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INTRODUCTION

Basic multiplication and division facts are considered foundational for further advancement in mathematics. They form the basis for learning multi-digit multiplication and division, area, fractions, percentages, volume, ratios, and decimals. Thus, it is essential that students develop fluency with basic multiplication facts (0 x 0 – 9 x 9) and related division facts.

Research suggests that in order for students to develop mastery of basic facts three phases of learning are necessary. Phase one involves concept learning. During this phase students develop an understanding of the meanings of multiplication and division. Students at this stage often use modeling and/or counting to find an answer as they focus on actions that relate to multiplication and division such as ‘groups of’, ‘equal groups’ etc. For example, to solve 6 x 4 a student may draw an array with 6 rows of 4 dots and count by ones or skip count to find the total number of dots.

The second crucial, but often neglected, phase involves students learning the basic facts in clusters based on thinking and reasoning strategies. For example, doubling is one of the multiplication clusters. Within that cluster are the twos facts (double), the fours facts (double, double), and the eights facts (double, double, double). During this stage it is important that strategies are introduced sequentially as the thinking required to learn one set of facts is a prerequisite for the next set of facts in the cluster. Regular opportunities for students to practice and discuss thinking and reasoning strategies in meaningful contexts (e.g. number talks, strategy games, word problems, etc.) is essential during this phase.

Phase three involves efficient and accurate recall of the basic facts. With repeated experiences working with numbers students will come to “just know” that 6 x 4 = 24. They become so fluent at applying the practiced strategies that they do so automatically without hesitation. Although at this stage reasoning strategies may no longer be necessary for basic fact recall, students will continue to find these strategies useful when working with larger numbers. For example, use of the double, double, double strategy for x8 facts can be extended to mentally solve more difficult problems such as 115 x 8 by thinking: “Double 115 is 230. Double 230 is 460. Double 460 is 920. So, 115 multiplied by 8 equals 920.” Similarly, the strategy of halving three times when dividing by 8 can be extended to mentally solve problems with multi-digit dividends such as 416 ÷ 8 by thinking: “Half of 416 is 208. Half of 208 is 104. Half of 104 is 52. So, 416 divided by 8 equals 52.”

The following two pages outline the thinking and reasoning strategies that are the focus of the practice activities and games in this resource.
MULTIPLICATION STRATEGIES

Cluster 1: Use Tens
x 10: Use place value.
   Example: 3 × 10 = ____  3 × (one 10) = 3 tens  3 × 10 = 30
x 5: Multiply by 10, then halve the product.
   Example: 8 × 5 = ____  8 × 10 = 80  half of 80 is 40  8 × 5 = 40

Cluster 2: Use Doubles
x 2: Double the other factor.
   Example: 6 × 2 = ____  double 6 is 12  6 × 2 = 12
x 4: Double the other factor, then double again.
   Example: 6 × 4 = ____  double 6 is 12  double 12 is 24  6 × 4 = 24
x 8: Double, double, double.
   Example: 6 × 8 = ____  double 6 is 12  double 12 is 24  double 24 is 48  6 × 8 = 48

Cluster 3: Use a Rule
x 0: Any number multiplied by 1 equals itself. (Zero Property)
x 1: Any number multiplied by 1 equals itself. (Identity Property)

Cluster 4: Build Up/Build Down
x 3: Multiply by 2, then add one more group.
   Example: 7 × 3 = ____  7 × 2 = 14  14 + 7 = 21  7 × 3 = 21
x 6: Multiply by 5, then add one more group
   Example: 9 × 6 = ____  9 × 5 = 45  45 + 9 = 54  9 × 6 = 54
x 7: Multiply by 5, then add the double
   Example: 4 × 7 = ____  4 × 5 = 20  20 + 8 = 28  4 × 7 = 28
x 9: Multiply by 10, then subtract one group
   Example: 8 × 9 = ____  8 × 10 = 80  80 − 8 = 72  8 × 9 = 72

Other Multiplication Strategies:

Use Related Facts (Commutative Property)
Example: If I know 7 × 6 = 42
   then I also know 6 × 7 = 42
DIVISION STRATEGIES

Cluster 1: Use Tens
÷ 5: If the dividend ends in zero divide by 10 and double the quotient.
Example: 40 ÷ 5 = ____  40 ÷ 10 = 4  double 4 is 8  40 ÷ 5 = 8

Cluster 2: Use Halving
÷ 2: (halve the dividend)
Example: 18 ÷ 2 = ____  half of 18 is 9  18 ÷ 2 = 9
÷ 4: (halve, halve)
Example: 32 ÷ 4 = ____  half of 32 is 16  half of 16 is 8  32 ÷ 4 = 8
÷ 8: (halve, halve, halve)
Example: 72 ÷ 8 = ____  half of 72 is 36  half of 36 is 18  half of 18 is 9  72 ÷ 8 = 9

Cluster 3: Use a Rule
÷ 1: Any number divided by 1 equals itself.  9 ÷ 1 = 9
÷ 0: Zero, divided by any number, except zero, equals 0.  0 ÷ 9 = 0

Other Division Strategies:

<table>
<thead>
<tr>
<th>Think Multiplication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: 15 ÷ 5 = ____ Think: What do I multiply 5 by to equal 15?</td>
</tr>
<tr>
<td>5 × 3 = 15</td>
</tr>
<tr>
<td>So, 15 ÷ 5 = 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Partition the Dividend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: 72 ÷ 6 = ____ Think: How can I split the dividend into parts that are easy to divide? (Distributive Property)</td>
</tr>
<tr>
<td>60 ÷ 12</td>
</tr>
<tr>
<td>72 ÷ 6 = ( 60 ÷ 6 ) + ( 12 ÷ 6 )</td>
</tr>
<tr>
<td>= 10 + 2</td>
</tr>
<tr>
<td>= 12</td>
</tr>
<tr>
<td>OR 6</td>
</tr>
<tr>
<td>10 + 2 = 12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: 45 ÷ 9 = ____ 48 ÷ 6 = ____</td>
</tr>
<tr>
<td>3 × 3</td>
</tr>
<tr>
<td>45 ÷ 3 = 15</td>
</tr>
<tr>
<td>15 ÷ 3 = 5</td>
</tr>
<tr>
<td>So, 45 ÷ 9 = 5</td>
</tr>
<tr>
<td>2 × 3</td>
</tr>
<tr>
<td>48 ÷ 2 = 24</td>
</tr>
<tr>
<td>24 ÷ 3 = 8</td>
</tr>
<tr>
<td>So, 48 ÷ 6 = 8</td>
</tr>
</tbody>
</table>
Multiply with 10

I can use place value to multiply with 10.

$3 \times 10 = __$

$3 \times 10 = 3 \times 1\text{ ten}$

$= 3 \text{ tens}$

$= 30$

$10 \times 3 = __$

$10 \times 3 = 1 \text{ ten} \times 3$

$= 3 \text{ tens}$

$= 30$

Try It:

$10 \times 4 = ___$

$10 \times 3 = ___$

$10 \times ___ = 60$

$\_ \times 10 = 50$

$\_ \times 8 = 80$

$7 \times \_ = 70$

$10 \times 10 = ___$

$9 \times 10 = ___$
Multiply with 10: Solve the following problems in your notebook.

1. Write a multiplication sentence for each expression.
   a) 7 tens            b) 10 twos            c) 8 tens

2. An array has 4 rows with 10 dots in each row. How many dots are in the array?

3. Lisa bought some stickers for one dollar and paid in dimes. How many dimes did she use? Explain.

4. Ben and Leo arrange their marbles in rows. Ben has 9 rows of 10 marbles. Leo has 10 rows of 8 marbles. Who has more marbles? How many more?

5. Write and solve a word problem with 10 as a factor.
Multiply with 10: Extend

I can use place value to multiply with 10.

12 \times 10 = ___

12 \times 10 = 12 \text{ tens}
\quad = 1 \text{ hundred } + 2 \text{ tens}
\quad = 120

10 \times 12 = ___

10 \times 12 = 12 \text{ tens}
\quad = 1 \text{ hundred } + 2 \text{ tens}
\quad = 120

Try It:

<table>
<thead>
<tr>
<th>11 \times 10 =</th>
<th>10 \times 16 =</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 \times 10 =</td>
<td>10 \times 15 =</td>
</tr>
</tbody>
</table>
Multiply with 10: Extend - Solve the following problems.

1. Write a multiplication sentence for each expression.
   a) 14 tens       b) 17 tens       c) 20 tens

2. An array has 13 rows with 10 dots in each row. How many dots are in the array?

3. Lisa bought some cherries and paid the cashier 18 dimes. How much money did Lisa give the cashier?

4. Ben and Leo arrange their baseball cards in rows. Ben has 19 rows of 10 cards. Leo has 10 rows of 18 cards. Who has more cards? How many more?

5. Write and solve a word problem with the factors 10 and 12.
Multiply with 5

I can multiply by 10 and halve the product to multiply with 5.

3 x 5 = ___

I know 3 x 5 is half of 3 x 10.

3 x 10 = 30
Half of 30 is 15
So, 3 x 5 = 15

5 x 3 = ___

10 x 3 = 30
Half of 30 is 15
So, 5 x 3 = 15

Try It:

6 x 5 = ___

7 x 5 = ___

5 x 4 = ___

5 x 8 = ___
Multiply with 5: Solve the following problems in your notebook.

1. Show 2 ways to draw an array with the factors 4 and 5. Write a multiplication equation for each array.

2. Leah put 6 stickers on 5 different pages in her book. Draw an array and write a multiplication equation to represent the total number of stickers Leah put in her book.

4. The apples in the store window are in 8 rows and 5 columns. How many apples are there?

5. Jen bought some candy for thirty-five cents and paid in nickels. Write a multiplication sentence to show how many nickels Jen used.

5. Write and solve a word problem with the factors 9 and 5.

Multiply with 5: Solve the following problems in your notebook.

1. Show 2 ways to draw an array with the factors 4 and 5. Write a multiplication equation for each array.

2. Leah put 6 stickers on 5 different pages in her book. Draw an array and write a multiplication equation to represent the total number of stickers Leah put in her book.

4. The apples in the store window are in 8 rows and 5 columns. How many apples are there?

5. Jen bought some candy for thirty-five cents and paid in nickels. Write a multiplication sentence to show how many nickels Jen used.

5. Write and solve a word problem with the factors 9 and 5.
Multiply with 5: Extend

I can multiply by 10 and halve the product to multiply with 5.

16 x 5 = __

16 x 10 = 160
Half of 160 is 80
So, 16 x 5 = 80

5 x 16 = ___

10 x 16 = 160
Half of 160 is 80
So, 16 x 5 = 80

Try It:

12 x 5 =

18 x 5 =

5 x 17 =

5 x 14 =
Multiply with 5: Extend - Solve the following problems.

1. Ben bought 5 boxes of crayons. Each box had 12 crayons. How many crayons in all?

2. Leah put 18 stickers on 5 different pages in her book. Write a multiplication equation to represent the total number of stickers Leah put in her book.

4. 13 students each donated 5 cans of dog food to an animal shelter. How many cans of dog food did they donate in all?

5. Jen picks 15 flowers. Each flower has 5 petals. What is the total number of petals?

5. Write and solve a word problem with the factors 5 and 19.
Multiply with 2

I can use doubles to multiply with 2.

\[ 2 \times 5 = \_\_ \]

Double 5 is 10.
So, \( 2 \times 5 = 10 \)

\[ 5 \times 2 = \_\_ \]

\[ 5 + 5 = 10 \]
So, \( 5 \times 2 = 10 \)

Try It:

\[ 2 \times 4 = \]

\[ 2 \times 7 = \]

\[ 8 \times 2 = \]

\[ 6 \times 2 = \]

\[ 2 \times 4 = \]

\[ 2 \times 7 = \]

\[ 8 \times 2 = \]

\[ 6 \times 2 = \]
Multiply with 2: Solve the following problems in your notebook.

1. Draw equal groups to show 4 groups of 2. Write a multiplication equation to describe the equal groups.

2. Draw an array to show 2 x 9. Write a multiplication equation to describe the array.

3. Write a multiplication equation for each expression.
   a) 7 twos  
   b) 2 tens  
   c) 8 twos

4. Peter says that when you multiply by 2 the product will always be even. Do you agree? Explain.

5. Write and solve a word problem with the factors 2 and 6.
Multiply with 2: Extend

I can use doubles to multiply with 2.

25 x 2 = ___

Double 25 is 50.
So, 25 x 2 = 50

2 x 25 = ___

20 + 20 = 40
5 + 5 = 10
40 + 10 = 50
So, 2 x 25 = 50

Try It:

14 x 2 =

16 x 2 =

2 x 23 =

2 x 34 =

Multiply when there are 2 equal groups is like adding doubles, so 25 x 2 is double 25, or 50.
Multiply with 2: Extend - Solve the following problems.

1. Peter says the product of 16 x 2 is 31. Is Peter correct? Explain.

2. Sasha ran 2 kilometers every day for 3 weeks. How many kilometers did Sasha run in all?

3. Write a multiplication equation for each expression.
   a) 31 twos   b) 24 twos   c) 18 twos

4. Mrs. Smith bought 19 boxes of cookies. Each box held two packets. How many packets of cookies did Mrs. Smith buy?

5. Write and solve a word problem with the factors 31 and 2.
Multiply with 4

I can double twice to multiply with 4 (double, double).

4 x 6 = __

\[ \begin{array}{c}
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\end{array} \]

\[ \begin{array}{c}
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\end{array} \]

6 + 6 = 12
12 + 12 = 24
So, 4 x 6 = 24

6 x 4 = __

\[ \begin{array}{c}
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\end{array} \]

\[ \begin{array}{c}
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\end{array} \]

6 x 2 = 12
12 x 2 = 24
So, 6 x 4 = 24

Try It:

<table>
<thead>
<tr>
<th>5 x 4 =</th>
<th>7 x 4 =</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4 x 8 =</th>
<th>4 x 9 =</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

I can double twice to multiply with 4 (double, double).

4 x 6 = __

\[ \begin{array}{c}
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\end{array} \]

\[ \begin{array}{c}
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\end{array} \]

6 + 6 = 12
2 x 6 = 12
12 + 12 = 24
or
2 x 12 = 24
So, 4 x 6 = 24

6 x 4 = __

\[ \begin{array}{c}
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\end{array} \]

\[ \begin{array}{c}
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\bullet \bullet \bullet \\
\end{array} \]

6 x 2 = 12
12 x 2 = 24
So, 6 x 4 = 24

Try It:

<table>
<thead>
<tr>
<th>5 x 4 =</th>
<th>7 x 4 =</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4 x 8 =</th>
<th>4 x 9 =</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Multiply with 4: Solve the following problems in your notebook.

1. Draw an array and write a multiplication equation for $3 \times 4$.

2. Draw equal groups to show 4 groups of 4. Write a multiplication equation to describe the picture.

3. Use multiplication to find the total number of sides on 9 squares.

4. The Smith family eats 4 eggs for breakfast each morning. Each egg carton has 24 eggs. How many days will it take the family to finish one carton of eggs? Solve using multiplication.

5. Explain how knowing the product for $2 \times 7$ can help you find the product for $4 \times 7$. 

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5. Explain how knowing the product for $2 \times 7$ can help you find the product for $4 \times 7$. 

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1. Draw an array and write a multiplication equation for $3 \times 4$.

2. Draw equal groups to show 4 groups of 4. Write a multiplication equation to describe the picture.

3. Use multiplication to find the total number of sides on 9 squares.

4. The Smith family eats 4 eggs for breakfast each morning. Each egg carton has 24 eggs. How many days will it take the family to finish one carton of eggs? Solve using multiplication.

5. Explain how knowing the product for $2 \times 7$ can help you find the product for $4 \times 7$.
Multiply with 4: Extend

I can double twice to multiply with 4 (double, double).

15 \times 4 = __

\begin{align*}
15 + 15 &= 30 \\
30 + 30 &= 60 \\
\text{or} & \\
15 \times 2 &= 30 \\
30 \times 2 &= 60 \\
\text{So, } 15 \times 4 &= 60
\end{align*}

So, 15 \times 4 = 60

4 \times 15 = __

\begin{align*}
2 \times 15 &= 30 \\
2 \times 30 &= 60 \\
\text{or} & \\
4 \times 15 &= (2 \times 15) + (2 \times 15) \\
&= 30 + 30 \\
&= 60
\end{align*}

So, 4 \times 15 = 60

Try It:

\begin{align*}
12 \times 4 &= \\
14 \times 4 &= \\
4 \times 11 &= \\
4 \times 12 &= \\
4 \times 11 &= \\
4 \times 13 &=
\end{align*}

Try It:

\begin{align*}
12 \times 4 &= \\
14 \times 4 &= \\
4 \times 11 &= \\
4 \times 12 &= \\
4 \times 11 &= \\
4 \times 13 &=
\end{align*}
Multiply with 4: Extend - Solve the following problems.

1. Joshua arranged his books in 14 piles. Each pile had 4 books. How many books in all?

2. Miguel swam 4 laps of the pool each morning before school. How many laps did he swim in 16 days?

3. Use multiplication to find the total number of sides on 19 squares.

4. Mr. Barnes has 17 packets of erasers. Each packet has 4 erasers. How many erasers in all?

5. Write and solve a word problem with the factors 23 and 4.
Multiply with 8

I can double three times to multiply with 8 (double, double, double).

3 x 8 = __

3 + 3 = 6
6 + 6 = 12
12 + 12 = 24
So, 3 x 8 = 24

8 x 3 = __

2 x 3 = 6
2 x 6 = 12
2 x 12 = 24
So, 8 x 3 = 24

Try It:

4 x 8 =

8 x 8 =

8 x 5 =

8 x 7 =

Try It:

4 x 8 =

8 x 8 =

8 x 5 =

8 x 7 =
Multiply with 8: Solve the following problems in your notebook.

1. An array has 8 rows with 5 dots in each row. How many dots are in the array?

2. Jack packs 7 bags with apples. Each bag has 8 apples. How many apples does Jack pack in all?

3. Leah arranges 24 buttons in an array. Each row has 8 buttons. Draw Leah’s array and write a multiplication equation to describe it.

4. Use multiplication to find the total number of sides on 9 octagons.

5. How can you use doubling to find $6 \times 8$? Explain.

Multiply with 8: Solve the following problems in your notebook.

1. An array has 8 rows with 5 dots in each row. How many dots are in the array?

2. Jack packs 7 bags with apples. Each bag has 8 apples. How many apples does Jack pack in all?

3. Leah arranges 24 buttons in an array. Each row has 8 buttons. Draw Leah’s array and write a multiplication equation to describe it.

4. Use multiplication to find the total number of sides on 9 octagons.

5. How can you use doubling to find $6 \times 8$? Explain.
Multiply with 8: Extend

I can double three times to multiply with 8 (double, double, double).

15 x 8 = __

15 x 2 = 30
30 x 2 = 60
60 x 2 = 120
So, 15 x 8 = 120

8 x 15 = __

2 x 15 = 30
2 x 30 = 60
2 x 60 = 120
So, 8 x 15 = 120

Try It:

12 x 8 = __
8 x 13 = __
Multiply with 8: Extend - Solve the following problems.

1. An array has 8 rows with 16 dots in each row. How many dots are in the array?
2. Jack packs 14 bags with apples. Each bag has 8 apples. How many apples does Jack pack in all?
3. Penny says the product of 8 x 12 is 95. Is Penny correct?
4. Use multiplication to find the total number of sides on 11 octagons.
5. How would you explain to a friend how to use doubling to solve 15 x 8.
Multiply with 9

I can multiply by 10 and subtract one set to multiply with 9.

3 \times 9 = __

\[3 \times 10 = 30\]

or

\[3 \times 9 = (3 \times 10) - 3\]

\[30 - 3 = 27\]

So, 3 \times 9 = 27

3 \times 9 \text{ is three less than } 3 \times 10.

Try It:

4 \times 9 =

6 \times 9 =

9 \times 5 =

9 \times 4 =

PREVIEW
Multiply with 9: Solve the following problems in your notebook.

1. Explain how you could use a x10 fact to help solve $4 \times 9$.

2. Alex arranged his books on 5 shelves. He put 9 books on each shelf. How many books did Alex arrange?

3. Sarah bought a book for $9. She then bought 5 more books for the same price. How much did Sarah spend in all?

4. Max wrote $9 \times 2 = 2 \times 9$. Do you agree or disagree? Draw an array to help explain your thinking.

5. Find the missing factor to make each equation true.
   a) $9 \times \_ = 90$
   b) $27 = \_ \times 9$
   c) $\_ \times 9 = 81$

Multiply with 9: Solve the following problems in your notebook.

1. Explain how you could use a x10 fact to help solve $4 \times 9$.

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   a) $9 \times \_ = 90$
   b) $27 = \_ \times 9$
   c) $\_ \times 9 = 81$
Multiply with 9: Extend

I can multiply by 10 and subtract one set to multiply with 9.

12 x 9 = ___
12 x 9 = (12 x 10) – 12
   = 120 – 12
   = 108

9 x 12 = ___
9 x 12 = (10 x 12) - 12
   = 120 - 12
   = 108

12 x 9 is 12 less than 12 x 10.

Try It:

11 x 9 =  
13 x 9 =  
9 x 11 =  
9 x 13 =  

9 x 11 =  
9 x 13 =  

12 x 9 is 12 less than 12 x 10.
Multiply with 9: Extend - Solve the following problems.

1. Explain how you could use a x10 fact to help solve 12 x 9.

2. Alex arranged his books on 13 shelves. He put 9 books on each shelf. How many books did Alex arrange?

3. Sarah bought 5 books for $9. She then bought 6 more books for the same price. How much did Sarah spend in all?

4. Max wrote 9 x 12 = 100 + 8. Do you agree or disagree?

5. Find the missing factor to make each equation true.
   a) 9 x ___ = 99   b) 108 = ___ x 9   c) ___ x 9 = 117