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Similarity Transformations Problems - Guided Lesson Explanation

Explanation#1

Step 1) The image of the point (x,y) translated h units horizontally and k units vertically is (x+h,y+k). If h is positive the point is translated to the right and if h is negative the point is translated to the left. If k is positive the point is translated up and if k is negative the point is translated down.

Dilating a circle about its center multiplies its radius by the scale factor of the dilation.

Step 2) Find the translation that maps the center of S to the center S′. The difference in the x-coordinates of S′ (0, 3) and S (-7, -4) and is 0-(-7)= 7. The difference in the y-coordinates of S′ (0, 3) and S (-7, -4) is 3-(-4)= 7.

Step 3) So, if you shift S(-7, -4) 7 units to the right and 7 units up, you arrive at S′ (0, 3). In other words, the translation that maps S (-7, -4) to S′(0, 3) is given by the rule (x, y) → (x+7, y+7).

Step 4) After translating center of S to the center of S′, dilate S about its new center to expand S onto S′. To find the scale factor of this dilation, calculate the ratio of radii. Notice that the radius of S′ is 6 and the radius of S is 3. Since you are expanding S onto S′, the dilation scale factor is the ratio of 6 to 3, which is 2.

Step 5) In summary, the translation and scale factor are:

Translation: (x, y) → (x+7, y+7)

Scale factor: 2

Explanation#2

Step 1) The origin is the point (3, 6).

The image of the point (x,y) translated h units horizontally and k units vertically is (x+h,y+k). If h is positive the point is translated to the right and if h is negative the point is translated to the left. If k is positive the point is translated up and if k is negative the point is translated down.

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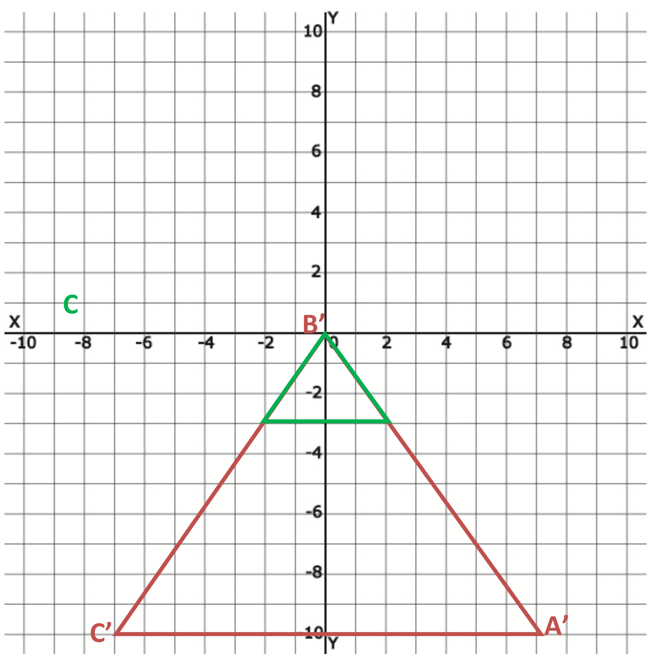
The image of the point (x,y) dilated with a scale factor of s centered at the origin is (sx,sy).

Since the dilation is centered at the origin, make sure that one pair of corresponding vertices is located at the origin before you apply the dilation. This makes sure that the dilation will not affect the coordinates of these points. (In general, it is always the case that the center of the dilation is not affected by the dilation.)

Step 2) From the diagram, you can see that B′ is already locked at the origin. So, find the translation that maps B (-6, 4) to B′ (0, 0).

Step 3) To translate B (-6, 4) to B′ (0, 0), move 6 units to right and 4 units Down. So, the translation that maps B to B′ is given by the rule (x, y) ⟶ (x+6, y-4). Next, apply this translation rule to the three vertices of ΔABC. The image of B is B′, the image of BA lies on top of B′A′, and the image of BC lies on top of B′C′.



Step 4) Now, find the scale factor of the dilation that will expand the image of ΔABC onto ΔA′B′C′. Choose a pair of corresponding vertices not located at the origin, like A′ (7, -10) and the image of E after the translation, which is (2, -3).

Step 5) Calculate the ratio of the x-coordinates or the ratio of the y-coordinates. For instance, the ratio of the x-coordinates is 7/2= 3.5, So the

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scale factor of the dilation that maps (2, -3) onto A′ (7, -10) is 3.5. This dilation also map the image of C, which is (-2, -3), onto G′ (-7, -10) and fixes both B and B′

Step 6) In the summary, the translation and scale factor are:

Translation: (x, y)→ (x+6, y-4)

Scale Factor: 3.5

Explanation#3

Step 1) The image of the point (x,y) translated h units horizontally and k units vertically is (x+h,y+k). If h is positive the point is translated to the right and if h is negative the point is translated to the left. If k is positive the point is translated up and if k is negative the point is translated down.

Dilating a circle about its center multiplies its radius by the scale factor of the dilation.

Step 2) Find the translation that maps the center of R to the center R′. The difference in the x-coordinates of R′ (-1, 3) and R (-5, 2) and is (-1)-(-5)= -4. The difference in the y-coordinates of S′ (-1, 3) and S (-5, 2) is 3-2= 1.

Step 3) So, if you shift R(-7, -4) 4 units to the right and 1 units up, you arrive at R′ (-1, 3). In other words, the translation that maps R (-5, 2) to R′ (-1, 3) is given by the rule (x, y)⟶ (x+4, y+1).

Step 4) After translating center of S to the center of R′, dilate R about its new center to expand R onto R′. To find the scale factor of this dilation, calculate the ratio of radii. Notice that the radius of R′ is 7 and the radius of R is 2. Since you are expanding R onto R′, the dilation scale factor is the ratio of 7 to 2, which is 3.5.

Step 5) In summary, the translation and scale factor are:

Translation: (x, y)→(x+4, y+1)

Scale factor: 3.5