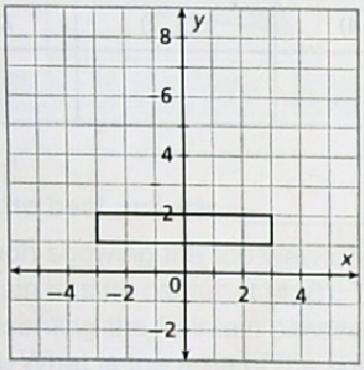
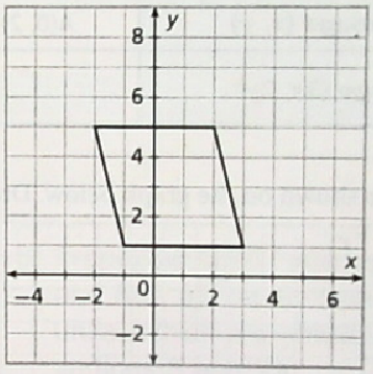
10.5 Effects of Changing Dimensions Proportionally

Draw the image of the given figure under the transformation. Find the areas of the figures, and calculate the ratio of the image area to the preimage area.

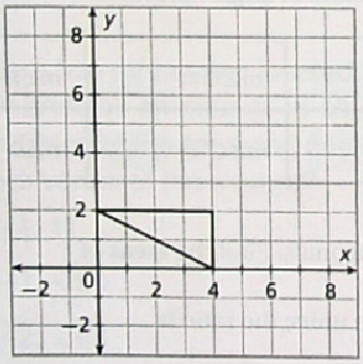
1. $(x, y) \rightarrow (x, 3y)$



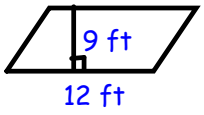
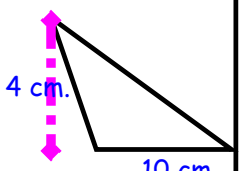
2. $(x, y) \rightarrow (2x, y)$



$(x, y) \rightarrow (1.5x, 3y)$

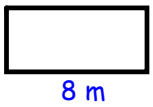
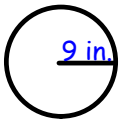


Ex 4: Fill in the chart below, then make a conjecture.

Polygon	Area	Change in dimension	New Area
		The height of the parallelogram is doubled.	
		The base of the triangle is tripled.	

If a dimension is changed by a factor of _____ then the area is also changed by a factor of _____.

Ex 5: Fill in the chart below, then make a conjecture.

Figure	Area	Changes	New Area
		The base and the height are both multiplied by 5.	
		The radius is multiplied by 1/3.	

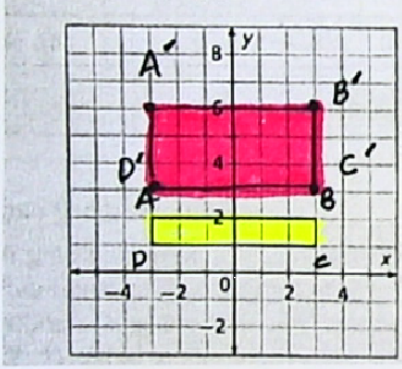
If all dimensions are multiplied by a factor of _____, then the perimeter changes by a factor of _____ and the area changes by a factor of _____.

10.5 Effects of Changing Dimensions Proportionally

Draw the image of the given figure under the transformation. Find the areas of the figures, and calculate the ratio of the image area to the preimage area. $(x,y) \longrightarrow (x,3y)$

Rule

1. $(x, y) \rightarrow (x, 3y)$



pre-image / image

A (-3, 2) → A' (-3, 6)
B (3, 2) → B' (3, 6)
C (3, 1) → C' (3, 3)
D (-3, 1) → D' (-3, 3)

pre-image area $A = 1 \cdot 6 = 6\ u^2$

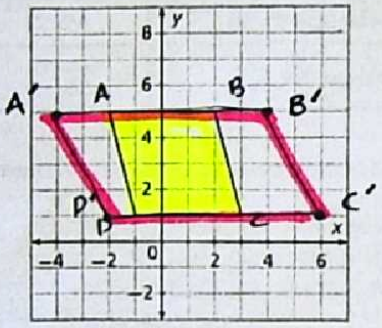
image area $= A = 3 \cdot 6 = 18\ u^2$

ratio of image to preimage area

18 : 6 or **3 : 1**

A (-2, 5) → A' (-4, 5)
B (2, 5) → B' (4, 5)
C (3, 1) → C' (6, 1)
D (-1, 1) → D' (-2, 1)

2. $(x, y) \rightarrow (2x, y)$

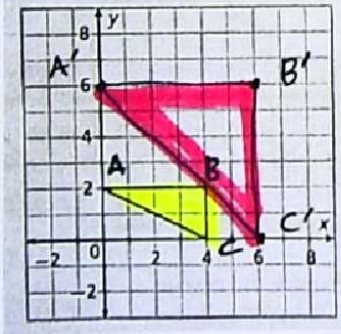


pre-image area $A = 4 \cdot 4 = 16u^2$

Image area $A = 8 \cdot 4 = 32u^2$

ratio of image to preimage 32 : 16 or **2 : 1**

$(x, y) \rightarrow (1.5x, 3y)$



pre-image / image

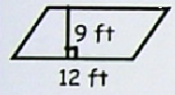
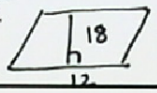
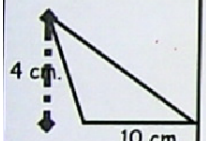
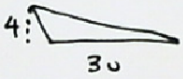
A (0, 2) → A' (0, 6)
B (4, 2) → B' (6, 6)
C (4, 0) → C' (6, 0)

pre-image area $A = \frac{1}{2}(4)(2) = 4u^2$

Image area $A = \frac{1}{2}(6)(6) = 18u^2$

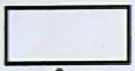
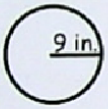
ratio of image to pre-image 18 : 4 or **9 : 2**

Ex 4: Fill in the chart below, then make a conjecture.

Polygon	Area	Change in dimension	New Area
	$B = b \cdot h$ $= 12 \cdot 9$ $= 108\ ft^2$	The height of the parallelogram is doubled. 	$A = 12 \cdot 18$ $= 216\ ft^2$ Area is doubled if 1 dimension is doubled
	$A = \frac{1}{2}bh$ $= \frac{1}{2}(10)(4)$ $= 20\ cm^2$	The base of the triangle is tripled. 	$A = \frac{1}{2}(30)(4)$ $= 60\ cm^2$ Area is tripled if 1 dimension is tripled.

If a dimension is changed by a factor of X then the area is also changed by a factor of X.

Ex 5: Fill in the chart below, then make a conjecture.

Figure	Area	Changes	New Area
	$24\ m^2$	The base and the height are both multiplied by 5.  $= 15 \cdot 40$ $= 600 m^2$	$600\ m^2$ Take original area $24 \cdot 5 \cdot 5$ or $25 \cdot 5^2$ 2 dimensions have changed
	πr^2 $\pi(9)^2$ 81π	The radius is multiplied by 1/3.  $\pi(3)^2$ 9π	9π Take original area of 81π and multiply by $(\frac{1}{3})^2$ or $81\pi \cdot \frac{1}{9}$

If all dimensions are multiplied by a factor of X, then the perimeter changes by a factor of X and the area changes by a factor of X^2.