



# Using Partial Quotients

Let's divide whole numbers.

## 10.1

## Notice and Wonder: Kiran's Calculations

Here are Kiran's calculations for finding  $657 \div 3$ :

$$600 \div 3 = 200$$

$$30 \div 3 = 10$$

$$27 \div 3 = 9$$

$$\hline 657 \div 3 = 219$$

What do you notice? What do you wonder?



## 10.2

# Using Partial Quotients to Calculate Quotients

1. Andre calculated  $657 \div 3$  using a method that was different from Kiran's.

He started by writing the dividend (657) and the divisor (3).

$$3 \overline{) 657}$$

Next, he subtracted 3 groups of different amounts from 657, starting with 3 groups of 200 . . .

$$\begin{array}{r} 200 \\ 3 \overline{) 657} \\ - 600 \\ \hline 57 \end{array}$$

. . . then 3 groups of 10, and then 3 groups of 9.

$$\begin{array}{r} 9 \\ 10 \\ 200 \\ 3 \overline{) 657} \\ - 600 \\ \hline 57 \\ - 30 \\ \hline 27 \\ - 27 \\ \hline 0 \end{array}$$

Andre calculated  $200 + 10 + 9$ , and wrote 219.

$$\begin{array}{r} 219 \\ 3 \overline{) 657} \\ - 600 \\ \hline 57 \\ - 30 \\ \hline 27 \\ - 27 \\ \hline 0 \end{array}$$

- Andre subtracted 600 from 657. What does the 600 represent?
- Andre wrote 10 above the 200, and then subtracted 30 from 57. How is the 30 related to the 10?
- What do the numbers 200, 10, and 9 represent?
- What is the meaning of the 0 at the bottom of Andre's work?



2. How might Andre calculate  $896 \div 4$ ? Explain or show your reasoning.



## 10.3

## What's the Quotient?

Find the value of each quotient. Show your reasoning. Use vertical calculations at least once.

1.  $1,332 \div 9$

2.  $1,115 \div 5$

3.  $432 \div 16$



## Lesson 10 Summary

Another way to find the quotient of  $345 \div 3$  is by using partial quotients, in which we keep subtracting 3 groups of some amount from 345. We can organize the steps and record the partial quotients in a vertical calculation.

Here are two calculations for finding  $345 \div 3$ :

$$\begin{array}{r}
 \boxed{1 \ 1 \ 5} \\
 \phantom{0} 5 \\
 \phantom{0} 1 \ 0 \\
 \phantom{0} 1 \ 0 \ 0 \\
 3 \overline{) 3 \ 4 \ 5} \\
 \underline{- 3 \ 0 \ 0} \leftarrow 3 \text{ groups of } 100 \\
 \phantom{0} 4 \ 5 \\
 \underline{- 3 \ 0} \leftarrow 3 \text{ groups of } 10 \\
 \phantom{0} 1 \ 5 \\
 \underline{- 1 \ 5} \leftarrow 3 \text{ groups of } 5 \\
 \phantom{0} 0
 \end{array}$$

$$\begin{array}{r}
 \boxed{1 \ 1 \ 5} \\
 \phantom{0} 5 \ 0 \\
 \phantom{0} 5 \ 0 \\
 \phantom{0} 1 \ 5 \\
 3 \overline{) 3 \ 4 \ 5} \\
 \underline{- \phantom{0} 4 \ 5} \leftarrow 3 \text{ groups of } 15 \\
 \phantom{0} 3 \ 0 \ 0 \\
 \underline{- 1 \ 5 \ 0} \leftarrow 3 \text{ groups of } 50 \\
 \phantom{0} 1 \ 5 \ 0 \\
 \underline{- 1 \ 5 \ 0} \leftarrow 3 \text{ groups of } 50 \\
 \phantom{0} 0
 \end{array}$$

- In the calculation on the left, first we subtract 3 groups of 100, then 3 groups of 10, and then 3 groups of 5. Adding up the partial quotients ( $100 + 10 + 5$ ) gives us 115.
- The calculation on the right shows a different amount per group subtracted each time (3 groups of 15, 3 groups of 50, and 3 more groups of 50), but the total amount in each of the 3 groups is still 115.

There are other ways of calculating  $345 \div 3$  using partial quotients. We can calculate with fewer steps by removing groups of larger sizes.