



# Infinite Decimal Expansions

Let's think about infinite decimals.

## 17.1 Searching for Digits

The first 3 digits after the decimal for the decimal expansion of  $\frac{3}{7}$  have been calculated. Find the next 4 digits.

$$\begin{array}{r} 0.428 \\ 7 \overline{) 3} \\ \underline{- 2} \phantom{8} \\ 20 \\ \underline{- 14} \\ 60 \\ \underline{- 56} \\ 4 \end{array}$$

## 17.2

## Some Numbers Are Rational

Your teacher will give your group a set of cards. Each card will have a calculations side and an explanation side.

1. The cards show Noah's work calculating the fraction representation of  $0.\overline{485}$ . Arrange these in order to see how he figured out that  $0.\overline{485} = \frac{481}{990}$  without needing a calculator.
2. Use Noah's method to calculate the fraction representation of:
  - a.  $0.1\overline{86}$

b.  $0.7\overline{88}$



**Are you ready for more?**

Use this technique to find fractional representations for  $0.\overline{3}$  and  $0.\overline{9}$ .



## 17.3

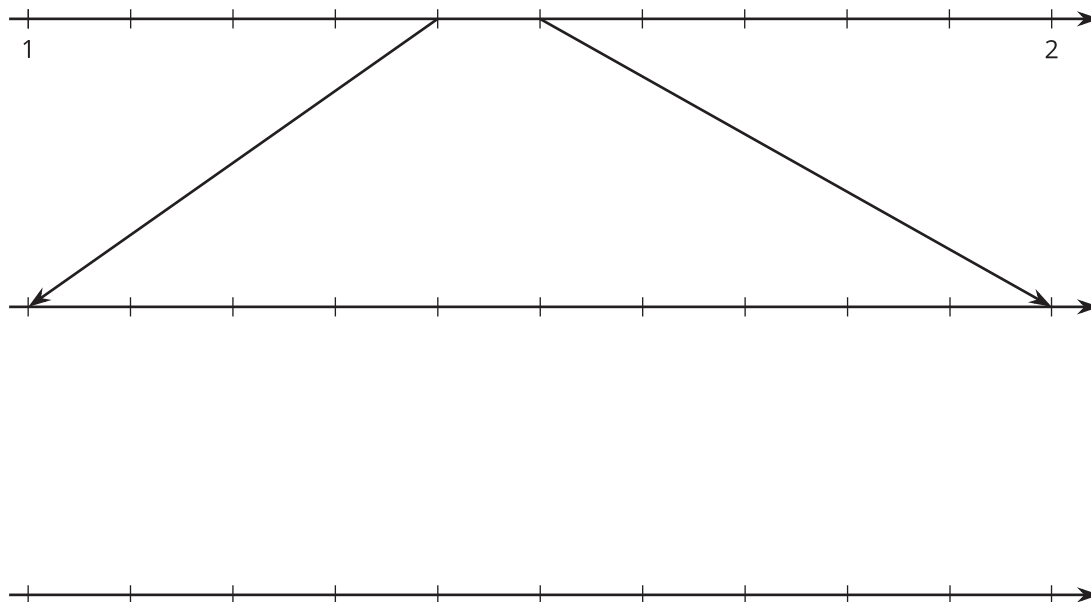
## Some Numbers Are Not Rational

1. a. Why is  $\sqrt{2}$  between 1 and 2 on the number line?

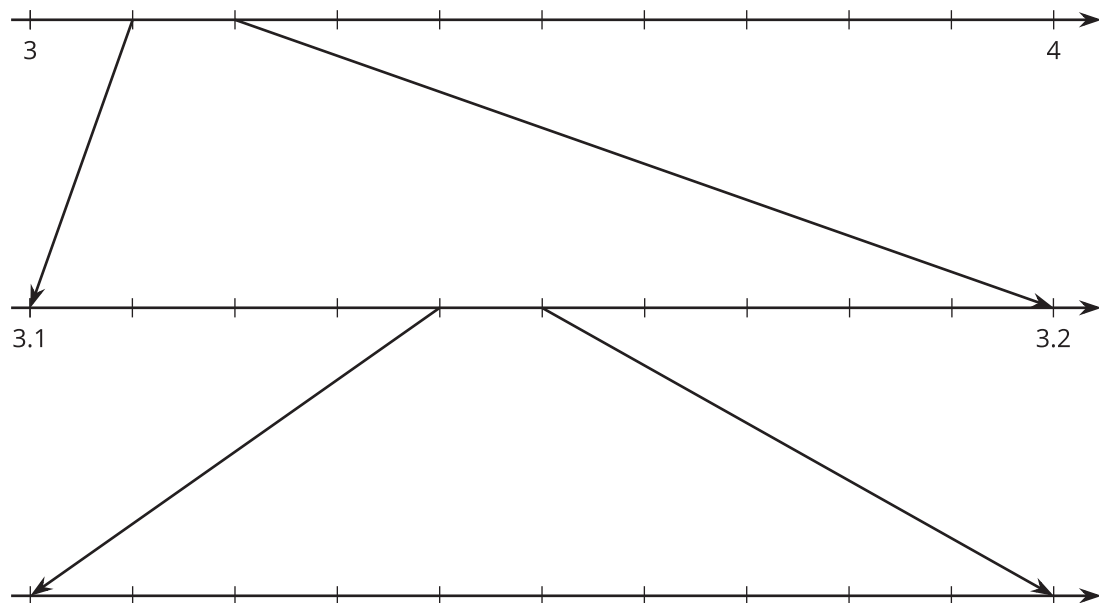
b. Why is  $\sqrt{2}$  between 1.4 and 1.5 on the number line?

c. How can you figure out an approximation for  $\sqrt{2}$  accurate to 3 decimal places?

d. Label all of the tick marks. Plot  $\sqrt{2}$  on all three number lines. Make sure to add arrows from the second to the third number line.



2. a. Elena notices that a beaker in science class says it has a diameter of 9 cm and measures its circumference to be 28.3 cm. Using these values and the equation for circumference,  $C = 2\pi r$ , what value do you get for  $\pi$ ?
- b. Diego learns that one of the space shuttle fuel tanks has a diameter of 840 cm and a circumference of 2,639 cm. Using these values and the equation for circumference,  $C = 2\pi r$ , what value do you get for  $\pi$ ?
- c. Label all of the tick marks on the number lines. Use a calculator to get a very accurate approximation of  $\pi$  and plot that number on all three number lines.



- d. How can you explain the differences between these calculations of  $\pi$ ?

## Lesson 17 Summary

Not every number is rational. Earlier we tried to find a fraction whose square is equal to 2. That turns out to be impossible, although we can get pretty close (try squaring  $\frac{7}{5}$ ). Since there is no fraction equal to  $\sqrt{2}$ , it is not a rational number, so we call it an "irrational number." Another well-known irrational number is  $\pi$ .

Every number, rational or irrational, has a decimal expansion. For example, the rational number  $\frac{2}{11}$  has the decimal expansion  $0.181818 \dots$  with the 18s repeating forever. Irrational numbers also have infinite decimal expansions, but they don't end up having a repeating pattern.

