3.5b Estimation

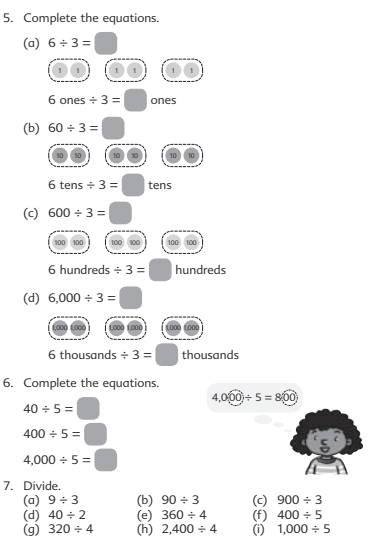
Objectives
- Estimate the answers to division problems.
- Solve word problems.

Materials
- Place-value discs
- Appendix 3.5b (Renamed from Appendix 3.5c)

PRIMARY digital

Common Core State Standards
3.OA.3
3.OA.4
3.OA.5
3.OA.7
3.OA.8
3.MD.4

Mathematical Practices
MP1
MP4
MP6
MP7

Divide tens, hundreds, or thousands mentally	Textbook, p. 115
• Students have already been dividing by ones, tens, and hundreds in division problems. On this page, focus on the number of zeros in the dividend and in the quotient and the place value of the digits. For all of these problems, if you take off some of the zeros, the digits that remain can be related to the division facts students should already know. The quotient will have only one nonzero digit. • In Task 4, there are the same number of zeros in the quotient as in the number we are dividing by 3. In Task 5, there is one less. Ask students to explain why. They cannot divide 4 ones by 5, but they can divide 40 ones by 5. So to divide 400 by 5, they are dividing 40 tens. The quotient will be tens, and so will have 1 zero. **Answers:** 5. (a) 2 2 (b) 20 2 (c) 200 2 (d) 2,000 2 6. 8 80 800 7. (a) 3 (b) 30 (c) 300 (d) 20 (e) 90 (f) 80 (g) 80 (h) 600 (i) 200	 5. Complete the equations. (a) 6 ÷ 3 = ☐ 6 ones ÷ 3 = ☐ ones (b) 60 ÷ 3 = ☐ 6 tens ÷ 3 = ☐ tens (c) 600 ÷ 3 = ☐ 6 hundreds ÷ 3 = ☐ hundreds (d) 6,000 ÷ 3 = ☐ 6 thousands ÷ 3 = ☐ thousands 6. Complete the equations. 40 ÷ 5 = ☐ 400 ÷ 4 = ☐ 4,000 ÷ 5 = ☐ 4,000 ÷ 5 = 800 7. Divide. (a) 9 ÷ 3 (b) 90 ÷ 3 (c) 900 ÷ 3 (d) 40 ÷ 2 (e) 360 ÷ 4 (f) 400 ÷ 5 (g) 320 ÷ 4 (h) 2,400 ÷ 4 (i) 1,000 ÷ 5 115
• Write problems such as those on the right and have students find the answer mentally or tell you that they will need to do the division algorithm. They need to recognize when the first number is a multiple of 10, 100, or 1,000 that can be evenly divided by the second, and when it cannot.	720 ÷ 8 (90) 6,300 ÷ 7 (900) 3,500 ÷ 6 (division algorithm) 4,200 ÷ 9 (division algorithm) 4,200 ÷ 7 (600) 10,000 ÷ 3 (division algorithm)

Estimation

- Remind students that they can estimate the answer to addition, subtraction, and multiplication problems by rounding the numbers to tens or hundreds, so it is easy to mentally calculate in order to get an approximate answer.
- Ask students to estimate the answer to 317 × 5.

Textbook, p. 116

317 × 5

↓

300 × 5 = 1,500

- Have students look at the problem in Task 8.
- Tell them that they can also round to estimate the answer for division problems, and they still want to round to something that makes the calculations easy. Because of remainders in division, rounding to the nearest hundreds will not help. They cannot easily divide 200 by 3. So with division, they usually round to a number that has 1 or 2 nonzero digits that they can easily divide mentally. 15 and 18 can be divided by 3.
- Ask students whether 150 or 180 is closer to 167. 180 is closer, but not by much.
- Tell students that often, it will be easier to pick the closest number to round to. If both numbers are close, they should not spend too much time deciding which is closer; estimation should be something that they can do quickly. An estimate using 150 ÷ 3 = 50 will still give an estimated answer close enough to tell whether the actual answer to 167 ÷ 3 is reasonable.
- Ask students to find the actual answer to 167 ÷ 3 (55 R 2).
- Have students do Task 8.

Answers:

8. 60
   60
9. (a) 70
   (b) 69
   0

8. Estimate the value of 167 ÷ 3.

200 ÷ 3 = ?
I can't round to the nearest hundred.
There will be a remainder.

167 < 150 ÷ 3
167 < 180 ÷ 3

180 ÷ 3 = ☐

The value of 167 ÷ 3 is about ☐.

9. Ashley made 276 muffins.
She put them into boxes of 4 muffins each.
How many boxes of muffins were there?
How many were left over?

(a) Estimate the number of boxes.

276 ÷ 4 = ?
4 × 6 = 24
4 × 7 = 28
I will use 280.

280 ÷ 4 = ☐

The answer will be around 70.

(b) Find the answer.

There were ☐ boxes of muffins.

☐ muffins were left over.

116

Assessment

- You can also have students find the actual answers for Task 9.
- Estimated answers can vary. A student good at mental math could estimate (a), using 840 ÷ 2 = 420.

Answers:

10. (a) 840 ÷ 4 = 210 or 800 ÷ 4 = 200
    (b) 380 ÷ 2 = 190 or 400 ÷ 2 = 200
    (c) 100 ÷ 5 = 20
    (d) 600 ÷ 3 = 200
    (e) 500 ÷ 2 = 250
    (f) 1,600 ÷ 4 = 400

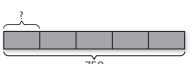
    exact answers:

    (a) 210 R 2 (b) 189 (c) 19 R 3
    (d) 189 R 1 (e) 256 (f) 423 R 1
11. $150
12. 105
    2

Textbook, p. 117

10. Estimate the value of
    (a) 842 ÷ 4
    (b) 378 ÷ 2
    (c) 98 ÷ 5
    (d) 568 ÷ 3
    (e) 512 ÷ 2
    (f) 1,693 ÷ 4

11. 5 bicycles cost $750.
How much does one bicycle cost?



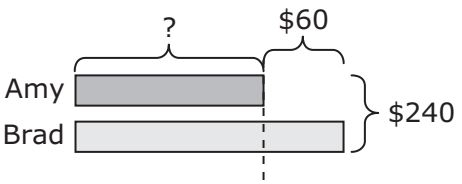
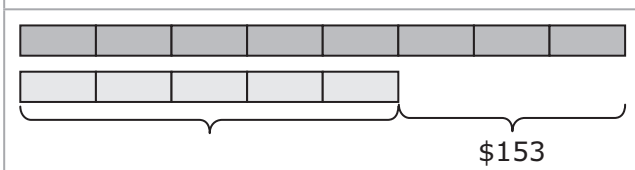
1 bicycle costs ☐.

12. Craig has 317 oranges.
He puts 3 oranges in each bag.
How many bags of oranges can he make?
How many oranges will be left over?

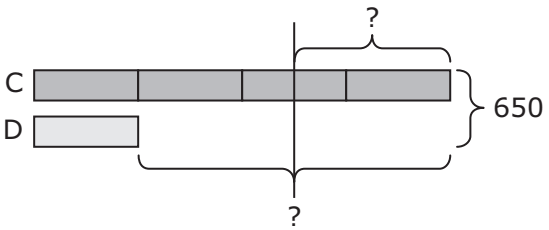
He can make ☐ bags of oranges.

☐ oranges will be left over.

117

Other word problems	Appendix 3.5b
• Provide students with copies of Appendix 3.5b and let them work on the problems. • Problem 4 is challenging. Students may not be able to solve it independently.	
• Students will probably draw a comparison model, as they are told how much more Brad has than Amy. If they make the amount Brad has the same as what Amy has, then they will have two equal units. To do that, they need to subtract \$60 from the amount Brad has, and therefore \$60 from the total.  2 units = 240 − 6 = 180 1 units = 180÷ 2 = 90 Amy has **\$90**. • If students have difficulty with this, draw a part-whole model with three parts. Two parts are equal (the amount Amy has and the part of what Brad has that is the same as what Amy has), and the third part is the amount Brad has more than Amy. Although comparison models are quite useful for multistep problems, this is essentially a 3-part-whole problem. With two of the parts equal, and with a part-whole model, it can be easier to visualize that they are subtracting \$60 from the total to get two equal units.	1. Amy and Brad have \$240. Brad has \$60 more than Amy. How much money does Amy have?
• Grouping problems are difficult to model, as the number of groups is not known. Some students may be able to easily solve this without a model; for others, some type of diagram may be useful in helping them visualize the situation. • As there are 5 muffins in each package, they first divide by 5 to get the number of packages. Then they can multiply that by the number of orange-cranberry muffins in each. 430 ÷ 5 = 86 86 × 3 = 258 There are **258** orange-cranberry muffins.	2. A bakery is packing 2 banana-nut muffins and 3 orange-cranberry muffins in each package. There are 430 muffins. How many of them are orange-cranberry muffins?
 153 ÷ 3 = 51 51 × 5 = 255 He spends **\$255**.	3. Tom wants to buy the same game for each of his nieces and nephews. He has enough money to buy 8 games, but he buys only 5 games. He has \$153 left. How much money does he spend?

- Students need to remember from a previous lesson that to have the same number of cards, the person with more cards has to give half the difference.



650 ÷ 5 = 130; 130 × 3 = 390
OR: 130 × 4 = 520, 520 − 130 = 390
390 ÷ 2 = 195
Charlie needs to give Drew **195** cards.

4. Charlie and Drew collected 650 game cards. Charlie has 4 times as many game cards as Drew. How many would he give to Drew so they both have the same number of cards?

Practice

Workbook Exercise 16, pp. 114–115

- Have students complete Workbook Exercise 16 on pages 114–115.

EXERCISE 16

1. Write the missing numbers.

(a) 8 tens ÷ 2 = **4** tens | 80 ÷ 2 = **40**

(b) 40 tens ÷ 4 = **10** tens | 400 ÷ 4 = **100**

(c) 10 tens ÷ 5 = **2** tens | 100 ÷ 5 = **20**

(d) 21 tens ÷ 3 = **7** tens | 210 ÷ 3 = **70**

2. Divide.

6 ÷ 2 = **3**	60 ÷ 2 = **30**	600 ÷ 2 = **300**
24 ÷ 3 = **8**	240 ÷ 3 = **80**	2,400 ÷ 3 = **800**
32 ÷ 4 = **8**	320 ÷ 4 = **80**	3,200 ÷ 4 = **800**

3. Estimate, and then divide.

(a)	222 ÷ 4 is about **200** ÷ 4 = **50**	$4\overline{)222}$ **55 R 2**
(b)	285 ÷ 3 is about **270** ÷ 3 = **90**	$3\overline{)285}$ **95**

4. David saved $900 in 4 months.
He saved the same amount of money each month.
How much did he save each month?

$900 ÷ 4 = $225

He saved $225 each month.

5. Ms. Holt had 186 stickers.
She gave 5 stickers to each student in her class.
How many students were there in her class?
How many stickers were left over?

186 ÷ 5 = 37 R 1

There were 37 students in her class.

1 sticker was left over.

6. 3 students sold 243 concert tickets altogether.
Each student sold the same number of tickets.
How many tickets did each student sell?

243 ÷ 3 = 81

Each student sold 81 tickets.

Mental Math 4.4e.1	Mental Math 4.4e.2
7,200 ÷ 9 = _____	435 + 98 = _____
120 ÷ 6 = _____	81 ÷ 9 = _____
6,300 ÷ 9 = _____	6 × 8 = _____
560 ÷ 8 = _____	328 + 671 = _____
3,000 ÷ 5 = _____	3,420 − 700 = _____
4,200 ÷ 7 = _____	64 ÷ 8 = _____
810 ÷ 9 = _____	52 × 4 = _____
4,800 ÷ 8 = _____	438 + 90 = _____
2,400 ÷ 6 = _____	800 × 7 = _____
450 ÷ 9 = _____	326 − 97 = _____
3,600 ÷ 6 = _____	387 + 8 = _____
2,800 ÷ 4 = _____	56 ÷ 7 = _____
9,000 ÷ 3 = _____	7 × 60 = _____
2,400 ÷ 8 = _____	48 + 85 = _____
2,500 ÷ 5 = _____	4,000 ÷ 8 = _____
10,000 ÷ 5 = _____	83 − 58 = _____
3,000 ÷ 6 = _____	357 ÷ 7 = _____
210 ÷ 7 = _____	12 × 7 = _____
150 ÷ 5 = _____	200 ÷ 5 = _____
2,000 ÷ 4 = _____	480 + 50 = _____