

Core Focus

- Multiplication: Using the standard multiplication algorithm and solving word problems
- Volume: Measuring volume and developing formulas

Multiplication

- The standard multiplication algorithm provides a method for performing multi-digit multiplications that are difficult to do mentally, such as 24×32 .

2.3 Multiplication: Using the standard algorithm with two two-digit factors

Step In A school hall has a rectangular floor. Its dimensions are $24 \text{ yd} \times 32 \text{ yd}$.

How would you estimate the area of the floor?
How would you calculate the exact area?

John drew this diagram. How will it help him figure out the area of the floor?

Write the partial product inside each part of the diagram.
What is the area? How do you know?

In this lesson, students use the standard algorithm to calculate multiplication problems.

- This algorithm can be represented visually using the **partial-products strategy**, which maps complex multiplication onto a rectangular area model that breaks **factors** down by place value.

2.5 Multiplication: Extending the standard algorithm

Step In The local park is rectangular and measures 134 yd by 232 yd .

How could you calculate the area of the park?

Mia drew this diagram of a rectangle split into parts to make it easier to multiply.

Write the partial product inside each part of her diagram.

Add the partial products in your head and write the area of the park below.

Area is yd^2

Alejandro used the standard multiplication algorithm to calculate the area. What steps did he follow?

Look carefully at the third and fifth rows of the algorithm. What do you notice?

Why is the product in the fifth row 100 times greater than the product in the third row?

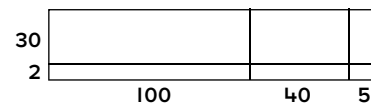
In this lesson, students connect the partial-products strategy to the standard algorithm for multiplication.

Ideas for Home

- Practice basic multiplication facts in short bursts throughout the week. Basic multiplication facts is another name for times tables or multiplication tables.
- If your child is having trouble with the standard algorithm, ask them to solve the problem first by using their preferred method. Then work with them step by step to connect their answer to the algorithm.

Glossary

- ▶ In multiplication, one **factor** is multiplied by the other, resulting in the **product**.
- ▶ Students use a rectangular area model in the **partial-products** approach to solving a complex multiplication problem, such as 32×145 . Students break the factors up into their separate place values and then find the product for each of the smaller rectangles. All the partial products are added together to find the total product. In this case, the answer is $4,640$.



Helpful videos

View these short one-minute videos to see these ideas in action.

www.bit.ly/OI_21
www.bit.ly/OI_22

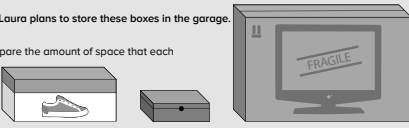
Volume

- The focus in later lessons of this module is on the concept of **volume**. To think about the volume of an object (e.g. a box), students visualize filling it with small identical cubes. The volume of the box is the number of cubes needed to fill it.
- Students visualize covering the base of an object with a single layer of small, identical cubes, and then think about how many layers of cubes would be needed to fill the shape.

2.8 Volume: Analyzing unit cubes and measuring volume

Step In Laura plans to store these boxes in the garage.

How can she compare the amount of space that each box will occupy?
How will this help?




To measure the space, she decides to fill each box with objects that are the same shape.
How will this help?

Look at these objects.

Which object would you use to measure the volume of each of the boxes above?
How did you decide?

Laura chose to use centimeter cubes to find the volume of the jewelry box.
Does she need to fill the whole box with cubes?
What is an easier way to calculate the volume?

Just find the number of cubes in one layer.
Then find the number of layers.



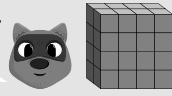
In this lesson, students use small blocks to find the volume of rectangular-based prisms.

- Students eventually find the volume of boxes by multiplying the area of the base by the height, which is the same as length \times width \times height.
- Students then work in reverse by starting with the volume of a box and thinking about what its dimensions might be (i.e. three numbers that multiply to give the volume). E.g. if the volume of a box is 30, possible dimensions include $2 \times 3 \times 5$, and $1 \times 6 \times 5$.
- Students then use what they have learned to solve a variety of real-world problems.

2.9 Volume: Developing a formula

Step In How can you figure out the volume of this prism without counting each individual cube?

I know there are 8 cubes in the base.
There are 4 layers. $8 + 8 + 8 + 8 = 32$.



Oscar multiplied the height of the prism by the number of cubes in the base.

Base	Height
8 cubes	4 layers
$8 \times 4 = 32$ cubes	
Volume is 32 cubes.	

Peta multiplied the dimensions.

Length	Width	Height
4 cubes	2 cubes	4 cubes
$4 \times 2 \times 4 = 32$ cubes		
Volume is 32 cubes.		

How are their methods similar?
What rule could you write to match each method?

Look at Peta's method.
Does it matter in what order she multiplies the dimensions?
How do you know?

Volume is usually measured in cubic units. The abbreviation for cubic centimeter is cm^3 .

In this lesson, students use small blocks to find the volume of a box.

Ideas for Home

- Have your child collect different-sized boxes from around your home (e.g. shoe boxes, cereal boxes, and gift boxes). Have your child measure the dimensions of the boxes (length, width, and height) to the nearest inch and then calculate the volume.
- Ask your child to compare the volumes of the different boxes. Boxes that look very different can have similar volumes.
- Make up the volume of a box and ask your child to find some possible dimensions. For example, if the volume is 36 cubic units, the dimensions could be $3 \times 3 \times 4$, or $2 \times 2 \times 9$. See how many solutions your child can find.

Glossary

- Volume** and capacity are measured in cubic units, but the two are not the same. Volume measures the amount of space an object occupies, and capacity measures the amount of space within a container.