Changing Dimensions: Area
A Closer Look at the Video

After watching the *Changing Dimensions: Area* video, make sense of the mathematics by reading through the problem situation and solution. Use the comments and questions in bold to help you understand how changing linear dimensions affects the area.

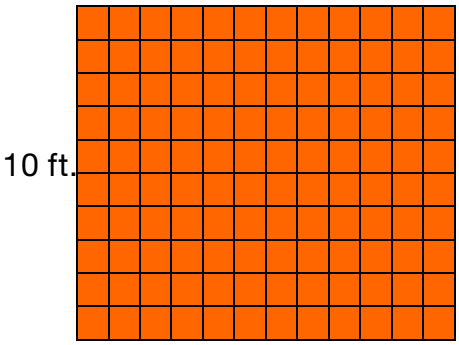
Problem: Carlos is helping Rick of Rathmell construction replace a cement patio. The homeowner told him that he wants to double the length and the width of the patio. He needs to determine the areas of the old and new patios.

What is the area of the old patio?
Old patio measurements: **10 feet wide by 12 feet long**

A = bh

A = 12ft. · 10ft.

A = 120 sq. ft.



If the linear dimensions of the old patio are each doubled, what is the area of the new patio?
New patio measurements: **20 feet wide by 24 feet long**

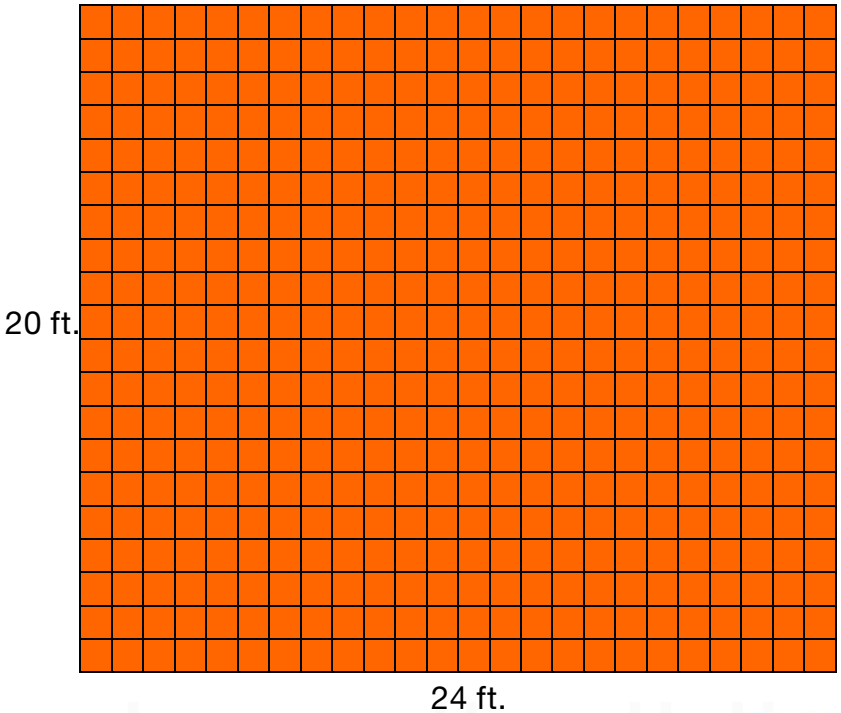
A = bh

A = 24ft. · 20ft.

A = 480 sq. ft.

480=120 · **4**

The area of the new patio is 4 times as large as the area of the old patio.



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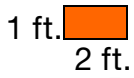
Why is the area of the new patio four times the area of the old patio instead of doubled when the linear dimensions doubled?
To investigate, look at some quick examples.

Example 1
If the linear dimensions of a rectangle are doubled (scale factor 2), what are the dimensions of the new rectangle?
original rectangle: **1 ft. by 2 ft.** new rectangle: **2 ft. by 4 ft.**

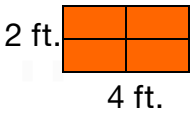
If the linear dimensions of a rectangle are doubled (scale factor 2), what is the relationship between the area of the original rectangle and the area of the new rectangle?

A = bh
A = 2ft. · 1ft.
A = 2 sq. ft.



x 4

A = bh
A = 4ft. · 2ft.
A = 8 sq. ft.



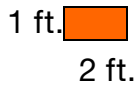
Scale Factor: 2
Area Factor: 4

The new area is 4 times larger than the original, so the area factor is 4.

Example 2
If the linear dimensions of a rectangle are tripled (scale factor 3), what are the dimensions of the new rectangle?
original rectangle: **1 ft. by 2 ft.** new rectangle: **2 ft. by 4 ft.**

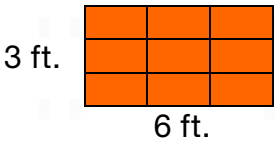
If the linear dimensions of a rectangle are tripled (scale factor 3), what is the relationship between the area of the original rectangle and the area of the new rectangle?

A = bh
A = 2ft. · 1ft.
A = 2 sq. ft.



x 9

A=bh
A=6ft. · 3ft.
A=18 sq. ft.



Scale Factor: 3
Area Factor: 9

The new area is 9 times larger than the original, so the area factor is 9.

MakingSense

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If the linear dimensions of a rectangle are multiplied by 4 (scale factor 4), what are the dimensions of the new rectangle?

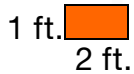
original rectangle: **1 ft. by 2 ft.** new rectangle: **4 ft. by 8 ft.**

If the linear dimensions of a rectangle are multiplied by 4 (scale factor 4), what is the relationship between the area of the original rectangle and the area of the new rectangle?

A = bh

A = 2ft. · 1ft.

A = 2 sq. ft.

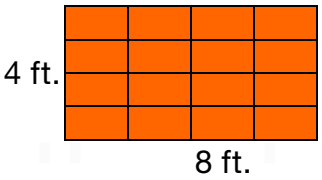


x 16

A = bh

A = 8ft. · 4ft.

A = 32 sq. ft.



Scale Factor: 4

Area Factor: 16

The new area is 16 times larger than the original, so the area factor is 16.

Study the following table and look for a pattern. What is the relationship between the scale factor and the area factor?

Scale Factor	Area Factor
2	4
3	9
4	16
n	

Looking at the pattern above, as each of the two dimensions of a rectangle is multiplied by the same number, the area is multiplied by the square of that number. Whatever the scale factor is, the area factor is the square of that number.

Scale Factor	Area Factor
2	$4 = 2^2$
3	$9 = 3^2$
4	$16 = 4^2$
n	n^2