

Multiplication

Unit 3 Overview: 7 lessons

Students multiply multiples of 10, 100 and 1,000 with a basic fact and the zeros of both factors (80×900 is 72 thousands) and write powers of ten with exponents. They round each factor to its greatest place to estimate a product and decide whether an answer is reasonable. Then they multiply 2-, 3- and 4-digit numbers by a 2-digit number with area models and partial products, move to the standard algorithm, go on to 4-digit times 2-digit and 3-digit times 3-digit with zeros in a factor, and solve stories of one and more steps. Ask “what is each part worth?” every day: each row of the standard algorithm is a row of the area model.

THE UNIT, DAY BY DAY

Day 1	Pre-Check	What students already know, before the first lesson.
Day 2	3.1 Multiply by multiples of 10, 100 and 1,000	I can multiply by multiples and powers of ten.
Day 3	3.2 Estimate products	I can estimate a product to check an answer.
Day 4	3.3 2-digit times 2-digit	I can multiply two 2-digit numbers with partial products.
Day 5	3.4 3- and 4-digit times 2-digit	I can multiply by a 2-digit number with partial products.
Day 6	3.5 The standard algorithm	I can multiply with the standard algorithm.
Day 7	3.6 Larger factors and zeros	I can multiply larger numbers.
Day 8	3.7 Multiplication stories	I can solve multiplication stories with one or two steps.
Day 9	Unit Review	The review, to go over together.
Day 10	Unit Test	Form A; Form B (other numbers) is for a retest.

GET READY FOR THE UNIT

- Grid paper (1 centimeter) for area models and for lining up columns
- A place value chart to hundred thousands for each student
- Whiteboards and dry erase markers, and colored pencils
- Multiplication charts for students who need the facts at hand
- Chart paper for anchor charts: powers of ten, area models, partial products, the standard algorithm

HOW EACH LESSON GOES

- 1. Warm up** (5 min)
 - 2. Teach** (10 min)
 - 3. Try it together** (10 min)
 - 4. Practice** (15 min)
 - 5. Exit ticket** (5 min): a quick check on the lesson.
- Each lesson page ends with the Animal Math sheets, makers, tools and quizzes for it. “Sheet 3” is the third worksheet of a pack; a color pack prints each sheet again in black and white.

CHECKING AS YOU GO

PRINTABLE	Pre-Check: Day 1, with a key	EXIT TICKET	Exit Tickets: one a lesson, two to a page
PRINTABLE	Unit Review: the day before the test	PRINTABLE	Unit Test: Forms A and B, with keys

Multiplication

Lesson 3.1: Multiply by multiples of 10, 100 and 1,000

GOAL Students multiply multiples of 10, 100 and 1,000 with a basic fact and the zeros of both factors (80×900 is 8×9 with three zeros: 72,000), and write powers of ten with exponents: 10^3 is $10 \times 10 \times 10$, or 1,000.

About 45 minutes

I can multiply by multiples and powers of ten.

THE LESSON

- 1 Warm up** (5 min) Quick facts: 8×9 , 6×6 and 7×7 . Then 93×10 , 93×100 and $93 \times 1,000$: what happens to the digits?
- 2 Teach** (10 min) Write 80×900 . Think $8 \times 9 = 72$, then write the zeros of both factors, one and two: 72,000 (8 tens times 9 hundreds is 72 thousands). Then $50 \times 2,000$: the fact $5 \times 2 = 10$ has a zero of its own, so 100,000 has five zeros. Last, $10 \times 10 \times 10 = 1,000$ is written 10^3 and read "10 to the 3rd power": the exponent counts the 10s. So 93×10^3 is 93,000.
Say: "I multiply the facts, then write the zeros of both factors. The exponent tells me how many 10s, so how many zeros."
- 3 Try it together** (10 min) Pairs write a fact (6×9 , 7×7 or 8×8) with tens, hundreds and thousands (60×90 , 600×90 , $60 \times 9,000$) and read each product in units. Then they solve $30 \times \square = 21,000$ and $2,000 \times \square = 160,000$, and write 45×10^3 as a number.
- 4 Practice** (15 min) Students do sheet 1 of Multiplying and Dividing by Powers of Ten, then a fact drill sheet of products like 80×900 (the maker below). Early finishers try sheet 4 of the powers pack, with decimals. For a step back, sheets 2-3 of Multiplying and Dividing by 10, 100 and 1,000 keep one factor to one digit.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 3.1** and circle a face beside the "I can" line. On question 1, look for 24,000, 150,000 and 40,000; 4,000 for 50×800 means the zero of $5 \times 8 = 40$ was lost. On question 2, look for 4,800 and 3; 960 means 10^2 was taken as 20.

Ready for more? Solve $70 \times \square = 490,000$ and $400 \times \square = 320,000$, then write one like them.

GET READY

- A place value chart for each student
- Multiplication charts
- Whiteboards and markers

WORDS TO USE

exponent: the small raised number: how many 10s are multiplied

power of ten: 10, 100, 1,000 and so on

multiple of 100: whole hundreds, like 900

ASK

- How many zeros do both factors have?
- Which fact helps with $60 \times 9,000$?
- What does the exponent tell you?

WATCH FOR

Writes 10,000 for $50 \times 2,000$. The fact $5 \times 2 = 10$ has a zero of its own: count it too.

Writes 20 for 10^2 . The exponent counts the 10s: 10×10 is 100.

Writes 7,200 for 80×900 . Count the zeros of both factors: one and two make three.

Need help? Write 80 as 8×10 and 900 as $9 \times 10 \times 10$, then multiply the facts and the 10s.

ON ANIMAL MATH

PRINTABLE

Multiplying and Dividing by Powers of Ten: sheet 1; sheet 4 for early finishers

PRINTABLE

Multiplying and Dividing by 10, 100 and 1,000: sheets 2-3 (4th grade), a step back

MAKER

Multiplication Fact Drills: Times Tables: Both Numbers Multiples of 10

TOOL

Multiplication Chart

QUIZ

Multi-Digit Multiplication Quiz: the Times 10, 100 and 1,000 level

EXIT TICKET

5th Grade Multiplying Whole Numbers Exit Tickets: Exit Ticket 3.1

Multiplication

Lesson 3.2: Estimate products

GOAL Students round each factor to its greatest place, multiply the rounded numbers to estimate a product, and use the estimate to decide whether an answer is reasonable: an answer far too big or too small means a place slipped, often a lost 0 in the second row.

About 45 minutes

I can estimate a product to check an answer.

THE LESSON

- 1 Warm up** (5 min) Round each number to its greatest place: 62, 285, 7,815 and 3,409.
- 2 Teach** (10 min) Estimate 632×28 : round to $600 \times 30 = 18,000$. Is $632 \times 28 = 17,696$ reasonable? Yes, it is close to 18,000. Is $892 \times 87 = 13,380$ reasonable? Round: $900 \times 90 = 81,000$. 13,380 is far too small, so no: the second row was added as 7,136, without its 0. With the 0, $6,244 + 71,360 = 77,604$, close to the estimate.
Say: "I round each factor to its greatest place and multiply. If the answer is far from my estimate, I check my work."
- 3 Try it together** (10 min) Show answer cards; pairs estimate on whiteboards and hold up yes or no: $291 \times 33 = 9,603$, $812 \times 36 = 7,308$ and $2,135 \times 82 = 175,070$. Fix the wrong one together (812×36 is about $800 \times 40 = 32,000$; it is 29,232).
- 4 Practice** (15 min) Students round, estimate, then multiply in problems 1 and 2 on sheet 5 of Multiplying by 2-Digit Numbers, then decide whether each answer is reasonable in problems 1 to 3 on sheet 5 of Multi-Digit Multiplication.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 3.2** and circle a face beside the "I can" line. On question 1, look for $500 \times 40 = 20,000$ and No: 4,212 is the product with the second row's 0 left out. On question 2, look for $3,000 \times 40 = 120,000$; 12,000 means a zero was lost, and 2,900 means 2,906 was rounded to the wrong place.

Need help? Write the rounded factors as a fact and zeros (900×90 is 9×9 and three zeros) before multiplying.

Ready for more? Write a wrong product that is still close to its estimate. How could you catch that mistake?

GET READY

- Answer cards with right and wrong products
- Number lines to 1,000
- Whiteboards and markers

WORDS TO USE

estimate: a close answer from rounded numbers

reasonable: close to the estimate, so it makes sense

greatest place: the place of the first digit: 892 rounds to 900

ASK

- What did you round each factor to?
- How many digits should the product have?
- How far is the answer from your estimate?

WATCH FOR

Rounds 892 down to 800. Put 892 on a number line between 800 and 900: it is closer to 900.

Calls 13,380 reasonable because the digits look right. Compare sizes: 13,380 is nowhere near 81,000.

Rounds only one factor. Round both factors to their greatest place, then multiply.

ON ANIMAL MATH

PRINTABLE

Multiplying by 2-Digit Numbers: sheet 5, problems 1 and 2

PRINTABLE

Multi-Digit Multiplication: sheet 5, problems 1 to 3

QUIZ

Multi-Digit Multiplication Quiz: the Estimate Products level

EXIT TICKET

5th Grade Multiplying Whole Numbers Exit Tickets: Exit Ticket 3.2

Multiplication

Lesson 3.3: 2-digit times 2-digit

GOAL Students multiply two 2-digit numbers with a four-part area model and with partial products in a column, and break one factor apart by place value ($74 \times 38 = 74 \times 30 + 74 \times 8$).

About 45 minutes

I can multiply two 2-digit numbers with partial products.

THE LESSON

- 1 Warm up** (5 min) Quick tens: 50×30 , 2×30 , 50×6 and 2×6 . Then add the four answers.
- 2 Teach** (10 min) Draw an area model for 52×36 : 50 and 2 across the top, 30 and 6 down the side. Fill in the four parts: 1,500, 60, 300 and 12. Add them: 1,872. Write the same four partial products in a column, each labelled (6×2 , 6×50 , 30×2 , 30×50), and add. Then break apart one factor only:
 $74 \times 38 = 74 \times 30 + 74 \times 8 = 2,220 + 592 = 2,812$.
Say: "I split the factors by place value, multiply every part by every part, then add the partial products."
- 3 Try it together** (10 min) Pairs draw the area model for 47×65 ($2,400 + 200 + 420 + 35 = 3,055$), then check it by breaking apart 65 only: $47 \times 60 + 47 \times 5 = 2,820 + 235$.
- 4 Practice** (15 min) Students fill in the area models, then write the four partial products in a column, on sheet 2 of Multi-Digit Multiplication. Early finishers make a maker sheet and solve each problem two ways.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 3.3** and circle a face beside the "I can" line. On question 1, look for 2,400, 420, 120 and 21, and 2,961; 2,421 means only tens times tens and ones times ones were found. On question 2, look for 20 and 9 (25 and 4 is right too), 1,120 and 504, and 1,624; 112 for 56×20 means the 2 tens were multiplied as ones.

Need help? Shade the four boxes in four colors and write each product inside its box before adding.

Ready for more? Find 99×99 with an area model, then a quicker way: 99×100 take away 99.

ON ANIMAL MATH

PRINTABLE

Multi-Digit Multiplication: sheet 2

MAKER

Column Multiplication: Factors: 2-Digit $\times$ 2-Digit

QUIZ

Multi-Digit Multiplication Quiz: the 2-Digit $\times$ 2-Digit level

EXIT TICKET

5th Grade Multiplying Whole Numbers Exit Tickets: Exit Ticket 3.3

GET READY

- Grid paper and colored pencils
- Rulers
- Whiteboards and markers

WORDS TO USE

area model: a rectangle with one part for each pair of places

partial product: the product of two parts, like 50×30

break apart: split a factor into tens and ones, multiply each, then add

ASK

- What are the four parts of the model?
- Which part is the biggest? Why?
- How do the rows of the column match the boxes of the model?

WATCH FOR

Finds only two parts: 50×30 and 2×6 . Point to each box of the model: every box needs a product.

Writes 150 for 50×30 . Say it in units: 5 tens times 3 tens is 15 hundreds, 1,500.

Adds the partial products out of line. Write them in a column, lined up by place value.

Multiplication

Lesson 3.4: 3- and 4-digit times 2-digit

GOAL Students multiply a 3- or 4-digit number by a 2-digit number with an area model of six or eight parts and with partial products: they add each row of the model (the top number times the tens, then times the ones), then add the two rows.

About 45 minutes

I can multiply by a 2-digit number with partial products.

THE LESSON

- 1 Warm up** (5 min) Write 653 and 2,418 in expanded form. Then 600×20 , 50×4 and $2,000 \times 5$.
- 2 Teach** (10 min) Draw an area model for 653×24 : 600, 50 and 3 across, 20 and 4 down. The row for 20 is $12,000 + 1,000 + 60 = 13,060$, which is 653×20 . The row for 4 is $2,400 + 200 + 12 = 2,612$. Add the rows: 15,672. Then $2,418 \times 35$ with the bottom factor broken apart:
 $2,418 \times 30 + 2,418 \times 5 = 72,540 + 12,090 = 84,630$.
Say: "Every part of the top number times every part of the bottom number. I add each row, then add the two rows."
- 3 Try it together** (10 min) Pairs draw the area model for 742×36 and add its rows ($22,260 + 4,452 = 26,712$). Then they break apart 42 to find $1,395 \times 42$: $55,800 + 2,790 = 58,590$.
- 4 Practice** (15 min) Students fill in the area models and add each row on sheet 1 of Multiplying by 2-Digit Numbers, then write the six and eight partial products on its sheet 2. Early finishers make a maker sheet and draw an area model for each problem.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 3.4** and circle a face beside the "I can" line. On question 1, look for the six parts, the rows 6,480 and 1,944, and 8,424; a row of 648 means 324×20 lost its 0. On question 2, look for 30 and 4, 48,810 and 6,508, and 55,318.

Need help? Write the expanded form of both factors along the sides of the model before multiplying.

Ready for more? Multiply $4,321 \times 12$ with an area model, then check it as $4,321 \times 10 + 4,321 \times 2$.

ON ANIMAL MATH

PRINTABLE

Multiplying by 2-Digit Numbers: sheets 1-2

MAKER

Column Multiplication: Factors: 3-Digit $\times$ 2-Digit or 4-Digit $\times$ 2-Digit (its key writes the two rows; students draw the area models)

QUIZ

Multi-Digit Multiplication Quiz: the 3- and 4-Digit $\times$ 2-Digit level

EXIT TICKET

5th Grade Multiplying Whole Numbers Exit Tickets: Exit Ticket 3.4

GET READY

- Grid paper and colored pencils
- A place value chart for each student
- Whiteboards and markers

WORDS TO USE

partial product: the product of two parts, like 600×20

row: the top number times one part of the bottom number

expanded form: 653 written as $600 + 50 + 3$

ASK

- How many parts does the model need? Why?
- What does each row of the model add up to?
- What is $2,000 \times 30$ in thousands?

WATCH FOR

Writes 1,200 for 600×20 . Say it in units: 6 hundreds times 2 tens is 12 thousands, 12,000.

Adds all six parts in a muddle. Add each row first; the two rows are the rows of the standard algorithm.

Splits 653 into $6 + 5 + 3$. Write each digit with its value: $600 + 50 + 3$.

Multiplication

Lesson 3.5: The standard algorithm

GOAL Students multiply 2- and 3-digit numbers by a 2-digit number with the standard algorithm: the first row is the top number times the ones, the second row the top number times the tens (it ends in 0), then they add the rows.

About 45 minutes

I can multiply with the standard algorithm.

THE LESSON

- 1 Warm up** (5 min) Find 372×40 and 372×6 with an area model, then add them.
- 2 Teach** (10 min) Now 372×46 in a column. First row: $372 \times 6 = 2,232$, regrouping 1 ten, then 4 hundreds. Cross out those small digits. Second row: write the 0, then 372×4 , so 14,880. Add: 17,112, the same as the area model. The first row is the model's row for 6 and the second its row for 40.
- 3 Say:** "The first row is times the ones. The second row is times the tens, so I write a 0 first. Then I add."
- 3 Try it together** (10 min) Solve 64×57 together on whiteboards (448 and 3,200, so 3,648). Then partners each do 529×38 and compare their second rows (15,870) before adding.
- 4 Practice** (15 min) Students multiply 3-digit numbers by 2-digit numbers on sheet 3 of Multiplying by 2-Digit Numbers, then do sheet 3 of Multi-Digit Multiplication (two 2-digit numbers) or problems 1 to 4 on its sheet 4.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 3.5** and circle a face beside the "I can" line. On question 1, look for 4,102 and 23,440, and 27,542; 6,446 means the second row lost its 0. On question 2, look for 2,720 circled; 272 is the row without its 0, and 204 is the first row.

Need help? Draw the area model beside the column and color each row of the model to match a row of the column.

Ready for more? Multiply 125×48 and 250×24 . Why are the products the same?

GET READY

- Grid paper for lining up columns
- The area model chart from lesson 3.4
- Whiteboards and markers

WORDS TO USE

standard algorithm: a short way to multiply in a column, a place at a time

second row: the top number times the tens; it ends in 0

regroup: trade 10 of a place for 1 of the next place

ASK

- What does the second row stand for?
- Why does the second row end in 0?
- What do you do with the first row's regrouped digits?

WATCH FOR

Leaves out the 0 in the second row. Say it: 372 times 4 tens is 1,488 tens, 14,880.

Uses the first row's regrouped digits again. Cross them out before starting the second row.

Adds the regrouped digit before multiplying. Multiply the digit, then add what was regrouped.

ON ANIMAL MATH

PRINTABLE

Multiplying by 2-Digit Numbers: sheet 3

PRINTABLE

Multi-Digit Multiplication: sheet 3, and sheet 4, problems 1 to 4

MAKER

Column Multiplication: Factors: 2-Digit $\times$ 2-Digit or 3-Digit $\times$ 2-Digit

QUIZ

Multi-Digit Multiplication Quiz: the 3- and 4-Digit $\times$ 2-Digit level

EXIT TICKET

5th Grade Multiplying Whole Numbers Exit Tickets: Exit Ticket 3.5

Multiplication

Lesson 3.6: Larger factors and zeros

GOAL Students multiply a 4-digit number by a 2-digit number and a 3-digit number by a 3-digit number with the standard algorithm (a third row for the hundreds, which starts with two zeros), keeping a 0 in a factor in its place.

About 45 minutes

I can multiply larger numbers.

THE LESSON

- 1 Warm up** (5 min) Estimate $8,207 \times 36$ and 604×253 by rounding each factor to its greatest place.
- 2 Teach** (10 min) Write $8,207 \times 36$. First row: $8,207 \times 6 = 49,242$; the 0 tens still get the regrouped 4. Second row: write the 0, then $8,207 \times 3$, so 246,210. Add: 295,452, near the estimate of 320,000. Then 604×253 takes three rows: $604 \times 3 = 1,812$, $604 \times 50 = 30,200$ and $604 \times 200 = 120,800$, with two zeros first. Add: 152,812.
Say: "One row for each digit of the bottom number: times the ones, times the tens with one 0, times the hundreds with two 0s. Then I add."
- 3 Try it together** (10 min) Pairs estimate, then solve $2,709 \times 64$ (10,836 and 162,540, so 173,376) and 486×327 (3,402, 9,720 and 145,800, so 158,922). Compare each answer with its estimate.
- 4 Practice** (15 min) Students do sheet 4 of Multiplying by 2-Digit Numbers (zeros in the top number, then 3 digits by 3 digits), then problems 5 to 8 on sheet 4 of Multi-Digit Multiplication (4-digit numbers).
- 5 Exit ticket** (5 min) Students do **Exit Ticket 3.6** and circle a face beside the "I can" line. On question 1, look for 2,448, 12,240 and 81,600, and 96,288; 8,160 as the third row means it got one 0, not two. On question 2, look for 123,000; 12,300 means the row lost its 0.

Need help? Write $\times 6$, $\times 30$ or $\times 200$ beside each row so the student says what the row is worth.

Ready for more? Multiply 999×999 . Then find it a quicker way: $999 \times 1,000$ take away 999.

GET READY

- Grid paper for lining up columns
- The two-row chart from lesson 3.5
- Whiteboards and markers

WORDS TO USE

third row: the top number times the hundreds; it ends in two zeros

placeholder zero: a 0 that keeps the other digits in their places

estimate: a close answer from rounded numbers

ASK

- How many rows will the product have?
- How many zeros start the third row? Why?
- Is your answer close to your estimate?

WATCH FOR

Skips the 0 in 8,207 and loses the regrouped digit. 0 times 6 is 0, but the regrouped 4 still goes in that place.

Starts the third row with one 0. It is times 2 hundreds: 604×200 , so two zeros come first.

Lines up the rows wrong. Use grid paper so each row starts in its place.

ON ANIMAL MATH

PRINTABLE

Multiplying by 2-Digit Numbers: sheet 4

PRINTABLE

Multi-Digit Multiplication: sheet 4, problems 5 to 8

MAKER

Column Multiplication: Factors: 4-Digit $\times$ 2-Digit or 3-Digit $\times$ 3-Digit

QUIZ

Multi-Digit Multiplication Quiz: the 3-Digit $\times$ 3-Digit level

EXIT TICKET

5th Grade Multiplying Whole Numbers Exit Tickets: Exit Ticket 3.6

Multiplication

Lesson 3.7: Multiplication stories

GOAL Students solve one-step and multi-step multiplication stories with multi-digit numbers: they decide what to multiply, write an equation with a letter for the unknown, estimate to check, and answer with the unit.

About 45 minutes

I can solve multiplication stories with one or two steps.

THE LESSON

- 1 Warm up** (5 min) A crate holds 36 melons. How many melons are in 17 crates? Students write $17 \times 36 = m$ and solve.
- 2 Teach** (10 min) Read: A stadium has 38 rows of 125 seats. How many seats? Equal groups: $s = 38 \times 125$, so 4,750 seats (estimate $40 \times 100 = 4,000$). Then: A printer prints 135 pages a minute. How many pages in 3 hours? Step 1: $3 \times 60 = 180$ minutes. Step 2: $p = 180 \times 135$, so 24,300 pages.
Say: "What is being multiplied? I write an equation with a letter, estimate, solve, then answer with the unit."
- 3 Try it together** (10 min) Pairs solve one story of each kind with an equation: 47 boxes of 36 pencils (1,692 pencils), and a gym with 24 rows of 36 lockers where 145 are in use ($864 - 145 = 719$ lockers free).
- 4 Practice** (15 min) Students solve the stories in problems 3 to 6 on sheet 5 of Multiplying by 2-Digit Numbers, then problems 4 to 7 on sheet 5 of Multi-Digit Multiplication. For a step back, sheet 2 of Multi-Step Word Problems has two-step stories with strip diagrams and smaller numbers.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 3.7** and circle a face beside the "I can" line. On question 1, look for $168 \times 24 = 4,032$ nails; 192 means the numbers were added. On question 2, look for $26 \times 48 = 1,248$, then $1,248 - 975 = 273$ pens; 1,248 means the second step was left out.

Need help? Draw a quick bar for each step and write the story's numbers on it before choosing the operation.

Ready for more? Write a two-step story whose first step is 32×45 , and trade with a partner.

ON ANIMAL MATH

PRINTABLE

Multiplying by 2-Digit Numbers: sheet 5, problems 3 to 6

PRINTABLE

Multi-Digit Multiplication: sheet 5, problems 4 to 7

PRINTABLE

Multi-Step Word Problems: sheet 2, a step back

QUIZ

Word Problems Quiz: the Multi-Step, Larger Numbers level

EXIT TICKET

5th Grade Multiplying Whole Numbers Exit Tickets: Exit Ticket 3.7

GET READY

- Story cards
- Grid paper for the multiplying
- Whiteboards and markers

WORDS TO USE

equation: a number sentence with an equal sign

letter: stands for the number we do not know yet

step: one part of the work; the answer to one step is used in the next

ASK

- What does your letter stand for?
- Is there a hidden step, like hours to minutes?
- Does your answer match your estimate?

WATCH FOR

Adds when the story has equal groups. Ask: is it the same number again and again? Then multiply.

Stops after the first step. Read the question again: what does it ask for?

Leaves off the unit. Read the question again: how many what?