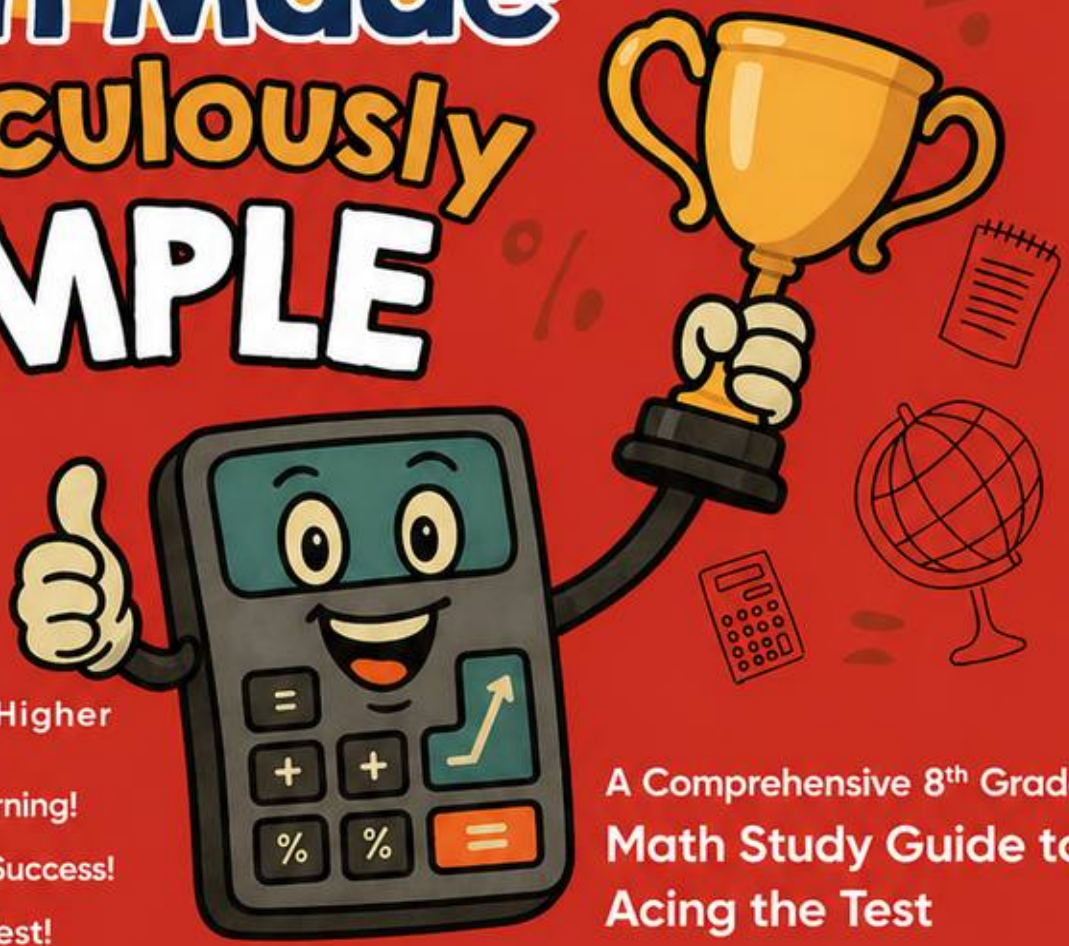
Virginia SOL Grade 8

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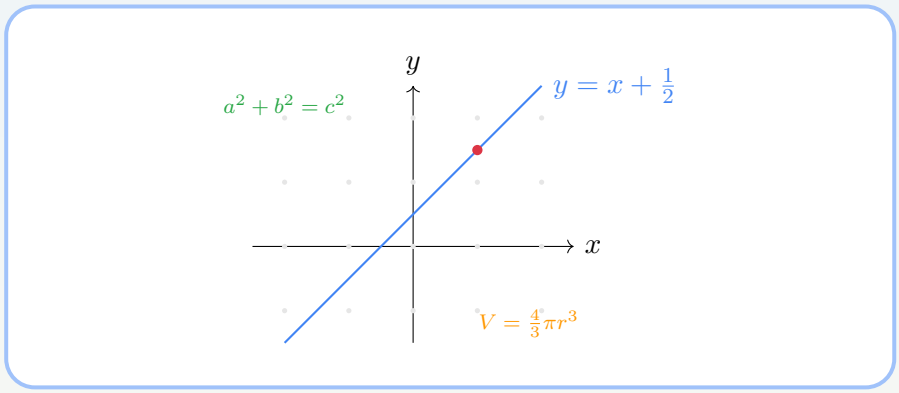
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Reza Nazari

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8.PS.1	The student will use statistical investigation to determine the probability of independent and dependent events, including those in context
8.PS.2	The student will apply the data cycle (formulate questions; collect or acquire data; organize and represent data; and analyze data and communicate results) with a focus on boxplots
8.PS.3	The student will apply the data cycle (formulate questions; collect or acquire data; organize and represent data; and analyze data and communicate results) with a focus on scatterplots

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CHAPTER

1

Real Numbers & Number Sense

1. Rational and Irrational Numbers 8.NS.1
2. Turning Repeating Decimals into Fractions 8.NS.2
3. Estimating Irrational Numbers 8.NS.1
4. Estimating Expressions with Irrational Numbers 8.NS.1

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!

✍ 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?

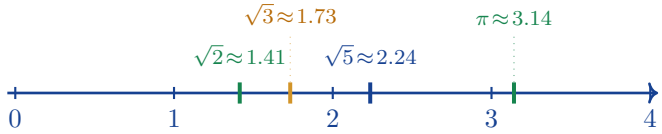
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1.4 Estimating Expressions with Irrational Numbers

8.NS.1

Estimating a *single* irrational number like $\sqrt{45}$ is one thing—you squeeze it between two perfect squares and zero in on the decimal. But what happens when an expression mixes **several** irrational numbers with addition, subtraction, multiplication, or exponents? **Here's how you handle it:** replace each irrational number with its decimal approximation, then carry out the arithmetic step by step. But here's the real secret that saves time and keeps your answer exact—**simplify before you substitute!** For example, $(\sqrt{3})^2 = 3$ exactly (no decimal needed!), and $\sqrt{2} \cdot \sqrt{8} = \sqrt{16} = 4$—the irrational parts cancel out completely. Only use decimal approximations for the parts that *truly* stay irrational. One more important rule: **round at the very end, not in the middle.** Early rounding piles up error and throws off your final answer. The reference line below collects the key approximations you'll need most.



Key Concepts & Quick Review

Useful approximations: $\sqrt{2} \approx 1.41$, $\sqrt{3} \approx 1.73$, $\sqrt{5} \approx 2.24$, $\pi \approx 3.14$

Strategy: Substitute ⇒ Simplify ⇒ Round to the required number of decimal places.

Bounding: Computing both a *lower bound* (using smaller approximations) and an *upper bound* (using larger ones) confirms how accurate the estimate is.

Examples

① Estimate π^2 to two decimal places.

Start by substituting: use $\pi \approx 3.14$. Then compute $\pi^2 \approx 3.14 \times 3.14$. **Break it into parts:** $3 \times 3.14 = 9.42$ and $0.14 \times 3.14 = 0.4396$. **Add them:** $9.42 + 0.44 = 9.86$ (rounding 0.4396 to 0.44). **Check your work:** the actual value is $9.8696\ldots$, so our estimate of 9.86 is spot-on! That's the power of smart substitution.

Answer: $\pi^2 \approx 9.86$

② Estimate $3\sqrt{5} - 2$ to one decimal place.

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