

Identifying Irrational Numbers

 Guide Notes

Math 8

An **irrational number** is a number that cannot be written as the ratio of two integers.

A decimal form of irrational numbers does not stop and does not repeat.

The most common example of this is the number π which you may know is approximately **3.14159 ...**

Sample Problem 1: Determine whether each number is rational or irrational.

a. $3.246\overline{7}$

$$3.246\overline{7} = 3.2467777777 \dots$$

This number is a repeating decimal, so the number is rational.

b. $12.14567890098765432 \dots$

$$12.14567890098765432 \dots$$

This number is irrational.

c. $\frac{78}{936}$

$$\frac{78}{936} = \frac{1 * 78}{12 * 78} = \frac{1}{12}$$

$$\frac{1}{12} = 1 \div 12 = 0.0833333 \dots$$

$$\begin{array}{r} -0 \\ 10 \\ -0 \\ \hline 100 \\ -96 \\ \hline 40 \\ -36 \\ \hline 40 \\ -36 \\ \hline 4 \end{array}$$

$$\frac{78}{936} = 0.0833333 \dots$$

This number is a repeating decimal, so the number is rational.

d. $\frac{14}{85}$

$$\frac{14}{85} = 14 \div 85 =$$

$$14 \div 85 = 0.1647058 \dots$$

$$\begin{array}{r} -0 \\ 140 \\ -85 \\ \hline 550 \\ -510 \\ \hline 400 \\ -340 \\ \hline 600 \\ -595 \\ \hline 50 \\ -0 \\ \hline 500 \\ -425 \\ \hline 750 \\ -680 \\ \hline \end{array}$$

$$\frac{14}{85} = 0.1647058 \dots$$

This number is irrational.

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Square Roots and Irrational Numbers

A square root is the inverse operation of squaring a number.

The symbol for square root is $\sqrt{\quad}$ and you should remember some basics such as $\sqrt{25} = 5$ or $\sqrt{0.81} = 0.9$ when we take the principal (or positive) square root.

Square roots of perfect squares are always whole numbers, so they are rational.

But the decimal forms of square roots of numbers that are not perfect squares never stop and never repeat, so these square roots are irrational.

Sample Problem 2: Determine whether each square root is rational or irrational number.

a. $\sqrt{324}$

$$\sqrt{324} = 18$$

This number is rational.

b. $\sqrt{12}$

$$\sqrt{12} = 3.46410161 \dots \dots$$

This number is irrational.

c. $\sqrt{3,136}$

$$\sqrt{3,136} = 56$$

This number is rational.

d. $\sqrt{34}$

$$\sqrt{34} = 5.83095 \dots \dots \dots$$

This number is irrational.