Math TODAY™
Student Edition

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Ballooning inside the box

Sources: FireFly Balloons; howstuffworks.com; Albuquerque International Balloon Fiesta
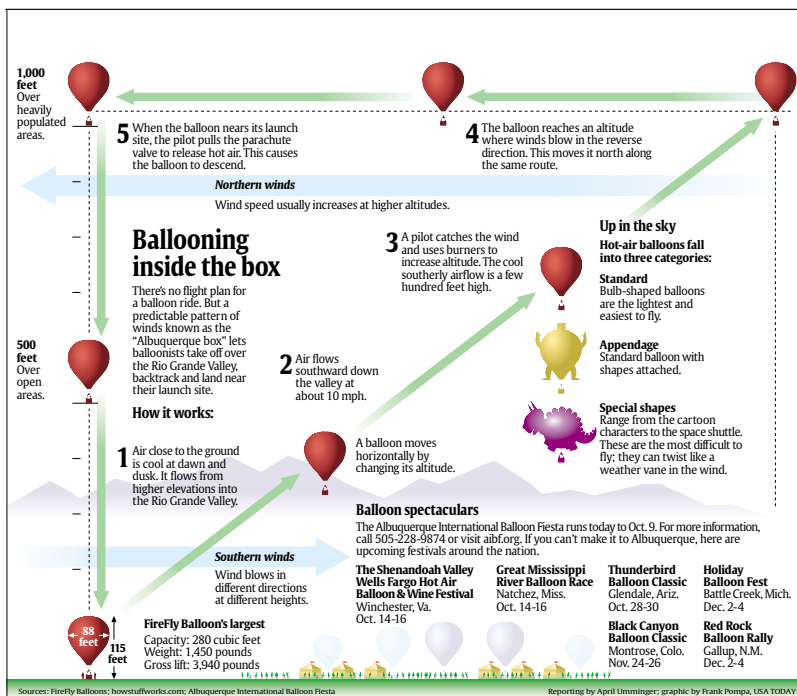
Reporting by April Umminger; graphic by Frank Pompa, USA TODAY

Activity Overview:

Using the USA TODAY Infograph, "Ballooning inside the box," you will explore the geometric relationships using similar triangles. You will use triangles with two pairs of congruent angles to explore similarity properties of the triangles. You will explore what happens to the ratios of corresponding sides of a variety of similar triangles. Finally, the relationships found will be applied to determine the height of a hot-air balloon indirectly.

Focus Questions:

Q. Maggie places a mirror on the ground 40.5 feet from the base of the basket. She walks backwards until she can see the top of the balloon in the middle of the mirror. At that point, Maggie's eyes are 5 feet off the ground and she is 2 feet from the mirror. What is the height of the balloon that Maggie is watching?

Q. A balloon is anchored to the ground at the beginning of a race with a cable. The cable forms a perpendicular line from the basket to the ground. Maggie places a mirror on the ground 150 feet from the perpendicular line and walks backward until she can see the bottom of the basket in the mirror. Her eyes are 5 feet off the ground and she is 8 feet from the mirror. What is the altitude of the bottom of the basket?

Q. Maggie is watching a balloon coming down. The balloon drops a 50 foot rope that forms a perpendicular with the ground. She is 6 feet from her mirror and looking at the bottom of the balloon in the mirror. She is kneeling and her eye level is 3 feet from the ground. How far is the mirror from the perpendicular line formed between the rope and ground?

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This activity was created for use with Texas Instruments handheld technology.

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Procedure:

Activity 1: You will explore geometric relationships with similar triangles. Complete Activity 1 before answering the Focus Questions.

Step 1. Press   and select Cabri Jr. and press ⊆.

Step 2. Press ⊥ (Y = button), select *Open…*, and press ⊆. Highlight **SIMILAR** and press ⊆. Look at the two triangles ABC and DEF, what conclusion can you make about them? _____

Step 3. Press β, choose *Calculate*, and press ⊆. Determine the three ratios in the lower right corner of the screen. Move the pointer to the measure of AC and press ⊆. Move the pointer to the measure of DF, press ∞ and ⊆ to calculate the ratio for AC:DF. Move this value to AC:DF on the screen and press ⊆. Repeat this procedure for the other ratios and press   when finished. What can you conclude about these ratios?_____

_____

_____

Step 4. Move the pointer to C and press . Grab and move C to change the measures for angles A and B. Press ⊆. Repeat the same procedure for F. Remember to keep the corresponding angle measures the same.

Step 5. After you have made a number of these changes, what can you conclude about the ratios? _____

Step 6. Complete the following:

• If two angles of one triangle are congruent to two angles of another triangle, then the triangles are _____.

• In similar figures, ratios of corresponding sides are _____.

Data Source:

FireFly Balloons; howstuffworks.com; Albuquerque International Balloon Fiesta

Materials:

• TI-83 Plus family or TI-84 Plus family
• Cabri™ Jr. Application

Additional Information:

Ballooning inside the box

Procedure:

Activity 2: Use the information from Activity 1 and the USA TODAY Infograph "Ballooning inside the box" to answer the Focus Questions.

Student Notes:

Step 1. Maggie places a mirror on the ground 40.5 feet from the base of the basket. She walks backwards until she can see the top of the balloon in the middle of the mirror. At that point, Maggie's eyes are 5 feet off the ground and she is 2 feet from the mirror. What is the height of the balloon that Maggie is watching? _____

Step 2. A balloon is anchored to the ground at the beginning of a race with a cable. The cable forms a perpendicular line from the basket to the ground. Maggie places a mirror on the ground 150 feet from the perpendicular line and walks backward until she can see the bottom of the basket in the mirror. Her eyes are 5 feet off the ground and she is 8 feet from the mirror. What is the altitude of the bottom of the basket? _____

Step 3. Maggie is watching a balloon coming down. The balloon drops a 50 foot rope that forms a perpendicular with the ground. She is 6 feet from her mirror and looking at the bottom of the balloon in the mirror. She is kneeling and her eye level is 3 feet from the ground. How far is the mirror from the perpendicular line formed between the rope and ground? _____