

Irrational Estimates

Use squares and decimals to place irrational numbers.

GRADE 8 • 8.NS.A.2

CCSS.Math.Content.8.NS.A.2 "Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π ; 2). For example..."

NAME _____

DATE _____

SQUARE TO LOCATE

To estimate $\sqrt{n}$, find decimal numbers whose squares are just below and just above n . To round to a place value, compare $\sqrt{n}$ with the midpoint between the two nearby decimals.

WORKED EXAMPLE

Estimate $\sqrt{11}$ to the nearest tenth.

- $3^2 = 9$ and $4^2 = 16$, so $\sqrt{11}$ is between 3 and 4.
- $3^2 = 10.89$ and $3.4^2 = 11.56$, so $\sqrt{11}$ is between 3.3 and 3.4.
- The midpoint is 3.35, and $3.35^2 = 11.2225$, which is greater than 11.
- $\sqrt{11}$ is less than 3.35, so it rounds to 3.3.

Answer: $\sqrt{11}$ is about 3.3.

PRACTICE 6 problems

- 1** Write two consecutive whole numbers that $\sqrt{27}$ is between.

ANSWER _____

- 2** Write two consecutive tenths that $\sqrt{19}$ is between.

ANSWER _____

- 3** A number line has marks at 6.7 and 6.8. Is $\sqrt{45}$ closer to 6.7 or 6.8? Show a comparison using squares.

ANSWER _____

- 4** Which is greater, $\sqrt{50}$ or 7.1? Explain with squares.

ANSWER _____

- 5** Use π about 3.14 to estimate π^2 to the nearest tenth.

ANSWER _____

- 6** Estimate $\sqrt{72}$ to the nearest tenth.

ANSWER _____

APPLY IT Show your work

- 1** A gaming club orders square controller decals. Each decal has an area of 95 square centimeters. Estimate the side length of one decal to the nearest tenth of a centimeter.

WORK SPACE

ANSWER _____

- 2** A student designs a circular profile icon with a radius of 5 centimeters. Use pi about 3.14 to estimate the area to the nearest whole square centimeter.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Without a calculator, show that $\sqrt{82}$ rounds to 9.06 to the nearest hundredth. Use the squares of 9.05, 9.055, and 9.06 in your explanation.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Write two consecutive whole numbers that $\sqrt{27}$ is between.	$5 < \sqrt{27} < 6$
2	Write two consecutive tenths that $\sqrt{19}$ is between.	$4.3 < \sqrt{19} < 4.4$
3	A number line has marks at 6.7 and 6.8. Is $\sqrt{45}$ closer to 6.7 or 6.8? Show a comparison using squares.	$\sqrt{45}$ is closer to 6.7 because $6.75^2 = 45.5625$, which is greater than 45.
4	Which is greater, $\sqrt{50}$ or 7.1? Explain with squares.	7.1 is greater because $7.1^2 = 50.41$, which is greater than 50.
5	Use π about 3.14 to estimate π^2 to the nearest tenth.	9.9
6	Estimate $\sqrt{72}$ to the nearest tenth.	8.5

PART 2 • APPLY IT

- 9.7 centimeters** The side length is $\sqrt{95}$. Since $9.75^2 = 95.0625$, $\sqrt{95}$ is less than 9.75, so it rounds to 9.7.
- 79 square centimeters** Use $A = \pi r^2$. With π about 3.14, the area is about $3.14 \times 5^2 = 78.5$, which rounds to 79.

CHALLENGE

$9.05^2 = 81.9025$, $9.055^2 = 81.993025$, and $9.06^2 = 82.0836$. Since 82 is greater than 9.055^2 and less than 9.06^2 , $\sqrt{82}$ is between 9.055 and 9.06, so $\sqrt{82}$ rounds to 9.06.

Accept equivalent inequality statements and correct square-based reasoning. For estimates, accept the stated rounded value with appropriate units when units are requested.