Exercise

Complete the table

	N	W	I	Q	$\overline{Q}$	R
5	✓	✓	✓	✓		✓
-2			✓	✓		✓
$\frac{3}{4}$				✓		✓
-1.3				✓		✓
$\sqrt{7}$					✓	✓
$\sqrt{95}$					✓	✓

TRY THIS

Work with a partner.

These are rational numbers.	These are not rational numbers.
$\sqrt{100}$ $\sqrt{0.25}$ $\sqrt[3]{8}$ 0.5	$\sqrt{0.24}$ $\sqrt[3]{9}$ $\sqrt{2}$
$\frac{5}{6}$ $\sqrt{\frac{9}{64}}$ 0.8^2 $\sqrt[5]{-32}$	$\sqrt{\frac{1}{3}}$ $\sqrt[4]{12}$

How do these rational radicals compare to these not rational numbers

4.2 Irrational Numbers

LESSON FOCUS Identify and order irrational numbers.

Make Connections

The formulas for the area and circumference of a circle involve π, which is not a rational number because it cannot be written as a quotient of integers.

What other numbers are not rational?

Which of these radicals are rational numbers?
Which are not rational numbers? How do you know?

$\sqrt{1.44}$	$\sqrt{\frac{64}{81}}$	$\sqrt[3]{-27}$	$\sqrt{\frac{4}{5}}$	$\sqrt{5}$
$= 1.2$	$= \frac{8}{9}$	$= -3$	$= \sqrt{0.8}$ $=0.8944...$	$= 2.236067....$

Write 3 other radicals that are rational numbers. Why are they rational?

Write 3 other radicals that are not rational numbers. Why are they not rational?

4.2 Irrational Numbers

When an irrational number is written as a radical, the radical is the exact value.

Examples: $\sqrt{2}$ $\sqrt[3]{-50}$ **exact**

When we use the square root or cube root key on our calculators we are obtaining approximate value of irrational numbers.

$$\sqrt{2} \approx 1.4142$$

Example 1 Classifying Numbers

Tell whether each number is rational or irrational. Explain how you know.

a) $-\frac{3}{5}$ b) $\sqrt{14}$ c) $\sqrt[3]{\frac{8}{27}}$

SOLUTION

a) $-\frac{3}{5}$ is rational since it is written as a quotient of integers.
Its decimal form is -0.6, which terminates.

b) $\sqrt{14}$ is irrational since 14 is not a perfect square.
The decimal form of $\sqrt{14}$ neither repeats nor terminates.

c) $\sqrt[3]{\frac{8}{27}}$ is rational since $\frac{8}{27}$ is a perfect cube.
$\sqrt[3]{\frac{8}{27}} = \frac{2}{3}$ or $0.\overline{6}$, which is a repeating decimal

CHECK YOUR UNDERSTANDING

4.2 Irrational Numbers

Example 2 Ordering Irrational Numbers on a Number Line

Use a number line to order these numbers from least to greatest.

$\sqrt[3]{13}$, $\sqrt{18}$, $\sqrt{9}$, $\sqrt[4]{27}$, $\sqrt[3]{-5}$

SOLUTION

13 is between the perfect cubes 8 and 27, and is closer to 8.

$$\begin{array}{ccc} \sqrt[3]{8} & \sqrt[3]{13} & \sqrt[3]{27} \\ \downarrow & \downarrow & \downarrow \\ 2 & ? & 3 \end{array}$$

Use a calculator.

$\sqrt[3]{13} = 2.3513\ldots$

3√(13)
2.351334688

18 is between the perfect squares 16 and 25, and is closer to 16.

$$\begin{array}{ccc} \sqrt{16} & \sqrt{18} & \sqrt{25} \\ \downarrow & \downarrow & \downarrow \\ 4 & ? & 5 \end{array}$$

(Solution continues.)

Example 2 Ordering Irrational Numbers on a Number Line

Use a calculator.

$\sqrt{18} = 4.2426\ldots$

√(18)
4.242640687

$\sqrt{9} = 3$

27 is between the perfect fourth powers 16 and 81, and is closer to 16.

$$\begin{array}{ccc} \sqrt[4]{16} & \sqrt[4]{27} & \sqrt[4]{81} \\ \downarrow & \downarrow & \downarrow \\ 2 & ? & 3 \end{array}$$

Use a calculator.

$\sqrt[4]{27} = 2.2795\ldots$

4ˣ√(27)
2.279507057

-5 is between the perfect cubes -1 and -8, and is closer to -8.

$$\begin{array}{ccc} \sqrt[3]{-1} & \sqrt[3]{-5} & \sqrt[3]{-8} \\ \downarrow & \downarrow & \downarrow \\ -1 & ? & -2 \end{array}$$

Use a calculator.

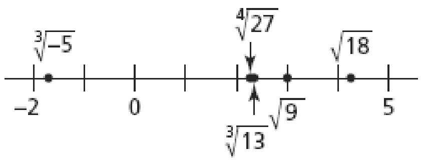
$\sqrt[3]{-5} = -1.7099\ldots$

3ˣ√(-5)
-1.709975947

(Solution continues.)

Example 2 Ordering Irrational Numbers on a Number Line

Mark each number on a number line.



From least to greatest: $\sqrt[3]{-5}$, $\sqrt[4]{27}$, $\sqrt[3]{13}$, $\sqrt{9}$, $\sqrt{18}$

CHECK YOUR UNDERSTANDING

4.2 Irrational Numbers

Classwork/Homework

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Questions 3, 4, 10(just use your calculator),

13, 14, 15, 17, 18ab, 20