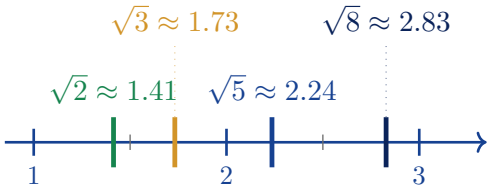
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1.3 Estimating Irrational Numbers

8.NO.NS, 8.NO.NS.2

When a square root isn't a perfect square, you can't just write down the exact decimal, but here's the good news: you can estimate it super well! The trick is to squeeze it between two perfect squares. For example, since $36 < 45 < 49$, you immediately know that $6 < \sqrt{45} < 7$—your answer is somewhere in that range. Then test tenths or hundredths to narrow it down even more. **The why behind this:** when you square nearby numbers, they tell you if you're too low or too high. This clever method helps you place irrational numbers on a number line and compare them to regular whole numbers and decimals. You've got a superpower now!



Key Concepts & Quick Review

Squeeze between consecutive integers: Find n and $n+1$ such that $n^2 < x < (n+1)^2$; then $n < \sqrt{x} < n+1$.

Refine to tenths: Try $n.1$, $n.2, \ldots$ until you find $a^2 < x < b^2$; then $a < \sqrt{x} < b$.

Comparing irrationals: $\sqrt{a} < \sqrt{b}$ whenever $a < b$ $(a, b > 0)$, so larger radicand $\Rightarrow$ larger square root.

Examples

① Between which two consecutive integers does $\sqrt{20}$ lie?

Find two perfect squares that squeeze 20: We have $4^2 = 16 < 20$ and $5^2 = 25 > 20$. So $\sqrt{20}$ must be between 4 and 5—you can be sure of that! **Now here's a helpful hint:** since 20 is closer to 25 than to 16, the square root is closer to 5. In fact, $\sqrt{20} \approx 4.47$—pretty close to 5, right?

Answer: $4 < \sqrt{20} < 5$

② Estimate $\sqrt{45}$ to one decimal place.

👉 First, squeeze with integers: $6^2 = 36 < 45 < 49 = 7^2$, so $6 < \sqrt{45} < 7$. Now refine to tenths. **Test:** $6.7^2 = 44.89 < 45$ and $6.8^2 = 46.24 > 45$. This tells us $6.7 < \sqrt{45} < 6.8$—we're narrowing it down! Since 45 is much closer to 44.89, we know $\sqrt{45} \approx 6.7$ is our best estimate to one decimal place.

💡 **Answer:** $\sqrt{45} \approx 6.7$

✎ Practice Problems

Give the two consecutive integers that bound each square root, then estimate to one decimal place where indicated.

1. $\sqrt{10}$ is between _____

2. $\sqrt{18}$ is between _____

3. $\sqrt{35}$ is between _____

4. $\sqrt{50}$ is between _____

5. $\sqrt{72}$ is between _____

6. $\sqrt{90}$ is between _____

7. $\sqrt{6} \approx$ _____ (1 d.p.)

8. $\sqrt{14} \approx$ _____ (1 d.p.)

9. $\sqrt{30} \approx$ _____ (1 d.p.)

10. $\sqrt{52} \approx$ _____ (1 d.p.)

11. Order: $\sqrt{5}$, 2, $\sqrt{3}$ _____

12. Greater: $\sqrt{11}$ or 3.3? _____

Study Tips

- Memorize perfect squares through 169 (13^2). This gives you the power to quickly bracket any square root and know which two integers it falls between. You're building your math toolkit!
- When estimating $\sqrt{x}$ to one decimal place, find the two tenths it falls between, then decide which is closer. If they're equally close, test hundredths for extra accuracy before rounding.
- **Here's a time-saver for comparing irrational numbers:** just compare the radicands directly—no estimation needed! Since $47 < 53$, you know right away that $\sqrt{47} < \sqrt{53}$. Smart thinking!

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✍ Word Problems

13. A square garden has an area of 75 m^2. The gardener wants to know whether the side length is closer to 8 m or 9 m so she can decide how many fence posts to order. Between which two consecutive integers does the side length fall, and which integer is it closest to?

_____

14. Two drones take off from the same point and fly in perpendicular directions. Drone A travels $\sqrt{60}$ km and Drone B travels 7.5 km. Without using a calculator, determine which drone flies farther.

_____

15. A park ranger estimates the distance across a circular lake. The lake's area is 200 m^2. (a) The radius satisfies $\pi r^2 = 200$. Find r^2. (b) Estimate r to the nearest tenth. (c) Estimate the diameter to the nearest metre.

_____

16. Between which two consecutive whole numbers does each value lie? (a) $\sqrt{50}$ (b) $\sqrt[3]{100}$ (c) Order from least to greatest: $\sqrt{50}$, $\sqrt[3]{100}$, 7.2

_____

17. A square garden has area 150 ft^2. You need to buy fencing for all four sides. Fencing is sold in whole-foot lengths. (a) Find the exact side length. (b) Estimate the perimeter to the nearest tenth of a foot. (c) How many whole feet of fencing must you buy?

_____