

## Title: Products and Factors

**Objective:** Students will be able to compare and contrast products and factors by experimenting with a simulation.

### Definition:

A **product** is the answer when two or more numbers are multiplied together.

**Factors** are numbers we can multiply together to get another number.

### Important Questions:

How do we determine the product of two numbers?

How do we determine the factors of a given product?

How are factors and products related?

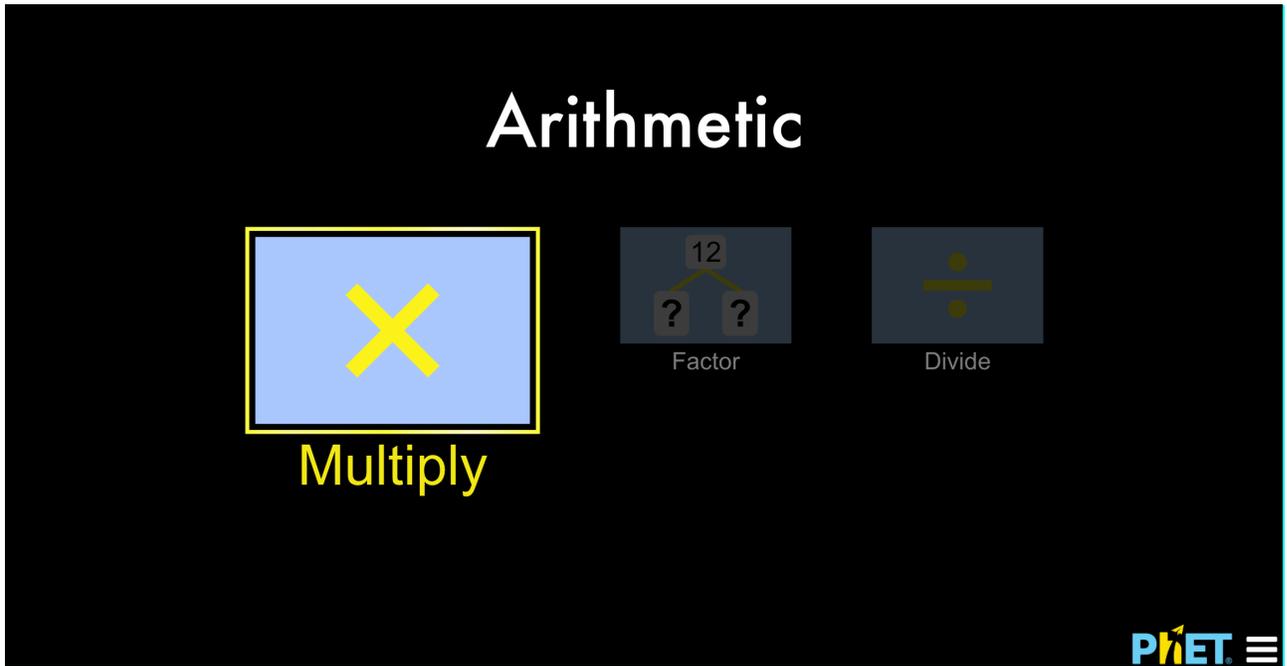
### Instructions:

You are going to explore products and factors in this activity. You will explore what a product is and how it is related to factors. You will go through three phases in this activity: Exploration, Explanation and Application using both the simulation and this document.

1. Click on this link: <http://phet.colorado.edu/>
2. You will see this screen:

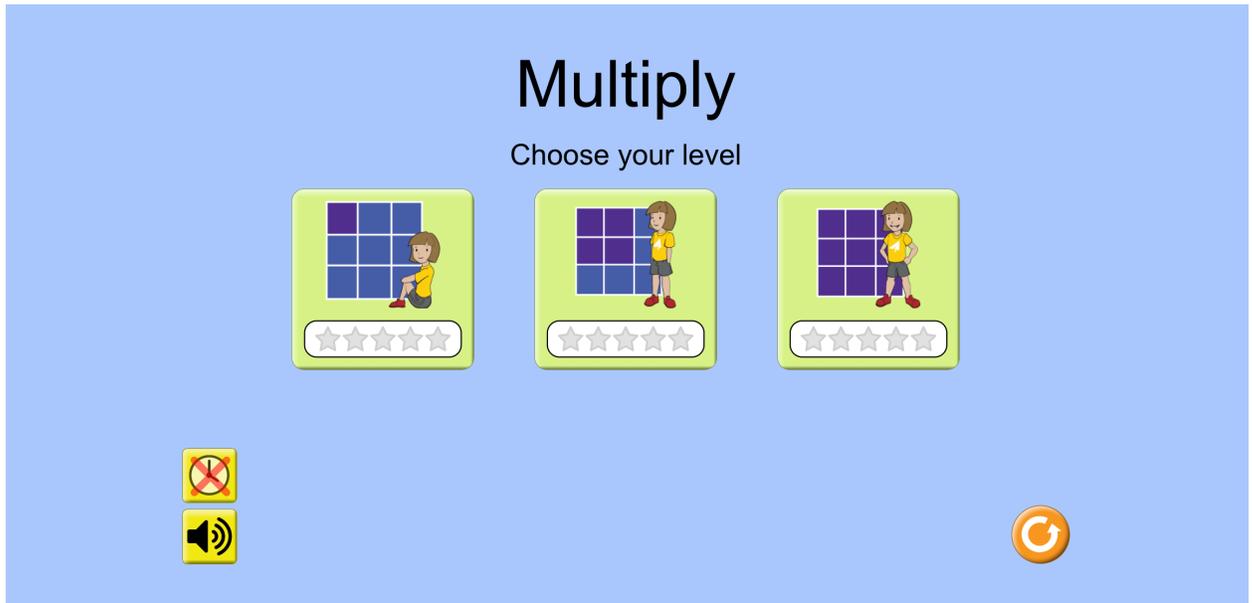
The screenshot shows the PhET Interactive Simulations website. At the top, there is a dark blue header with the PhET logo (Interactive Simulations) on the left, a search bar in the center, and the University of Colorado Boulder logo and name on the right. To the right of the header are 'SIGN IN' and 'REGISTER' buttons. Below the header, the main content area is divided into two columns. The left column features the text 'INTERACTIVE SIMULATIONS FOR SCIENCE AND MATH' and 'Over 360 million simulations delivered'. Below this are two buttons: 'Play with Simulations' (with a play icon) and 'Teachers Register Here' (with a person icon). The right column displays a preview of the 'Area Builder' simulation. The simulation interface shows a grid with blue blocks forming a shape, a 'Start Over' button, 'Level 5' and 'Score: 2' indicators, and a 'You built!' area showing 'Area = 32'. Below the simulation preview is a 'Math' navigation bar. At the bottom of the page, there are three columns of text. The first column, titled 'What is PhET?', describes the project's history and mission. The second column, titled 'Teaching Resources', lists 'Browse Activities', 'Share your Activities', and 'Tips for Using PhET'. The third column, titled 'DONATE TODAY', features the Promethean logo and text stating 'PhET is supported by... and our other sponsors, including educators like you.'

3. Enter "Arithmetic" in the search bar.
4. Find "Arithmetic" and click the play button.
5. You should see this screen:



### Exploration Phase:

1. Click on "Multiply."
2. You should see this screen:



3. Start with level one. Begin to explore the sim.
4. Answer the given multiplication problem using the keypad and click the "Check" button to see what happens.

5. Notice what changes occur in the sim when the numbers being multiplied changes.

**Questions:**

1. How does the times table change when different numbers are being multiplied?

---

---

---

---

2. What is highlighted in the times table when a multiplication equation is given?

---

---

---

---

3. What was the last multiplication problem given? What was the answer? Count the number of boxes highlighted. What do you notice about the highlighted boxes?

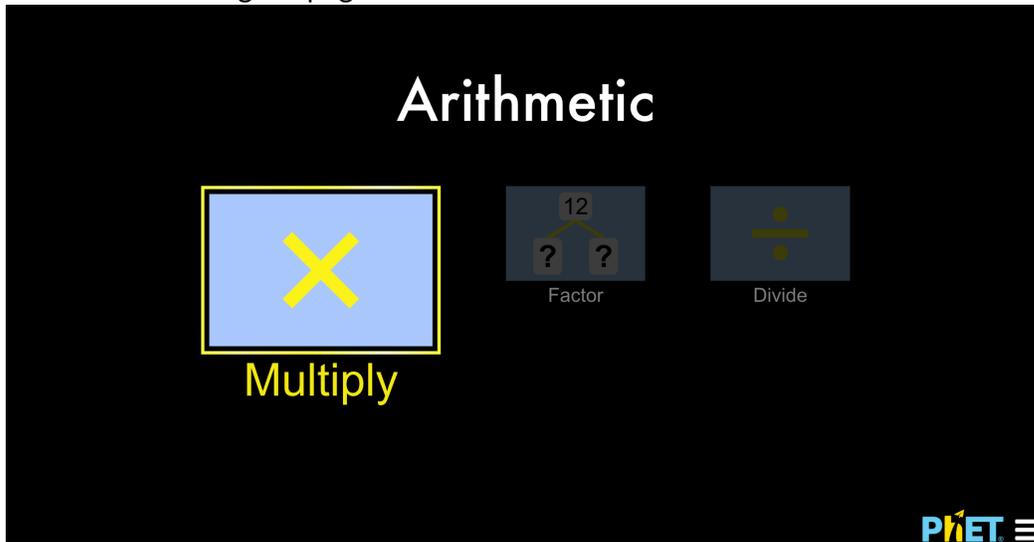
---

---

---

---

6. Go back to the original page:



7. Click "Factor." Begin with level 1.
8. Explore this sim. Move your mouse around the times table and see what occurs.
9. Notice which numbers and boxes are being highlighted.

**Questions:**

1. What occurs when you move your mouse to different spots on the times table?

---

---

---

---

2. How are the numbers being highlighted related to the boxes being highlighted?

---

---

---

---

3. Which part of the times table shows the factors? Which part shows the products?

---

---

---

---

**Explanation Phase:**

***Aim:*** Discover relationship between products and factors by finding the relationship between the highlighted boxes and the highlighted numbers.

**Part 1**

***Aim:*** Determine the relationship between the product and the number of boxes being highlighted.

Go back to the “Multiplication” sim.

Click on the yellow refresh button on the right side if you had anything entered on the table:

The screenshot shows a multiplication simulation interface. On the left, there is a 6x6 grid. The top row and left column are red and labeled with numbers 1 through 6. The grid contains purple boxes at (1,2), (2,2), (3,2), and (4,2). The number 24 is displayed in the cell (6,4). Below the grid is an equation editor showing  $4 \times 2 = |$ . To the right of the grid is a control panel with a 'Multiply Level 1 Score: 1' box, a yellow refresh button, a numeric keypad (0-9), and a 'Check' button.

Look at the given multiplication sentence and enter your answer then check if it is correct.

Continue this for 10 multiplication equations. Then enter the data you have come up with into the chart:

**X      1      2      3      4      5      6**

<b>1</b>						
<b>2</b>						
<b>3</b>						
<b>4</b>						
<b>5</b>						
<b>6</b>						

What are the numbers you are filling in inside the box called?

How many rows are highlighted in the multiplication problem  $4 \times 2$  shown above? How many columns?

How would you use this model to find the product of  $4 \times 2$ ? What would your answer be? How do you know?

How many possible products are there for  $4 \times 2$ ?

Press the yellow back arrow on the top left to return to the page with different level:  
Click on the 2<sup>nd</sup> level.



Enter an answer in the blank slot for 5 more multiplication problems and enter your data on the chart below:

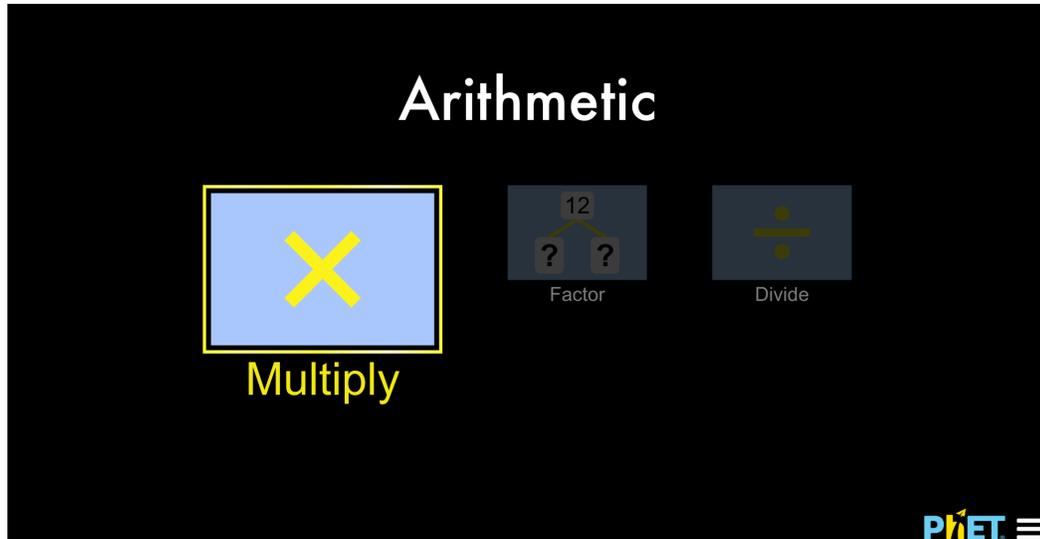
<b>X</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
<b>1</b>									
<b>2</b>									
<b>3</b>									
<b>4</b>									
<b>5</b>									
<b>6</b>									
<b>7</b>									
<b>8</b>									
<b>9</b>									

Drag your mouse to the box that meets between 1 (on top) and 1 (on the side bar) on the above chart. Click down and drag it so that it ends up where the 5 from the top row and the 7 from the side row meets. The boxes in between should now be highlighted. How many boxes are there? How is this number related to 5 and 7?

## Part 2

*Aim: Determine the relationship between factors and the number of rows and columns being highlighted.*

Go back to the original page:



Click on "Factor" and go to the 2<sup>nd</sup> level.

You should see this page:



The image shows the "Factor Level 2" game interface. It features a 9x9 grid with a red header row containing numbers 1-9 and a red leftmost column containing numbers 1-9. The cell at row 3, column 1 (containing '3' and '1') is highlighted in yellow. A blue hand cursor is positioned over the grid. To the right is a control panel with the text "Factor", "Level 2", and "Score: 0", along with a yellow refresh button. At the bottom, a mathematical equation is displayed:  $? \times ? = 8$ .

Drag your mouse so that the two numbers highlighted fit the multiplication problem being given. Then check if your answer is correct.

Continue to do this for 10 multiplication problems.

Look at the answer to your last problem. How are the number of boxes highlighted, when you bring your mouse to the correct spot, related to the multiplication problem?

What are the numbers being highlighted called?

If you were given the product 60, what factors can be multiplied? How many rows and how many columns will be highlighted when multiplying these factors?

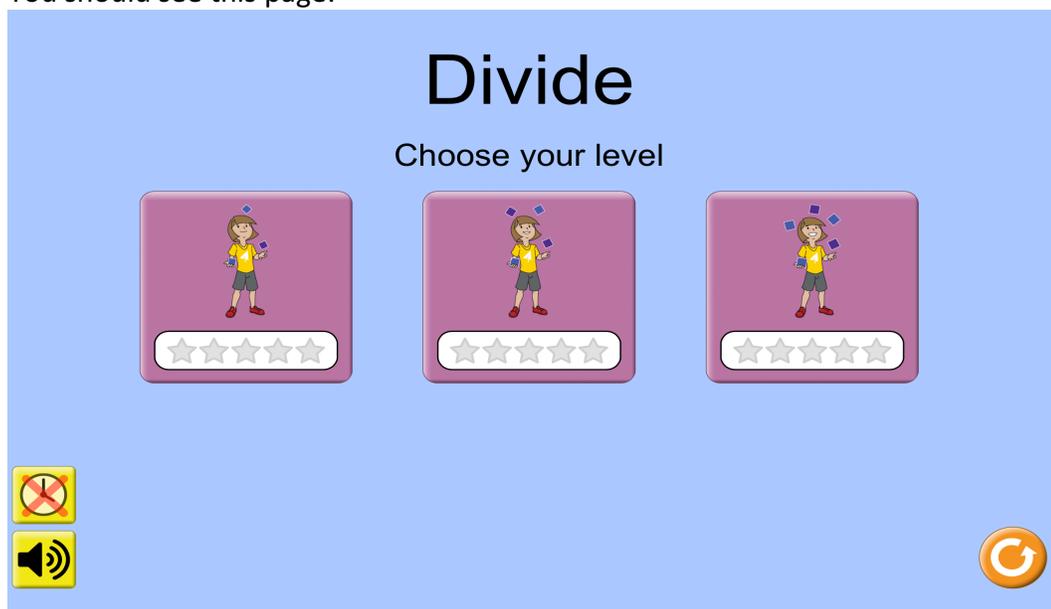
Are there any other ways to get the product 60?

*What is the relationship between the products and factors?*

### Application Phase:

Go back to the original page and click "Divide."

You should see this page:



Click on level 2 (2<sup>nd</sup> box). Enter a number in the blank box to make the equation true. Then check your answer.

×	1	2	3	4	5	6	7	8	9
1									
2									
3									
4									
5									
6									
7									
8									
9									

× 8 = 16

7 8 9  
4 5 6  
1 2 3  
0

Check

**Divide**  
**Level 2**  
Score: 0



Enter your final score below:

Score: \_\_\_\_\_

How many different factors can a product have? (only 1 pair or multiple pairs?)

All finished!

(Unless you want to challenge yourself with level 3!)