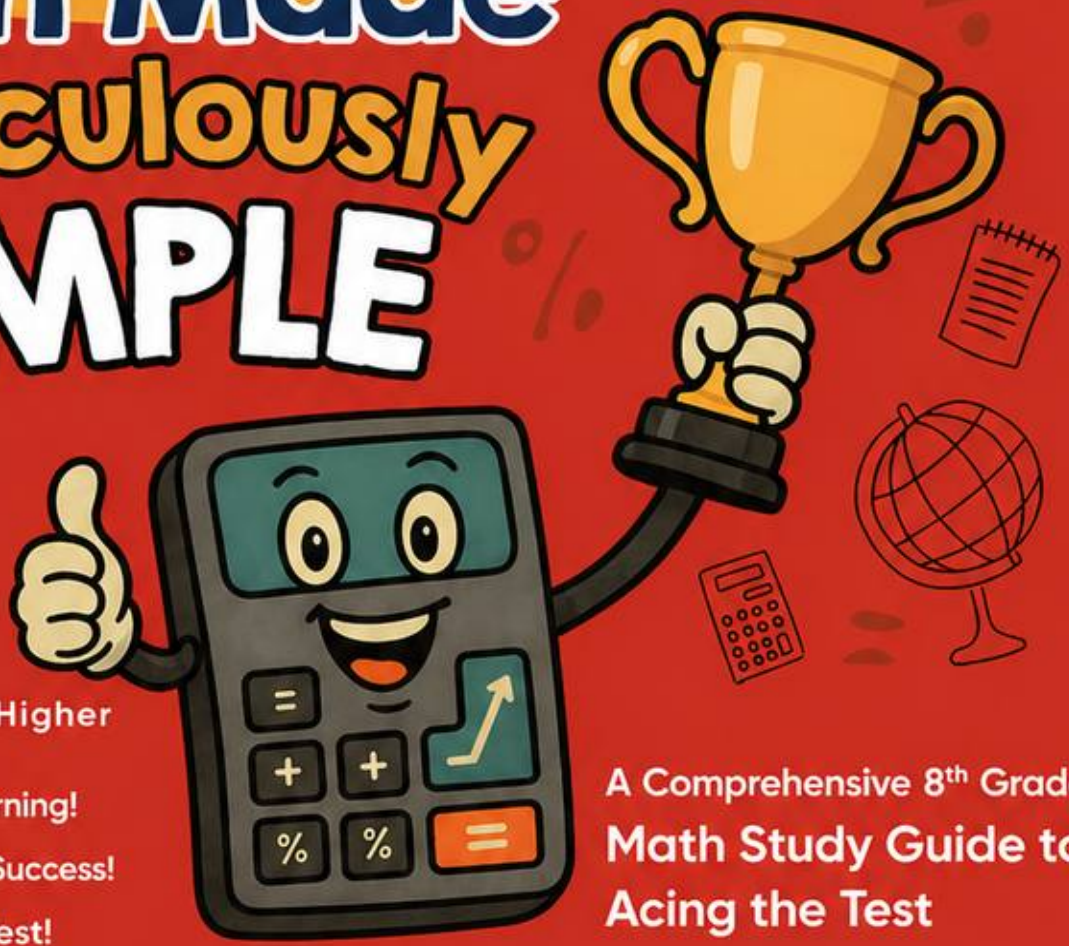
Minnesota MCA Grade 8

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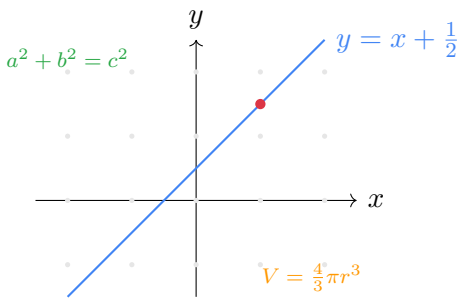
A Comprehensive 8th Grade Math Study Guide to Acing the Test

Learn Faster · Understand Deeper · Succeed with Confidence

Minnesota MCA Grade 8 Math

Made Ridiculously Simple

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



Reza Nazari

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8.2.3.1 Evaluate algebraic expressions, including expressions containing radicals and absolute values, at specified values of their variables

8.2.3.2 Justify steps in generating equivalent expressions by identifying the properties used, including the properties of algebra. Properties include the associative, commutative and distributive laws, and the order of operations, including grouping symbols

8.2.4 Represent real-world and mathematical situations using equations and inequalities involving linear expressions. Solve equations and inequalities symbolically and graphically. Interpret solutions in the original context

8.2.4.1 Use linear equations to represent situations involving a constant rate of change, including proportional and non-proportional relationships

8.2.4.2 Solve multi-step equations in one variable. Solve for one variable in a multi-variable equation in terms of the other variables. Justify the steps by identifying the properties of equalities used

8.2.4.3 Express linear equations in slope-intercept, point-slope and standard forms, and convert between these forms. Given sufficient information, find an equation of a line

8.2.4.4 Use linear inequalities to represent relationships in various contexts

8.2.4.5 Solve linear inequalities using properties of inequalities. Graph the solutions on a number line

8.2.4.6 Represent relationships in various contexts with equations and inequalities involving the absolute value of a linear expression. Solve such equations and inequalities and graph the solutions on a number line

8.2.4.7 Represent relationships in various contexts using systems of linear equations. Solve systems of linear equations in two variables symbolically, graphically and numerically

8.2.4.8 Understand that a system of linear equations may have no solution, one solution, or an infinite number of solutions. Relate the number of solutions to pairs of lines that are intersecting, parallel or identical. Check whether a pair of numbers satisfies a system of two linear equations in two unknowns by substituting the numbers into both equations

8.2.4.9 Use the relationship between square roots and squares of a number to solve problems

8.3 | Geometry & Measurement

Apply geometric reasoning and measurement to solve problems

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8.3.1 Solve problems involving right triangles using the Pythagorean theorem and its converse

8.3.1.1 Use the Pythagorean theorem to solve problems involving right triangles

8.3.1.2 Determine the distance between two points on a horizontal or vertical line in a coordinate system. Use the Pythagorean theorem to find the distance between any two points in a coordinate system

8.3.1.3 Informally justify the Pythagorean theorem by using measurements, diagrams and computer software

8.3.2 Solve problems involving parallel and perpendicular lines on a coordinate system

8.3.2.1 Understand and apply the relationships between the slopes of parallel lines and between the slopes of perpendicular lines. Dynamic graphing software may be used to examine these relationships

8.3.2.2 Analyze polygons on a coordinate system by determining the slopes of their sides

8.3.2.3 Given a line on a coordinate system and the coordinates of a point not on the line, find lines through that point that are parallel and perpendicular to the given line, symbolically and graphically

8.4 | Data Analysis & Probability

Analyze data, apply probability, and draw conclusions

8.4.1 Interpret data using scatterplots and approximate lines of best fit. Use lines of best fit to draw conclusions about data

8.4.1.1 Collect, display and interpret data using scatterplots. Use the shape of the scatterplot to informally estimate a line of best fit and determine an equation for the line. Use appropriate titles, labels and units. Know how to use graphing technology to display scatterplots and corresponding lines of best fit

8.4.1.2 Use a line of best fit to make statements about approximate rate of change and to make predictions about values not in the original data set

8.4.1.3 Assess the reasonableness of predictions using scatterplots by interpreting them in the original context

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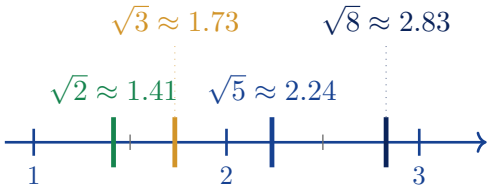
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1.3 Estimating Irrational Numbers

8.1.1, 8.1.1.2

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?

_____