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STUDY GUIDE: Area & Perimeter with Rectangles

Left: A square with side length l; Right: a rectangle with side lengths l and w.

RECALL: The definition of the terms *Perimeter* and *Area.*

- **Perimeter:** The total length of the outside border of a 2D shape or face, measured in *units.*
- **Area:** The measurable space **inside** of a 2D shape or face, measured in sq. units, or $units^2$ (read as "units squared").

Knowing this, we have the following formulas for *area* and *perimeter*.

Perimeter: Since a rectangular prism has two *l*-length sides and two *w*-length sides, we can say its perimeter formula is:

1. $P = l + l + w + w$
2. $P = (2 \times l) + (2 \times w)$

And if we manipulate this a little, using *the distributive property,*

3. $P = 2 \times (l + w)$

This gives us **three** choices for perimeter. The most straightforward formula is the first, but you will often seen the second formula. However, in my opinion, the third formula is the fastest. **You must decide which is the best formula to use.** Also, since a **square** has **four equal sides,** or four *l* length, its perimeter is:

$$P_{square} = l + l + l + l = 4 \times l$$

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Area: Think of area as "stretching" a length into the 2nd dimension to give it a width. You can also think of this as "stacking" lengths on top of each other.

As a result of "stretching" or "stacking" the length l over and over w *times*, we get the beautiful formula:

$$A = l \times w$$

Example 1: Find the perimeter and area of the following rectangle.

$w = 1\frac{1}{4}$

$l = 5\frac{1}{3}$

Perimeter: For the perimeter of this shape, we'll use $P = 2 \times (l + w)$.

$$P = 2 \times \left(5\frac{1}{3} + 1\frac{1}{4}\right)$$
$$P = 2 \times \left(5\frac{4}{12} + 1\frac{3}{12}\right)$$
$$P = 2 \times \left(6\frac{7}{12}\right)$$

Now this is where things get ✨beautiful!!! ✨ Using distribution, I can distribute the 2 across terms being added in the parenthesis… but where is the addition? **Between the whole number component and fraction component!** We have two options to solve this problem as a result, one with distribution, and one without. Both are below:

Without Distribution (Improper Fractions):	With Distribution:
$P = 2 \times \left(\frac{16}{3} + \frac{5}{4}\right)$ $P = 2 \times \left(\frac{64}{12} + \frac{15}{12}\right)$ $P = 2 \times \left(\frac{79}{12}\right)$ $P = \frac{158}{12}\ OR\ 13\frac{2}{12}\ OR\ 13\frac{1}{6}$	$P = 2 \times \left(6 + \frac{7}{12}\right)$ $P = (2 \times 6) + \left(2 \times \frac{7}{12}\right)$ $P = 12 + \frac{14}{12}$ $P = 13\frac{2}{12}$ OR $13\frac{1}{6}$

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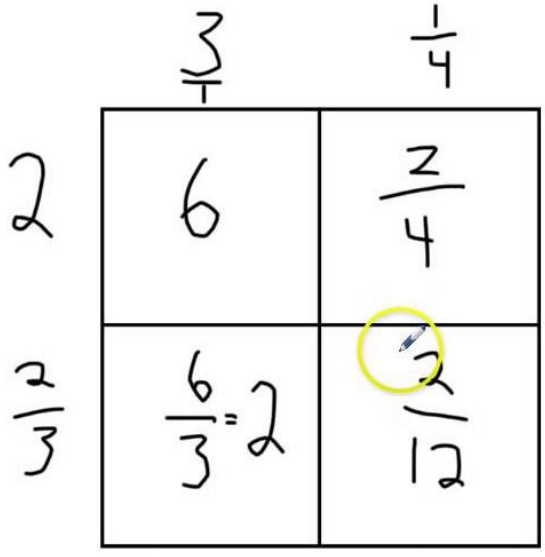
For area, we **must** convert to an improper fraction when using mixed numbers, **unless** you want to use an area model. We'll talk about that next…

$$A = \frac{16}{3} \times \frac{5}{4}$$
$$A = \frac{80}{12}$$
$$A = 6\frac{2}{3}$$

Area Models for Area

Recall: We can split a mixed number into a whole number and fraction, or a decimal into whole number and decimal component. We can then split lengths to create sub-rectangles, and find total area by adding up all the smaller rectangles. See below:

$3\frac{1}{4} \times 2\frac{2}{3}$



$$A = 6 + \frac{2}{4} + 2 + \frac{2}{12} = 8\frac{2}{3}$$

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Your Turn:

Find the **area and perimeter** of *each* rectangular prism below.

1. A rectangle with length of 5.2 in and a width of 1.5 in.

2. A rectangle with length of 8.25 ft and a width of 7.3 ft.

3. A rectangle with length of $2\frac{1}{4}$ m and a width of $3\frac{3}{8}$ m.

4. A rectangle with a length of $12\frac{4}{5}$ cm and a width of $9\frac{1}{3}$ cm.

Find the **missing length.**

5. A rectangle has an area of 18.75 u^2 and a length of 1.5 u. What is its width?

6. A rectangle has an area of 24.42 u^2 and a width of 3.3 u. What is its length?

7. A rectangle has an area of $\frac{1}{8}$ u^2 and a length of $\frac{1}{2}$ u. What is its width?

8. A rectangle has an area of $\frac{1}{5}$ u^2 and a width of $\frac{1}{3}$ u. What is its length?

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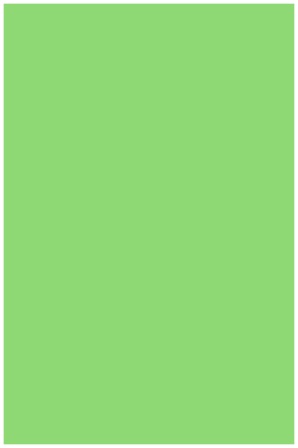
Find the **<u>area and perimeter</u>** of *each* rectangular prism below.

9.

$w = 2\frac{1}{8}$

$l = 4\frac{2}{5}$

10.



$w = 5.8$

$l = 3.15$

Use the **area** model to find the area. **The figure is cut up for you, but you must fill in the information..**

11. $4\frac{1}{3} \times 2\frac{3}{4}$