Grade 7- Critical Attributes of Similarity

7(5)(A) **Proportionality.** The student applies mathematical process standards to use geometry to describe or solve problems involving proportional relationships. The student is expected to generalize the critical attributes of similarity, including ratios within and between similar shapes.

Materials:

- **Testing Triangle Ratios** (print with "No Scaling")
- Metric Ruler – 1 per student
- Protractor or Patty Paper (1-2 sheets per student)

Testing Triangle Ratios

Part A

Use the **Shape Templates** shown below and a metric ruler to complete the following: Measure to the nearest tenth of a centimeter.

1. Comparing Triangle *B* to Triangle *A*

	Base Length (cm)	Height (cm)	$\frac{h}{b}$
Triangle *A*			
Triangle *B*			

How do the ratios of $\frac{h}{b}$ within each of these two triangles compare?

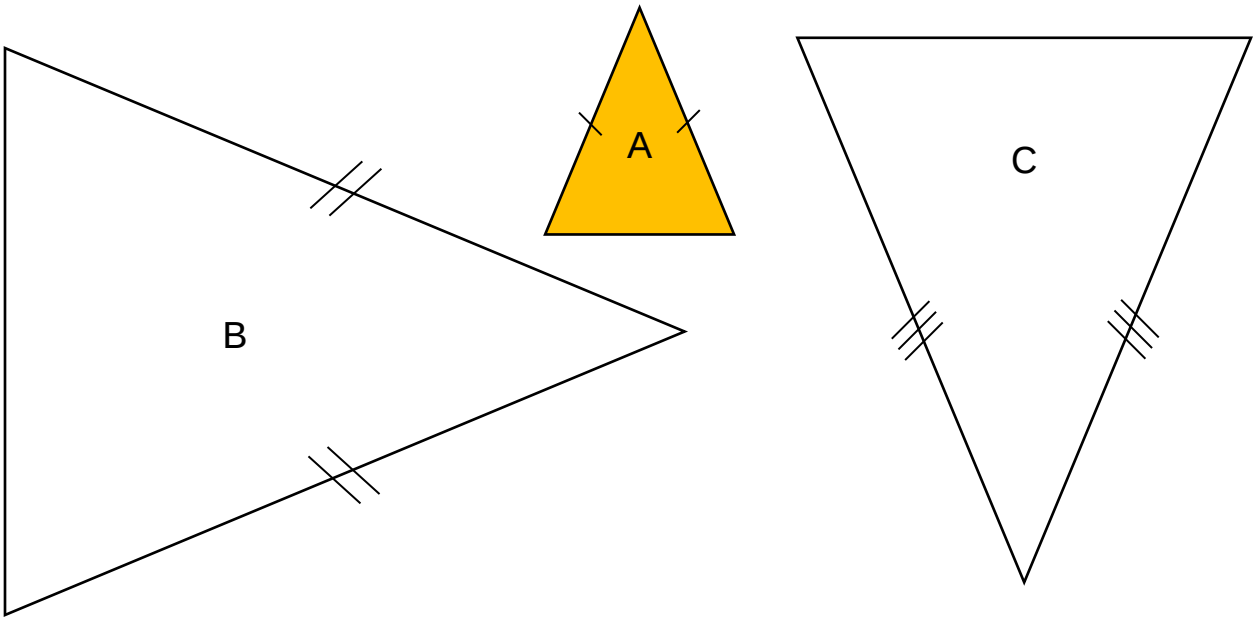
2. Comparing Triangle *C* to Triangle *A*

	Base Length (cm)	Height (cm)	$\frac{h}{b}$
Triangle *A*			
Triangle *C*			

How do the ratios of $\frac{h}{b}$ within each of these two triangles compare?

Do you think these three triangles are similar to each other? Justify your conjecture.

Shape Templates (Part A)



Testing Triangle Ratios (Continued)

Part B

Use the **Shape Templates** shown below and a metric ruler to complete the following. Measure to the nearest tenth of a centimeter.

3. Comparing Triangle *E* to Triangle *D*

	Base Length (cm)	Height (cm)	$\frac{h}{b}$
Triangle *D*			
Triangle *E*			

How do the ratios of $\frac{h}{b}$ within each of these two triangles compare?

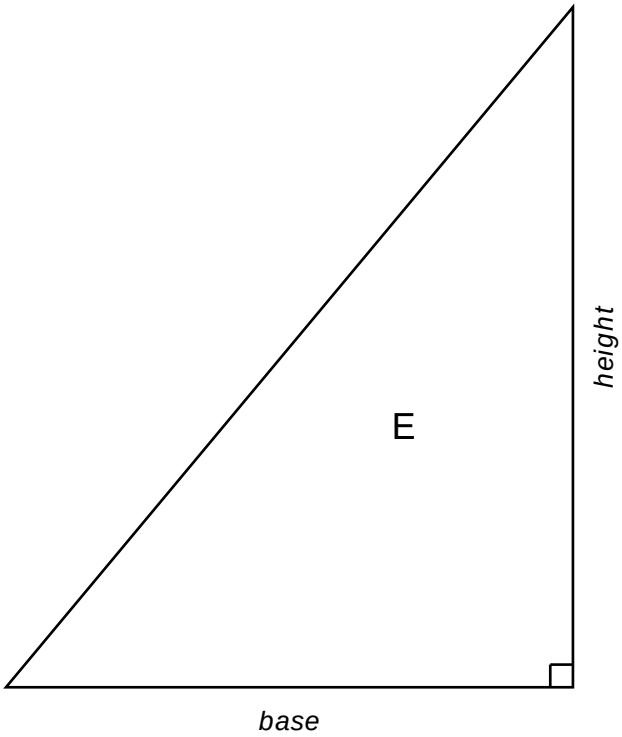
4. Comparing Triangle *F* to Triangle *D*

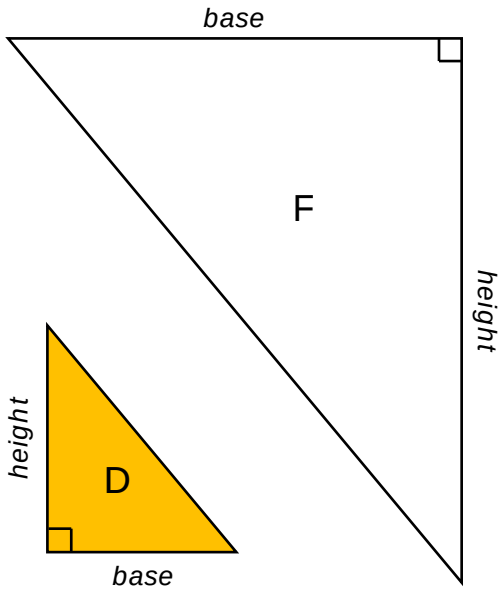
	Base Length (cm)	Height (cm)	$\frac{h}{b}$
Triangle *D*			
Triangle *F*			

How do the ratios of $\frac{h}{b}$ within each of these two triangles compare?

Do you think these three triangles are similar to each other? Justify your conjecture.

Shape Templates (Part B)





Testing Triangle Ratios (Continued)

Summary

Work with a partner to answer the following questions:

5. What do you notice about the height-to-base ratios of all six of the triangles, *A, B, C, D, E,* and *F*? Do you think the six triangles are all similar to each other? Why or why not?

6. Based on the height-to-base ratios and the angle relationships, what inferences can you make about triangles *A, B,* and *C*?

7. Based on the height-to-base ratios and the angle relationships, what inferences can you make about triangles *D, E,* and *F*?

8. Based on the height-to-base ratios and the angle relationships, what inferences can you make about triangles *A, B, C, D, E,* and *F*?

9. If you are given a new set of triangles, describe a process you could use to determine if they are similar to each other.

Answer Key:

Part A

Comparing Triangle *B* to Triangle *A*

1

	Base Length (cm)	Height (cm)	$\frac{h}{b}$
Triangle *A*	**2.5**	**3**	$\frac{\mathbf{3}}{\mathbf{2.5}} = \frac{\mathbf{6}}{\mathbf{5}}$
Triangle *B*	**7.5**	**9**	$\frac{\mathbf{9}}{\mathbf{7.5}} = \frac{\mathbf{90}}{\mathbf{75}} = \frac{\mathbf{6}}{\mathbf{5}}$

How do the ratios of $\frac{h}{b}$ within each of these two triangles compare?

They are the same.

Comparing Triangle *C* to Triangle *A*

2

	Base Length (cm)	Height (cm)	$\frac{h}{b}$
Triangle *A*	**2.5**	**3**	$\frac{\mathbf{3}}{\mathbf{2.5}} = \frac{\mathbf{6}}{\mathbf{5}}$
Triangle *C*	**6**	**7.2**	$\frac{\mathbf{7.2}}{\mathbf{6}} = \frac{\mathbf{72}}{\mathbf{60}} = \frac{\mathbf{6}}{\mathbf{5}}$

How do the ratios of $\frac{h}{b}$ within each of these two triangles compare?

They are the same.

Do you think these three triangles are similar to each other? Justify your conjecture.

Possible responses include the following: Yes, I think these triangles are all similar to each other. The equivalent base-to-height ratios within each of the triangles lets me know they all have the same shape.

No, I don't think these triangles are necessarily similar because I don't know if the corresponding angles are congruent.

Part B

Comparing Triangle *E* to Triangle *D*

3

	Base Length (cm)	Height (cm)	$\frac{h}{b}$
Triangle *D*	**2.5**	**3**	$\frac{\mathbf{3}}{\mathbf{2.5}} = \frac{\mathbf{6}}{\mathbf{5}}$
Triangle *E*	**7.5**	**9**	$\frac{\mathbf{9}}{\mathbf{7.5}} = \frac{\mathbf{90}}{\mathbf{75}} = \frac{\mathbf{6}}{\mathbf{5}}$

How do the ratios of $\frac{h}{b}$ within each of these two triangles compare?

They are the same.

Comparing Triangle *F* to Triangle *D*

4

	Base Length (cm)	Height (cm)	$\frac{h}{b}$
Triangle *D*	**2.5**	**3**	$\frac{\mathbf{3}}{\mathbf{2.5}} = \frac{\mathbf{6}}{\mathbf{5}}$
Triangle *F*	**6**	**7.2**	$\frac{\mathbf{7.2}}{\mathbf{6}} = \frac{\mathbf{72}}{\mathbf{60}} = \frac{\mathbf{6}}{\mathbf{5}}$

How do the ratios of $\frac{h}{b}$ within each of these two triangles compare?

They are the same.

Do you think these three triangles are similar to each other? Justify your conjecture.

Possible responses include the following: Yes, I think these triangles are all similar to each other. The equivalent base to height ratios within each of the triangles lets me know they all have the same shape.

No, I don't think these triangles are necessarily similar because I don't know if the corresponding angles are congruent.

Summary

Possible responses include:

5. What do you notice about the height-to-base ratios of all six of the triangles, *A, B, C, D, E,* and *F*? Do you think the six triangles are all similar to each other? Why or why not?
   I noticed that the base-to-height ratios of the six triangles are all congruent. Originally, I thought this meant the triangles must be similar to each other, but I can see from looking at the triangles that they are not all similar. I think they are not similar because the corresponding angles are not congruent.

6. Based on the height-to-base ratios and the angle relationships, what inferences can you make about triangles *A, B,* and *C*?
   I used patty paper to compare the measures of corresponding angles and verified that for these three triangles, the corresponding angles are congruent. I already knew the base-to-height ratios within each of these three triangles are also congruent. Because both of these conditions are true, I know that triangles *A, B*, and *C* are all similar to each other.

7. Based on the height-to-base ratios and the angle relationships, what inferences can you make about triangles *D, E,* and *F*?
   I used patty paper to compare the measures of corresponding angles and verified that for these three triangles, the corresponding angles are congruent. I already knew the base-to-height ratios within each of these three triangles are also congruent. Because both of these conditions are true, I know that triangles *D, E*, and *F* are all similar to each other.

8. Based on the height to base ratios and the angle relationships, what inferences can you make about triangles *A, B, C, D, E,* and *F*?
   Triangles *D, E*, and *F* are right triangles. Triangles *A, B*, and *C* are acute triangles. Therefore I know that they do not have congruent corresponding angles. Even though the base-to-height ratios among all six triangles are congruent, they cannot be all similar to each other because both conditions are not true.

9. If you are given a new set of triangles, describe a process you could use to determine if they are similar to each other.
   I would have to show that both the corresponding angles are congruent and the corresponding side lengths are proportional.