Mathematics:

"A Story of Units"

Parent Handbook

Grade 5
Module 2

Grade 5 • Module 2

Multi-Digit Whole Number and Decimal Fraction Operations

OVERVIEW

In Module 1, students explored the relationships of adjacent units on the place value chart to generalize whole number algorithms to decimal fraction operations. In Module 2, students apply the patterns of the base ten system to mental strategies and the multiplication and division algorithms.

Topics A through D provide a sequential study of multiplication. To link to prior learning and set the foundation for understanding the standard multiplication algorithm, students begin at the concrete–pictorial level in Topic A. They use number disks to model multi-digit multiplication of place value units, e.g., 42 × 10, 42 × 100, 42 × 1,000, leading to problems such as 42 × 30, 42 × 300 and 42 × 3,000. They then round factors in Lesson 2 and discuss the reasonableness of their products. Throughout Topic A, students evaluate and write simple expressions to record their calculations using the associative property and parentheses to record the relevant order of calculations.

In Topic B, place value understanding moves toward understanding the distributive property via area diagrams which are used to generate and record the partial products of the standard algorithm. Topic C moves students from whole numbers to multiplication with decimals, again using place value as a guide to reason and make estimations about products. In Topic D, students explore multiplication as a method for expressing equivalent measures. For example, they multiply to convert between meters and centimeters or ounces and cups with measurements in both whole number and decimal form.

Topics E through H provide a similar sequence for division. Topic E begins concretely with number disks as an Introduction to division with multi-digit whole numbers. In the same lesson, 420 ÷ 60 is interpreted as 420 ÷ 10 ÷ 6. Next, students round dividends and two-digit divisors to nearby multiples of 10 in order to estimate single-digit quotients (e.g., 431 ÷ 58 ≈ 420 ÷ 60 = 7) and then multi-digit quotients. This work is done horizontally, outside the context of the written vertical method.

 The series of lessons in Topic F leads students to divide multi-digit dividends by two-digit divisors using the written vertical method. Each lesson moves to a new level of difficulty with a sequence beginning with divisors that are multiples of 10 to non-multiples of 10. Two instructional days are devoted to single-digit quotients with and without remainders before progressing into two- and three-digit quotients.

In Topic G, students use their understanding to divide decimals by two-digit divisors in a sequence similar to that of Topic F with whole numbers.

 In Topic H, students apply the work of the module to solve multi-step word problems using multi-digit division with unknowns representing either the group size or number of groups. In this topic, an emphasis on checking the reasonableness of their answers draws on skills learned throughout the module, including refining their knowledge of place value, rounding, and estimation.

**The sample questions/responses contained in this manual are straight from http://www.engageny.org/. They are provided to give some insight into the kinds of skills expected of students as the lesson is taught.

Terminology

New or Recently Introduced Terms

- Decimal Fraction (a proper fraction whose denominator is a power of 10)

- Multiplier (a quantity by which a given number—a multiplicand—is to be multiplied)

- Parentheses (the symbols used to relate order of operations)

Familiar Terms and Symbols

- Decimal (a fraction whose denominator is a power of ten and whose numerator is expressed by figures placed to the right of a decimal point)

- Digit (a numeral between 0 and 9)

- Divisor (the number by which another number is divided)

- Equation (a statement that the values of two mathematical expressions are equal)

- Equivalence (a state of being equal or equivalent)

- Equivalent measures (e.g., 12 inches = 1 foot; 16 ounces = 1 pound)

- Estimate (approximation of the value of a quantity or number)

- Exponent (the number of times a number is to be used as a factor in a multiplication expression)

- Multiple (a number that can be divided by another number without a remainder like 15, 20, or any multiple of 5)

- Pattern (a systematically consistent and recurring trait within a sequence)

- Product (the result of a multiplication of factors)

- Quotient (the answer of dividing one quantity by another)

- Remainder (the number left over when one integer is divided by another)

- Renaming (making a larger unit)

- Rounding (approximating the value of a given number)

- Unit Form (place value counting, e.g., 34 stated as 3 tens 4 ones)

Suggested Tools and Representations

- Area models (e.g., an array)

- Number bond (visual model which shows a larger section as the sum of the smaller sections or parts)

- Number disks (visual representation of a digit's value by place value disks, e.g., 34 = 10, 10, 10, 1, 1, 1, 1 in disks)

- Partial product (an algorithmic method that takes base ten decompositions of factors, makes products of all pairs, and adds all products together)

- Partial quotient (an algorithmic method using successive approximation)

Area Model: These area models both show a visual representation of 21 x 5, breaking apart the 21 by tens and ones (20 and 1).
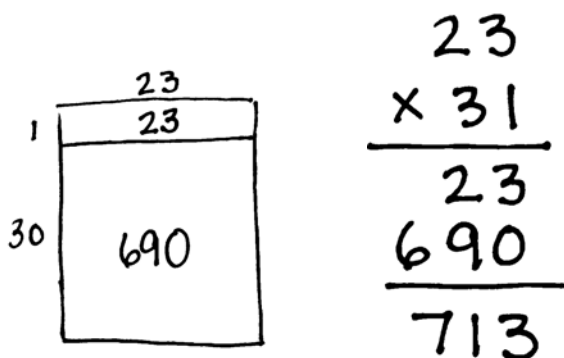
5

1

20

1 X 5

20 x 5
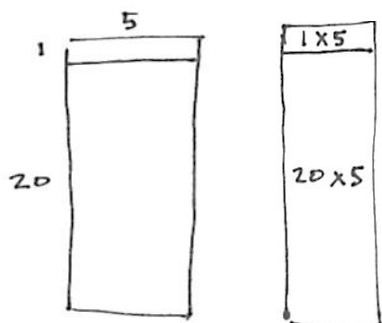
Number Bond: This bond is showing that the addends or parts, 8 and 2, together total the sum, 10.

10

8   2
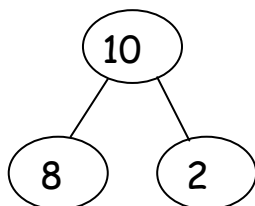
Number Disks: The value 726 is shown using number disks.

| 100 | 100 | 100 |
| 100 | 100 | 100 |
| 100 |

10   10

1   1   1
1   1   1

Partial Products: The partial products, 23 and 690, are added to get the final product of 713.

23
1   23
30   690

$$23$$
$$\times\ 31$$
$$23$$
$$690$$
$$713$$

Lesson 1

Objective: Multiply multi-digit whole numbers and multiples of 10 using place value patterns and the distributive and associative properties.

a. 23×20

Think: 23 ones × 2 tens = ___46___ tens

$23 \times 20 =$ ___460___

c. 40×5 40×50 40×500 400×5000

$= 200$ $= 20 \times 100$ $= (4 \times 10) \times (5 \times 100)$ $= (4 \times 5) \times (100 \times 1000)$

         $= 2,000$ $= (4 \times 5) \times 1000$ $= 20 \times 100,000$

                        $= 20,000$ $= 2,000,000$

Lesson 2

Objective: Estimate multi-digit products by rounding factors to a basic fact and using place value patterns.

1. Round the factors to estimate the products.
   a. 597×52 = ___600___ × ___50___ = ___30,000___

   A reasonable estimate for 597×52 is ___30,000___.

6. Michael saves $423 dollars a month for college.

   a. About how much money would he have saved after 4 years?
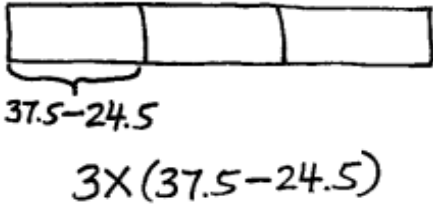
   $4 \times 12 = 48$ months

   $\$423 \times 48 \approx \$400 \times 50 = \$20,000$
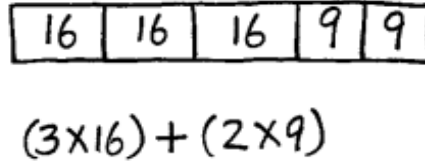
   He would have saved about $20,000 after 4 years.

Lesson 3

Objective: Write and interpret numerical expressions and compare expressions using a visual model.

c. 3 times the difference between 37.5 and 24.5

$$37.5 - 24.5$$

$$3 \times (37.5 - 24.5)$$

d. The sum of 3 sixteens and 2 nines

16	16	16	9	9

$$(3 \times 16) + (2 \times 9)$$

6. A box contains 24 oranges. Mr. Lee ordered 8 boxes for his store and 12 boxes for his restaurant.

   a. Write an expression to show how to find the total number of oranges ordered.

   $$(24 \times 8) + (24 \times 12) \quad \text{OR} \quad 24 \times (8 + 12) \quad \text{OR} \quad (24 \times 20)$$

   b. Next week, Mr. Lee will both double the number of boxes he orders. Write a new expression to represent the number of oranges in next week's order.

   $$\big((24 \times 8) + (24 \times 12)\big) \times 2 \quad \text{OR} \quad (24 \times 20) \times 2$$

Lesson 4

Objective: Convert numerical expressions into unit form as a mental strategy for multi-digit multiplication.

5. Solve mentally.

   a. 101 × 15   __1515__
   $$= (100 \times 15) + (1 \times 15)$$

   b. 18 × 99   __1782__
   $$= (100 \times 18) - (1 \times 18)$$

2. Solve using mental math. Draw a tape diagram and fill in the blanks to show your thinking. The first one was done for you.

   a. 19 × 25 = __19__ twenty-fives

25	25	25	...	25	☒
1	2	3	...	19	20

   Think: 20 twenty-fives – 1 twenty-five.

   $$= (\underline{20} \times 25) - (\underline{1} \times 25)$$
   $$= \underline{500} - \underline{25} = \underline{475}$$

   b. 24 × 11 = __11__ twenty-fours

   11 twenty-fours

24	24	24	...	24

   10 twenty-fours   1 twenty four

   Think: __10__ twenty fours + __1__ twenty four

   $$= (\underline{10} \times 24) + (\underline{1} \times 24)$$
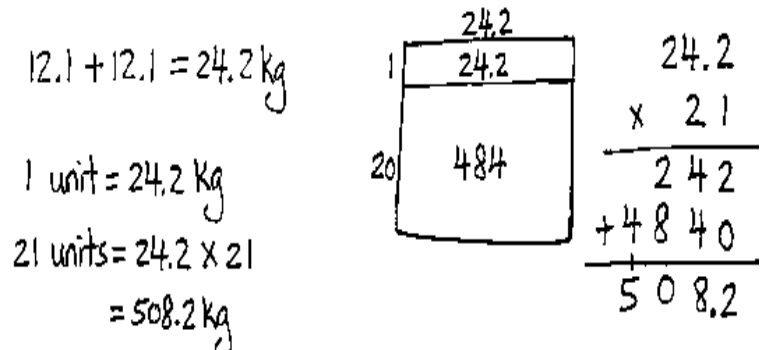 $$= \underline{240} + \underline{24} = \underline{264}$$

Lesson 5

Objective: Connect visual models and the distributive property to partial products of the standard algorithm without renaming.

1. Draw an area model and then solve using the standard algorithm. Use arrows to match the partial products from the area model to the partial products of the algorithm.

a. 34×21

$$
\begin{array}{r}
34 \\
\times\ 21 \\
\hline
34 \\
+\ 680 \\
\hline
714
\end{array}
$$
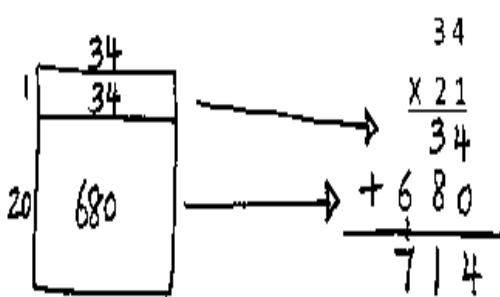
4. Farmer Brown feeds 12.1 kg of alfalfa to each of his 2 horses daily. How many kilograms of alfalfa will all his horses have eaten after 21 days? Draw an area model to solve.

$12.1 + 12.1 = 24.2$ kg

1 unit = 24.2 kg

21 units = 24.2×21

$= 508.2$ kg

$$
\begin{array}{r}
24.2 \\
\times\ 21 \\
\hline
242 \\
+\ 4840 \\
\hline
508.2
\end{array}
$$

Lesson 6

Objective: Connect area diagrams and the distributive property to partial products of the standard algorithm without renaming.

1. Draw an area model, and then solve using the standard algorithm. Use arrows to match the partial products from your area model to the partial products in the algorithm.

a. 48×35

$$
\begin{array}{r}
48 \\
\times\ 35 \\
\hline
240 \\
+\ 1440 \\
\hline
1680
\end{array}
$$
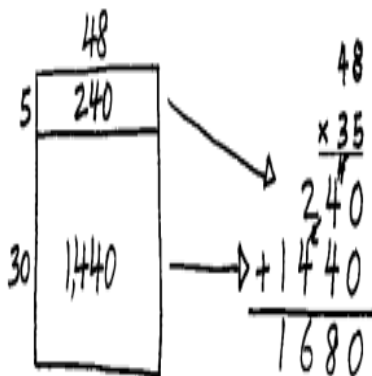
4. General admission to The American Museum of Natural History is $19.

a. If a group of 125 students visits the museum, how much will the group's tickets cost?

1 unit = $19

125 units = $125 \times 19 = \$2,375$

$$
\begin{array}{r}
125 \\
\times\ 19 \\
\hline
1125 \\
+\ 1250 \\
\hline
2375
\end{array}
$$

The group's tickets will cost $2,375.

b. If the group also purchases IMAX movie tickets for an additional $4 per student, what is the new total cost of all the tickets? Write an expression that shows how you calculated the new price.

$(19+4) \times 125$

$= 23 \times 125$

$= 2,875$

$$
\begin{array}{r}
125 \\
\times\ 23 \\
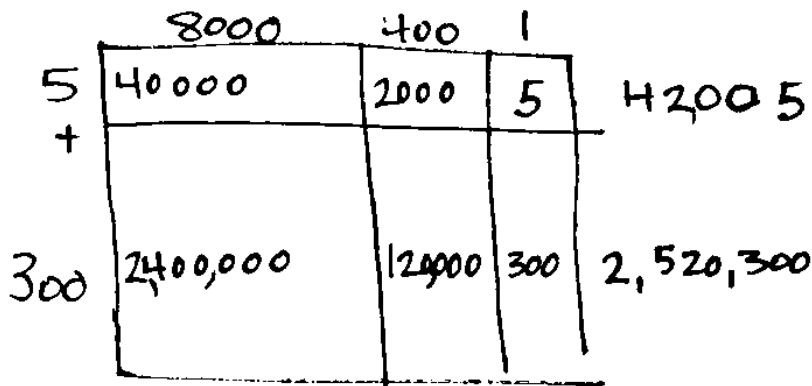\hline
375 \\
+\ 2500 \\
\hline
2,875
\end{array}
$$

The new total cost of all the tickets will be $2,875.

Lesson 7

Objective: Connect area diagrams and the distributive property to partial products of the standard algorithm with renaming.

2. Solve by drawing the area model and using the standard algorithm.

a. 8401 × 305

$$8000 \quad 400 \quad 1$$

	8000	400	1
5	40000	2000	5
300	2,400,000	120,000	300

42005

2,520,300

```
  8 4 0 1
X   3 0 5
  4 2 0 0 5
2 5 2 0 3 0 0
2,5 6 2,3 0 5
```

Lesson 8

Objective: Fluently multiply multi-digit whole numbers using the standard algorithm and using estimation to check for reasonableness of the product.

1. Estimate the product first. Solve by using the standard algorithm. Use your estimate to check the reasonableness of the product.

a. 213 × 328

≈ 200 × 300
= 60,000

```
    2 1 3
  X 3 2 8
  1 7 0 4
  4 2 6 0
+ 6 3 9 0 0
  6 9,8 6 4
```

a. 662 × 372

≈ 700 × 400
= 280,000

```
    6 6 2
  X 3 7 2
  1 3 2 4
  4 6 3 4 0
+ 1 9 8 6 0 0
  2 4 6,2 6 4
```

c. 739 × 442

≈ 700 × 400
= 280,000

```
    7 3 9
  x 4 4 2
  1 4 7 8
  2 9 5 6 0
+ 2 9 5 6 0 0
  3 2 6,6 3 8
```

2. Each container holds 1 L 275 mL of water. How much water is in 609 identical containers? Find the difference between your estimated product and precise product.

Estimate: 1200 ml × 600
= 720,000 ml
= 720 L

Actual: 1275 ml × 609
= 776,475 ml
= 776 L 475 ml

```
  776 L 475 ml
-  720 L
   56 L 475 ml
```

My actual product was 56 L 475 ml larger than the estimated product.

Lesson 9

Objective: Fluently multiply multi-digit whole numbers using the standard algorithm to solve multi-step word problems.

2. Gemma and Leah are both jewelry makers. Gemma made 106 beaded necklaces. Leah made 39 more necklaces than Gemma.

   a. Each necklace they make has exactly 104 beads on it. How many beads did both girls use altogether while making their necklaces?

   Gemma's necklaces [106] 39 x 104 ⎫
   Leah's necklaces [   ]   x 104 ⎬ ? beads

   ```
   106      145        11,024
   x 104    x 104    + 15,080
   ----     ----       ------
    424      580       26,104
   +10600   14500
   ------   ------
   11024    15080
   ```

   The girls used 26,104 beads altogether.

   b. At a recent craft fair, Gemma sold each of her necklaces for $14. Leah sold each of her necklaces for 10 dollars more. Who made more money at the craft fair? How much more?

   Leah made $1,996 more.

   ```
   106      145       2 13 17 10
   x 14     x 24       3 4 8 0
   ----     ----      - 1484
    424      580      -------
   +1060    2900       $1996
   ----     ----
   1484     3480
   ```

Lesson 10

Objective: Multiply decimal fractions with tenths by multi-digit whole numbers using place value understanding to record partial products.

1. Estimate the product. Solve using an area model and the standard algorithm. Remember to express your products in standard form.

   22 x 2.4≈ _20_ x _2_ = _40_

   ```
           20  +  4 tenths
       2 |  40  |  8  |  48 tenths
      +  |      |     |
      20 | 400  | 80  | 480 tenths
   ```

   ```
   2 4 (tenths)
   × 2 2
   -----
     48
   + 480
   -----
   52 8 (tenths) = 52.8
   ```

1. Estimate, then use the standard algorithm to solve. Express your products in standard form.

   3.2 x 47 ≈ _3_ x _50_ = _150_   3.2 x 94 ≈ _3_ x _90_ = _270_

   ```
   3 2 (tenths)              3 2 (tenths)

   × 4 7                     × 9 4
   -----                     -----
    22 4                      128
   +128 0                    +288 0
   ------                    ------
   150 4 (tenths) = 150.4    300 8 tenths = 300.8
   ```

Lesson 11

Objective: Multiply decimal fractions by multi-digit whole numbers through conversion to a whole number problem and reasoning about the placement of the decimal.

1. Estimate the product. Solve using the standard algorithm. Use the thought bubbles to show your thinking. (Draw an area model on a separate sheet if it helps you.)

1.38 x 32 ≈ __1__ × _30_ = _30_   3.55 x 89 ≈ __4__ × _90_ = _360_

Think: 138
(1.38 × 100)
01.38

```
  × 32
  .2 7 6
+ 4 1 4 0
─────────
  4 4 1 6  →  44.16
```

355
3.55

```
   × 89
   3 1 9 5
+ 2 8 4 0 0
───────────
  3 1 5 9 5  →  315.95
```

3. Use the whole number product and place value reasoning to place the decimal point in the second product. Explain how you know.

   a. If 98 × 768 = 75,264   then   98 × 7.68 = __752.64__

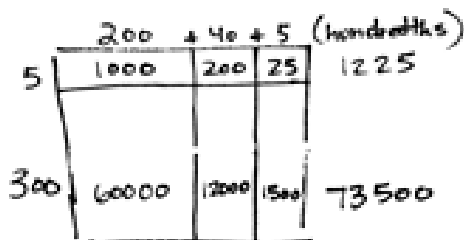   7.68 would be like 768 (hundredths) so just divide by 100.

Lesson 12

Objective: Reason about the product of a whole number and a decimal with hundredths using place value understanding and estimation.

1. Estimate, and then solve using the standard algorithm. You may draw an area model if it helps you.

2.45 x 305 ≈ __3__ × _300_ = _900_

```
  2.45
× 3 0 5
───────
  1 2 2 5
7 3 5 0 0
─────────
7 4 7.2 5
```

	200	40	5 (hundredths)	
5	1000	200	25	1225
300	60000	12000	1500	73500

2. Estimate, and then solve using the standard algorithm. You may draw an area model if it helps you.

a. 1.23 × 12 ≈ 1 × 12 = 12

```
  1 2 3
×   1 2
───────
  2 4 6
1 2 3 0
───────
1 4 7 6       14.76
```

c. 0.23 × 14 ≈ 20 tenths
                = 2

Lesson 13

Objective: Use whole number multiplication to express equivalent measurements.

4. Convert. Use your Reference Sheet to remind you of the conversion factors. Show your work.

a. 27 ft = __324__ in

$$\begin{array}{r} 27 \\ \times\ 12 \\ \hline 54 \\ +\ 270 \\ \hline 32\ 4 \end{array}$$

d. 7 kg = __7000__ g

7 × 1000

g. 3 km 85 m = __3,085__ m

3000 + 85

6. Ben helps his dad make chicken soup. Their recipe makes 15 cups of soup. If they each eat 2 cups and freeze the rest, will the leftovers fit in a 64-ounce container?

15c − 4c = 9c left   9 × 8oz = 72 oz

No, the leftovers won't fit.

Lesson 14

Objective: Use decimal multiplication to express equivalent measurements.

1. Convert. Use your reference sheet to help you remember the conversion factors.

b. __22__ fl. oz. = 2.75 c

$$\begin{array}{r} 2.75 \\ \times\ \ 8 \\ \hline 22.00 \end{array}$$

e. 3.25 gal. = __13__ qt.

$$\begin{array}{r} 3.25 \\ \times\ \ 4 \\ \hline 13.00 \end{array}$$

h. 7.9 m = __790__ cm

3. Emma can't believe how huge the Statue of Liberty is. She finds more information about Lady Liberty. Help Emma fill in the rest of the chart and then answer the questions.

The Statue of Liberty's	CUSTOMARY UNITS		METRIC UNITS	
	Feet	Inches	Meters	Centimeters
nose	48 + 6 4 ft 6 in	54 in	1.37 m	137 cm
index finger	8 ft ×12	96 in	2.44 m	244 cm
head	17 ft 3 in	207 in	5.26 m	526 cm
eye	2 ft 6 in	30 in	0.76 m	76 cm

a. Emma is 52 inches tall. Which of Lady Liberty's body parts above is the closest to Emma's height? What is the difference between these two measurements in inches?

The nose is the closest. It is 2 inches longer.

Lesson 15

Objective: Solve two-step word problems involving measurement and multi-digit multiplication.

3. Josie is 1.4 meters tall. Her sister is 54 cm shorter.
   a. Find her sister's height in meters.

$$1.4\,m = 1\overset{3}{4}\overset{10}{0}\,cm$$
$$\quad\quad -\ 54\,cm$$
$$\quad\quad\overline{\quad 86\,cm}$$

86 cm = 0.86 m

Josie's sister is 0.86m tall.

   b. How tall are Josie and her sister combined, in meters?

$$1.40$$
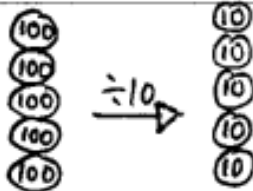$$+\ 0.86$$
$$\overline{2.26}$$

The sisters are 2.26m tall altogether.

Lesson 16

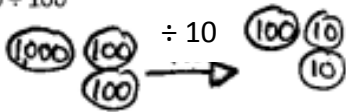Objective: Use *divide by 10* patterns for multi-digit whole number division.

1. Divide. Draw number disks to show your thinking for (a) and (c). You may draw disks on your white board to solve the others if necessary.

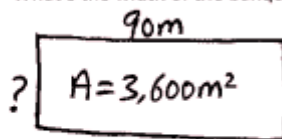| a. 500 ÷ 10	b. 360 ÷ 10
= 50	$=36 \div 1$ $=36$
c. 12,000 ÷ 100	d. 450,000 ÷ 100
= 120	$=4{,}500 \div 1$ $=4{,}500$

3. The floor of a rectangular banquet hall has an area of 3600 m². The length is 90 m.
   a. What's the width of the banquet hall?

90m

? A=3,600m²

$$3{,}600 \div 90$$
$$=3{,}600 \div 10 \div 9$$
$$=360 \div 9$$
$$=40m$$

The width of the banquet hall was 40m.

Lesson 17

Objective: Use basic facts to estimate quotients with two-digit divisors.

1. Estimate the quotient for the following problems. Round the divisor first.

a. 609 ÷ 21	b. 913 ÷ 29	c. 826 ÷ 37
= 600 ÷ 20	= 900 ÷ 30	≈ 800 ÷ 40
= 30	= 30	= 20

2. A video game store has a budget of $825 and would like to purchase new video games. If each video game costs $41, estimate the total number of video games the store can purchase with their budget. Explain your thinking.

I estimated $825 divided by $41 to be $800 ÷ 40, and got 20. This means that the store can purchase a total of 20 video games with their budget.

Lesson 18

Objective: Use basic facts to estimate quotients with two-digit divisors.

1. Estimate the quotient for the following problems. The first one is done for you.

a. 5,738 ÷ 21	b. 2,659 ÷ 28	c. 9,155 ÷ 34
= 6,000 ÷ 20	= 3,000 ÷ 30	≈ 9,000 ÷ 30
= 300	= 100	= 300

3. Janice bought 28 apps for her phone that, altogether used 1348 MB of space.
   a. If each app used the same amount of space, about how many MB of memory did each app use? Show how you estimated.

$$1,348 \div 28$$
$$\approx 1,200 \div 30$$
$$= 40$$

Each app used about 40 MB of memory.

Lesson 19

Objective: Divide two- and three-digit dividends by multiples of 10 with single-digit quotients and make connections to a written method.

1. Divide, then check. The first one is done for you.

   a. $41 \div 30$ Check:

$$\begin{array}{r} 1 \quad \text{R } 11 \\ 3 \; 0 \, \overline{)\; 4 \quad 1\;} \\ 3 \quad 0 \\ \hline 1 \quad 1 \end{array}$$

   $30 \times 1 = 30$

   $30 + 11 = 41$

3. A number divided by 80 has a quotient of 7 with 4 as a remainder. Find the number.

$$80 \overline{)\; ?\;}^{\;7 \; R4} \quad \longrightarrow \quad \begin{array}{l} 80 \times 7 = 560 \\ 560 + 4 = 564 \end{array}$$

The number was 564.

Lesson 20

Objective: Divide two- and three-digit dividends by two-digit divisors with single-digit quotients and make connections to a written method.

1. Divide, then check with multiplication. The first one is done for you.

   a. $65 \div 17$ d. $84 \div 32$

$$\begin{array}{r} 3 \quad \text{R } 14 \\ 1 \; 7 \, \overline{)\; 6 \quad 5\;} \\ - \; 5 \quad 1 \\ \hline 1 \quad 4 \end{array}$$

   Check:
   $17 \times 3 = 51$
   $51 + 14 = 65$

$$\begin{array}{r} 2 \quad R20 \\ 32 \overline{)\; 84\;} \\ -64 \\ \hline 20 \end{array}$$

   $32 \times 2 = 64$
   $64 + 20 = 84$

5. Mrs. Silverstein sold 91 cupcakes at a food fair. The cupcakes were sold in boxes of "a baker's dozen," which is 13. She sold all the cupcakes at $15 per box. How much money did she receive?

$$\begin{array}{r} 7 \\ 13 \overline{)\; 91\;} \\ -91 \\ \hline 0 \end{array}$$

   1 unit = $15
   7 units = $15 × 7 = $105

She received $105.

Lesson 21

Objective: Divide two- and three-digit dividends by two-digit divisors with single-digit quotients and make connections to a written method.

1. Divide, then check using multiplication. The first one is done for you.

   a. 258 ÷ 47

   $$\begin{array}{r} 5 \quad \text{R } 23 \\ 4\ 7\overline{\smash)2\ \ 5\ \ 8} \\ -\ 2\ \ 3\ \ 5 \\ \hline 2\ \ 3 \end{array}$$

   Check:

   47 × 5 = 235

   235 + 23 = 258

3. Assume that Mrs. Giang's car travels 14 miles on each gallon of gas. If she travels to visit her niece who lives 133 miles away, how many gallons of gas will Mrs. Giang need to make the round trip?

   133 + 133 = 266 miles

   266 ÷ 14 = 19 gallons

   Mrs. Giang needs 19 gallons of gas to make the round trip.

   $$\begin{array}{r} 19 \\ 14\overline{\smash)266} \\ -14 \\ \hline 126 \\ -126 \\ \hline 0 \end{array}$$

Lesson 22

Objective: Divide three- and four-digit dividends by two-digit divisors resulting in two- and three-digit quotients, reasoning about the decomposition of successive remainders in each place value.

2. Halle solved 664 ÷ 48 below, and got a quotient of 13 remainder 40. How could she use her work below to solve 659 ÷ 48 without redoing the work? Explain your thinking.

   $$\begin{array}{r} 1\quad 3 \\ 4\ 8\overline{\smash)6\ \ 6\ \ 4} \\ -\ 4\ 8 \\ \hline 1\ 8\ \ 4 \\ -\ 1\ 4\ \ 4 \\ \hline 4\ \ 0 \end{array}$$

   $$\begin{array}{r} 13 \\ 48\overline{\smash)659} \\ -48 \\ \hline 179 \\ -144 \\ \hline 35 \end{array}$$

   Since the whole of 659 is 5 less than the original whole of 664. It means that instead of a remainder of 40, it should be 35. The quotient of 659 divided by 48 is 13 with a remainder of 35.

Lesson 23

Objective: Divide three- and four-digit dividends by two-digit divisors resulting in two- and three-digit quotients, reasoning about the decomposition of successive remainders in each place value.
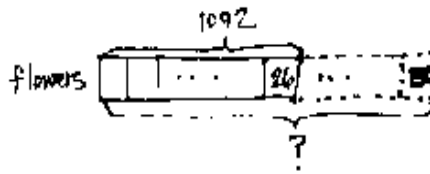
1. Divide, then check using multiplication.

a. 4,859 ÷ 23

3. 1,092 flowers are arranged into 26 vases, with the same number of flowers in each vase. How many flowers would be needed to fill 130 such vases?

5,460 flowers would be needed to fill 130 vases.

Lesson 24

Objective: Divide decimal dividends by multiples of 10, reasoning about the placement of the decimal point and making connections to a written method.

1. Divide. Show the division in the right hand column in two steps. The first two have been done for you.

a. $1.2 \div 6 = 0.2$

b. $1.2 \div 60 = (1.2 \div 6) \div 10 = 0.2 \div 10 = 0.02$

c. $2.4 \div 4 = \underline{0.6}$

$2.4 \div 40 = (2.4 \div 4) \div 10 = 0.6 \div 10 = 0.06$

2. Use place value reasoning and the first quotient to compute the second quotient. Explain your thought process.

a. $46.5 \div 5 = 9.3$

$46.5 \div 50 = \underline{0.93}$

÷50 is the same as ÷5 then ÷10. So if you divide the first answer by 10 you get the second one.

Lesson 25

Objective: Use basic facts to approximate decimal quotients with two-digit divisors, reasoning about the placement of the decimal point.

2. Estimate the quotient in (a). Use your estimated quotient to estimate (b) and (c).

a. $7.16 \div 36 \approx$ $8 \div 40 = (8 \div 4) \div 10 = 2 \div 10 = 0.2$

b. $716 \div 36 \approx$ $800 \div 40 = 20$

c. $71.6 \div 36 \approx$ $80 \div 40 = 2$

3. Edward bikes the same route to and from school each day. After 28 school days, he bikes a total distance of 389.2 miles.

a. Estimate how many miles he bikes in one day.

$390 \div 30 = (390 \div 10) \div 3 = 39 \div 3 = 13$

Edward bikes about 13 miles a day

b. If Edward continues his routine of biking to school, about how days altogether will it take him to reach a total distance of 500 miles?

$500 \div 13$

$\approx 450 \div 15 = 30$

$\approx 480 \div 12 = 40$

It will take about 40 days to reach 500 miles

Lesson 26

Objective: Divide decimal dividends by two-digit divisors, estimating quotients, reasoning about the placement of the decimal point, and making connections to a written method.

1. 156 ÷ 24 and 102 ÷ 15 both have a quotient of 6 and a remainder of 12. a. Are the division expressions equivalent to each other? Use your knowledge of decimal division to justify your answer.

$$24\overline{)156.0}$$ with 6.5; -144; 12.0; -12.0

$$15\overline{)102.0}$$ with 6.8; 90; 12.0; -12.0

No, they are not equal

$6.5 \neq 6.8$

b. Construct your own division problem with a two-digit divisor that has a quotient of 6 and a remainder of 12 but is not equivalent to the problems in 1(a).

$114 \div 17$

$17 \times 6 = 60 + 42 = 102$
$+ 12$
114

3. The weight of 72 identical marbles is 183.6 grams. What is the weight of each marble? Explain how you know the decimal point of your quotient is placed reasonably.

Each marble weighs 2.55 grams. This makes sense because $183.6 \div 72$ is about $180 \div 60$ which is 3.

$$72\overline{)183.60}$$ with 2.55; -144; 396; -360; 360; -360; 0

Lesson 27

Objective: Divide decimal dividends by two-digit divisors, estimating quotients, reasoning about the placement of the decimal point, and making connections to a written method.   1. Divide. Check your work with multiplication.

$5.6 \div 16 =$

$$16\overline{)5.60} \quad 0.35$$

$$\begin{array}{r} 0.35 \\ 16\overline{)5.60} \\ -48 \\ \hline 80 \\ 80 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 0.35 \\ \times\ 16 \\ \hline 210 \\ +350 \\ \hline 5.60 \end{array}$$

$36 \div 24 =$

$$\begin{array}{r} 1.5 \\ 24\overline{)36.0} \\ -24 \\ \hline 120 \\ -120 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 1.5 \\ \times 24 \\ \hline 60 \\ 3.00 \\ \hline 36.0 \end{array}$$

4. A soccer coach spent $162 dollars on 24 pairs of socks for his players. How much did five pairs of socks cost?

$$\begin{array}{r} 6.75 \\ 24\overline{)162.00} \\ -144 \\ \hline 180 \\ -168 \\ \hline 120 \\ -120 \\ \hline 0 \end{array}$$
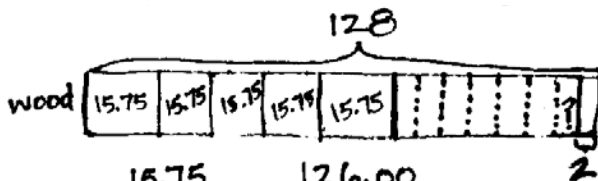
$$\begin{array}{r} 6.75 \\ \times\ 5 \\ \hline 33.75 \end{array}$$

Five pairs of socks
cost $33.75

Lesson 28

Objective: Solve division word problems involving multi-digit division with group size unknown and the number of groups unknown.

3. Jim Nasium is building a tree house for his two daughters. He cuts 12 pieces of wood from a board that is 128 inches long. He cuts 5 pieces that measure 15.75 inches each, and 7 pieces evenly cut from what is left. Jim calculates that due to the width of his cutting blade, he will lose a total of 2 inches of wood after making all of the cuts. What is the length of each of the seven pieces?

$$\begin{array}{r} 15.75 \\ \times\ 5 \\ \hline 78.75 \end{array}$$

$$\begin{array}{r} 126.00 \\ -\ 78.75 \\ \hline 47.25 \end{array}$$

$$\begin{array}{r} 6.75 \\ 7\overline{)47.25} \\ -42 \\ \hline 52 \\ -49 \\ \hline 35 \end{array}$$

$78.75 + 2 + 7\text{units} = 128$

$7\text{units} = 47.25$

$1\text{unit} = 6.75$

Each of the 7 pieces
is 6.75 inches long.

Lesson 29

Objective: Solve division word problems involving multi-digit division with group size unknown and the number of groups unknown.

1. Lamar has 1,354.5 kilograms of potatoes to deliver equally to 18 stores. 12 of the stores are in the Bronx. How many kilograms of potatoes will be delivered to stores in the Bronx?
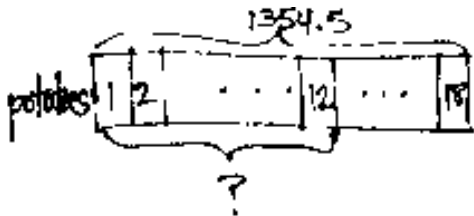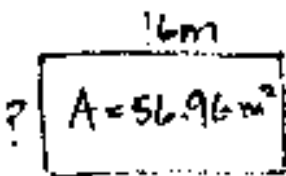
$$18\sqrt{1354.5}$$

15 units = 1354.5

1 unit = 75.25

12 units =

$$
\begin{array}{r}
75.25 \\
18\overline{\smash{)}1354.50} \\
\underline{126} \\
94 \\
\underline{-90} \\
45 \\
\underline{-36} \\
90 \\
\underline{-90} \\
0
\end{array}
$$

$$
\begin{array}{r}
75.25 \\
\times \quad 12 \\
\hline
15050 \\
+75250 \\
\hline
903.00
\end{array}
$$

903 pounds of potatoes will be delivered to the Bronx.

3. The area of a rectangle is 56.96 m$_2$. If the length is 16 m, what is its perimeter?

16m

? A = 56.96 m²

P = ?

P = (3.56 × 2) + (16 × 2)

‣ 7.12   † 32

= 39.12

$$
\begin{array}{r}
3.56 \\
16\overline{\smash{)}56.96} \\
\underline{-48} \\
89 \\
\underline{-80} \\
96 \\
\underline{-96} \\
0
\end{array}
$$

The perimeter of the rectangle is 39.12 m.