Bellringer

- Write each decimal as a fraction in simplest form.

1. 0.82
2. 0.5

- Write the fraction as a decimal.

3. $\frac{3}{4}$

1.1 Rational and Irrational Numbers

8.NS.1
Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number

8.NS.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 fo expressions

Vocabulary

Rational Number - is any number that can be written as ratio $\frac{a}{b}$ where a & b are integers and $b \neq 0$

ex: $6 = \frac{6}{1}$ $.5 = \frac{5}{10} = \frac{1}{2}$

Terminating Decimal - has a finite (definite) # of digits ex: $.25 = \frac{1}{4}$

Repeating Decimal - has block of 1 or more repeating digits

ex: $\frac{1}{3} = .33333\overline{3}$

Irrational Number - Number that is not rational

ex: π

EXAMPLE 1

COMMON CORE 8.NS.1

Write each fraction as a decimal.

A $\frac{1}{4}$

.25

$$\begin{array}{r} .25 \\ 4\overline{)1.00} \\ -\ 8\downarrow \\ \hline 20 \\ 20 \\ \hline 0 \end{array}$$

B $\frac{1}{3}$

.3

$\frac{1}{4}$ ← Divide

B

$$\begin{array}{r} .333 \\ 3\overline{)1.000} \\ 9\downarrow \\ \hline 10 \\ 9\downarrow \\ \hline 10 \end{array}$$

ADDITIONAL EXAMPLE 1

Write each fraction as a decimal.

A $\frac{2}{5}$

.4

$$5\overline{)2.0}$$

20

0

B $\frac{5}{9}$

$.\overline{5}$

.555

$$9\overline{)5.000}$$

45

50

45

50

YOUR TURN

Write each fraction as a decimal.

1. $\frac{5}{11}$ $\overline{.45}$ 2. $\frac{1}{8}$ .125 3. $2\frac{1}{3}$ $2.\overline{3}$

① $\frac{5}{11}$

$$\begin{array}{r} .4545 \\ 11\overline{)5.0000} \\ 44 \\ \hline 60 \\ 55 \\ \hline 50 \\ 44 \\ \hline 60 \\ 55 \end{array}$$

② $\frac{1}{8}$

$$\begin{array}{r} .125 \\ 8\overline{)1.000} \\ 8 \\ \hline 20 \\ 16 \\ \hline 40 \\ 40 \\ \hline 0 \end{array}$$

③ $2\frac{1}{3}$

$$\begin{array}{r} 0.3\overline{3} \\ 3\overline{)1.00} \\ 9 \\ \hline 10 \end{array}$$

$2\frac{1}{3} = \frac{7}{3}$

$$\begin{array}{r} 2.3\overline{3} \\ 3\overline{)7.00} \\ 6 \\ \hline 10 \\ 9 \\ \hline 10 \end{array}$$

EXAMPLE 2

COMMON CORE 8.NS.1

Write each decimal as a fraction in simplest form.

A 0.825

$$\frac{825 \div 25}{1000 \div 25} = \frac{33}{40}$$

10 100 1000 10000

. tenths hundredths thousandths ten thousandths

↑ Decimal

B $0.\overline{37}$

$$X = .\overline{37}$$

$$100(X) = 100(.\overline{37})$$

$$100X = 37.\overline{37}$$

$$-X \quad -.\overline{37}$$

$$\frac{99X}{99} = \frac{37}{99}$$

$$\frac{37}{99}$$

ADDITIONAL EXAMPLE 2

Write each decimal as a fraction in simplest form.

A 0.355

$$\frac{355 \div 5}{1000 \div 5} = \frac{71}{200}$$

B $0.\overline{43}$

$X = \frac{43}{99}$

$X = .\overline{43}$

$100(X) = 100(.\overline{43})$

$100X = 43.\overline{43}$

$-X \quad -.\overline{43}$

$99X = 43$

$\frac{99X}{99} = \frac{43}{99}$

YOUR TURN

Q Write each decimal as a fraction in simplest form.

4. 0.12 $\frac{3}{25}$

5. $0.\overline{57}$ $\frac{19}{33}$

6. 1.4 $1\frac{2}{5}$

$\frac{12 \div 2}{100 \div 2} = \frac{6 \div 2}{50 \div 2} = \frac{3}{25}$

$x = .\overline{57}$

$100(x) = 100(.\overline{57})$

$100x = 57.\overline{57}$

$-x \quad -.\overline{57}$

$\frac{99x}{99} = \frac{57}{99} \quad x = \frac{57 \div 3}{99 \div 3}$

$\frac{4 \div 2}{10 \div 2} = \frac{2}{5}$

Vocabulary

Square root - opposite of squaring; There are 2 square roots for every positive #

ex: $5^2 = 25$ (5 x 5; squaring) $\quad \sqrt{25} = \pm 5$ (square root) $\quad -5^2 = 25$ (-5 x -5)

principal square root - positive square root

perfect square - has square roots that are integers ex: $\sqrt{64} = \pm 8$

cube root - opposite of cubing; there is 1 cube root for every positive #

ex: $2^3 = 2 \times 2 \times 2 = 8$ (cubing) $\quad \sqrt[3]{8} = 2$ (cube root)

perfect cube - has cube root that is an integer

Perfect Squares

$\sqrt{1} = \pm 1$

$\sqrt{4} = \pm 2$

$\sqrt{9} = \pm 3$

$\sqrt{16} = \pm 4$

$\sqrt{25} = \pm 5$

$\sqrt{144} = \pm 12$

Perfect Cubes

$\sqrt[3]{1} = 1$

$\sqrt[3]{8} = 2$

$\sqrt[3]{27} = 3$

$\sqrt[3]{64} = 4$

EXAMPLE 3

COMMON CORE 8.EE.2

Solve each equation for x.

A $x^2 = 121$

$\sqrt{x^2} = \sqrt{121}$

$x = \sqrt{121}$

$x = \pm 11$

B $x^2 = \frac{16}{169}$

$\sqrt{x^2} = \sqrt{\frac{16}{169}} = \frac{\sqrt{16}}{\sqrt{169}}$

$x = \pm \frac{4}{13}$

C $729 = x^3$

$\sqrt[3]{729} = \sqrt[3]{x^3}$

$\sqrt[3]{729} = x$

$9 = x$

D $x^3 = \frac{8}{125}$

$\sqrt[3]{x^3} = \sqrt[3]{\frac{8}{125}} = \frac{\sqrt[3]{8}}{\sqrt[3]{125}}$

$x = \frac{2}{5}$

ADDITIONAL EXAMPLE 3

Solve each equation for *x*.

A $x^2 = 324$

B $x^2 = \frac{25}{144}$

(A) $\sqrt{x^2} = \sqrt{324}$

$x = \pm 18$

(B) $\sqrt{x^2} = \sqrt{\frac{25}{144}}$

$x = \pm \frac{5}{12}$

YOUR TURN

Solve each equation for x.

7. $x^2 = 196$ $x = \pm 14$

8. $x^2 = \frac{9}{256}$ $x = \pm \frac{3}{16}$

9. $x^3 = 512$ $x = 8$

10. $x^3 = \frac{64}{343}$ $x = \frac{4}{7}$

(7) $\sqrt{x^2} = \sqrt{196}$

$x = \sqrt{196}$

$x = \pm 14$

(8) $\sqrt{x^2} = \sqrt{\frac{9}{256}} = \frac{\sqrt{9}}{\sqrt{256}}$

$x = \frac{\sqrt{9}}{\sqrt{256}}$

$x = \pm \frac{3}{16}$

(9) $\sqrt[3]{x^3} = \sqrt[3]{512}$

$x = \sqrt[3]{512}$

$x = 8$

(10) $\sqrt[3]{x^3} = \sqrt[3]{\frac{64}{343}}$

$x = \sqrt[3]{\frac{64}{343}}$

$x = \frac{4}{7}$

Estimate the value of $\sqrt{2}$.

A Since 2 is not a perfect square, $\sqrt{2}$ is irrational.

B To estimate $\sqrt{2}$, first find two consecutive perfect squares that 2 is between. Complete the inequality by writing these perfect squares in the boxes.

$$\boxed{1} < 2 < \boxed{4}$$

C Now take the square root of each number.

$$\sqrt{\boxed{1}} < \sqrt{2} < \sqrt{\boxed{4}}$$

D Simplify the square roots of perfect squares.

$$\boxed{1} < \sqrt{2} < \boxed{2}$$

$\sqrt{2}$ is between _____ and _____ .

$\sqrt{1} = 1$ $\quad$ $\sqrt{16} = 4$

$\sqrt{4} = 2$ $\quad$ $\sqrt{25} = 5$

$\sqrt{9} = 3$

Estimate the value of the irrational numbers

use perfect squares to help

$\sqrt{7}$

$\sqrt{1}=1$

$\sqrt{4}=2$

$\sqrt{9}=3$

$\sqrt{4}, \sqrt{7}, \sqrt{9}$

$2, \square, 3$

$\sqrt{11}$

$\sqrt{1}=1$

$\sqrt{4}=2$

$\sqrt{9}=3$

$\sqrt{16}=4$

$\sqrt{9}, \sqrt{11}, \sqrt{16}$

$3, \square, 4$

E Estimate that $\sqrt{2} \approx 1.5$.

F To find a better estimate, first choose some numbers between 1 and 2 and square them. For example, choose 1.3, 1.4, and 1.5.

$1.3^2 =$ _____ $1.4^2 =$ _____ $1.5^2 =$ _____

Is $\sqrt{2}$ between 1.3 and 1.4? How do you know?

_____

_____

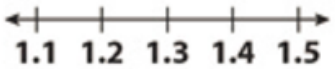
Is $\sqrt{2}$ between 1.4 and 1.5? How do you know?

_____

_____

$\sqrt{2}$ is between _____ and _____, so $\sqrt{2} \approx$ _____ .

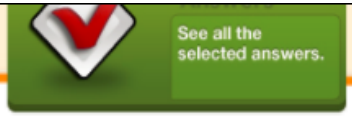
G Locate and label this value on the number line.



G.P. p 12 (1-19)

I.P. p 13 (20-27)

Guided Practice



Q

Write each fraction or mixed number as a decimal. (Example 1)

1. $\frac{2}{5}$ .4
2. $\frac{8}{9}$ _____
3. $3\frac{3}{4}$ _____
4. $\frac{7}{10}$ _____
5. $2\frac{3}{8}$ _____
6. $\frac{5}{6}$ _____

$$\begin{array}{r} .4 \\ 05\overline{)2.0} \\ -20 \\ \hline 0 \end{array}$$

Write each decimal as a fraction or mixed number in simplest form. (Example 2)

7. 0.675 _____
8. 5.6 _____
9. 0.44 _____

10. $0.\overline{4}$

$10x = 4.\overline{4}$

$-x \quad -.\overline{4}$

$9x = 4$

$x = \frac{4}{9}$

11. $0.\overline{26}$

$100x =$ ☐

$-x \quad -$ ☐

☐ $x =$ ☐

$x =$ _____

12. $0.\overline{325}$

$1000x =$ ☐

$-x \quad -$ ☐

☐ $x =$ ☐

$x =$ _____