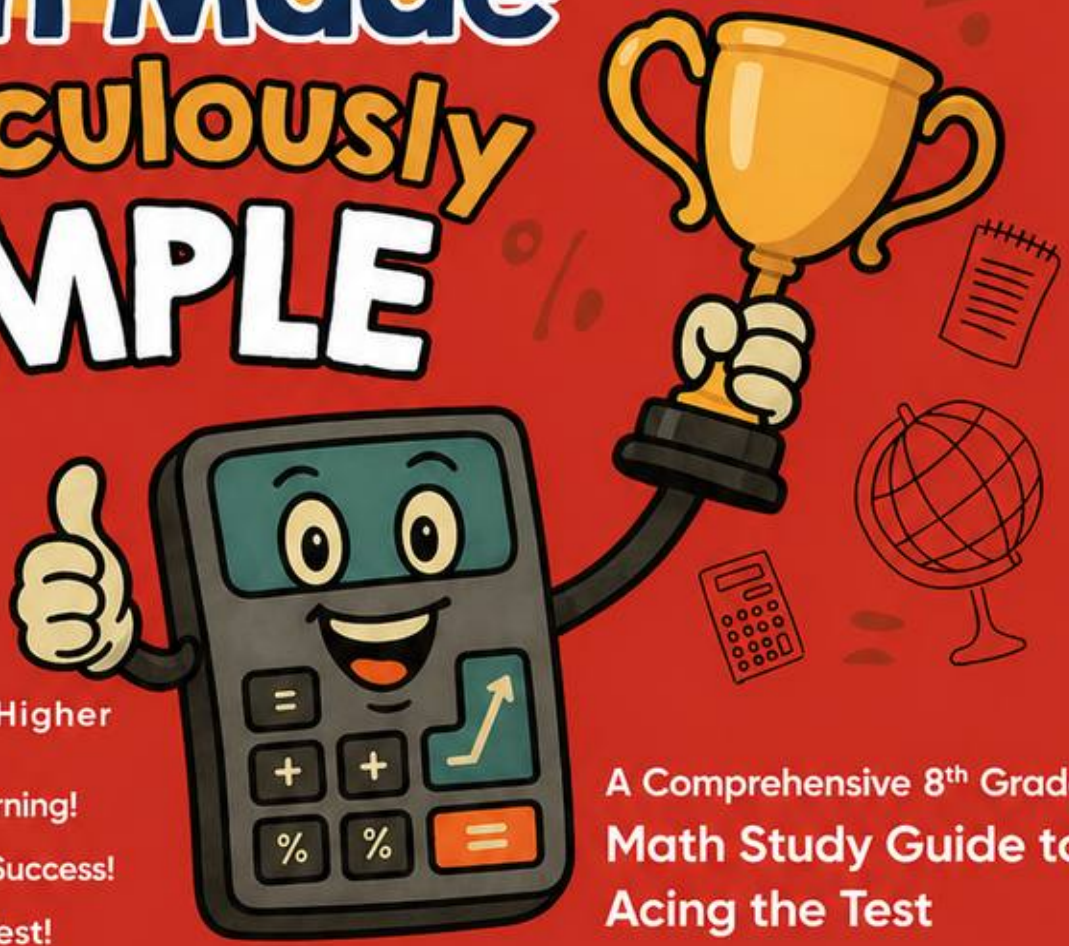
# Alaska AK STAR Grade 8

# Math Made Ridiculously SIMPLE



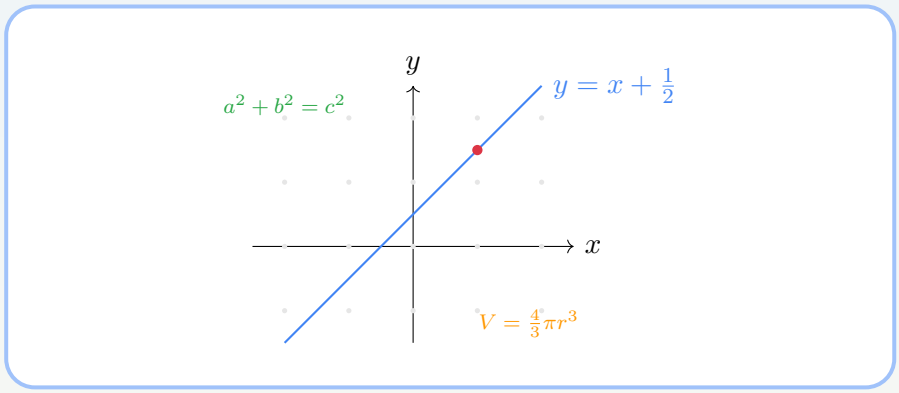
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# Alaska AK STAR Grade 8 Math
## Made Ridiculously Simple

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




**Reza Nazari**

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| | |
|---|---|
| 8.G.2 | Demonstrate understanding of congruence by applying a sequence of translations, reflections, and rotations on two-dimensional figures. Given two congruent figures, describe a sequence that exhibits the congruence between them |
| 8.G.3 | Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates |
| 8.G.4 | Demonstrate understanding of similarity, by applying a sequence of translations, reflections, rotations, and dilations on two-dimensional figures. Describe a sequence that exhibits the similarity between them |
| 8.G.5 | Justify using informal arguments to establish facts about |
| 8.G.6 | Explain the Pythagorean Theorem and its converse |
| 8.G.7 | Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions |
| 8.G.8 | Apply the Pythagorean Theorem to find the distance between two points in a coordinate system |
| 8.G.9 | Identify and apply the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems |

## 8.NS | The Number System

*Understand and apply concepts of rational and irrational numbers*

| | |
|---|---|
| 8.NS.1 | Classify real numbers as either rational (the ratio of two integers, a terminating decimal number, or a repeating decimal number) or irrational |
| 8.NS.2 | Order real numbers, using approximations of irrational numbers, locating them on a number line |
| 8.NS.3 | Identify or write the prime factorization of a number using exponents |

## 8.SP | Statistics and Probability

*Investigate patterns of association in bivariate data*



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| | |
|---|---|
| 8.SP.1 | Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association |
| 8.SP.2 | Explain why straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line |
| 8.SP.3 | Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and y-intercept |
| 8.SP.4 | Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects and use relative frequencies to describe possible association between the two variables |

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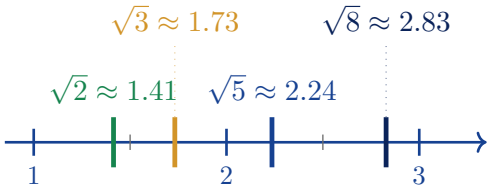
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## 1.3 Estimating Irrational Numbers

8.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?

_____