

# MYSTERY PICTURE

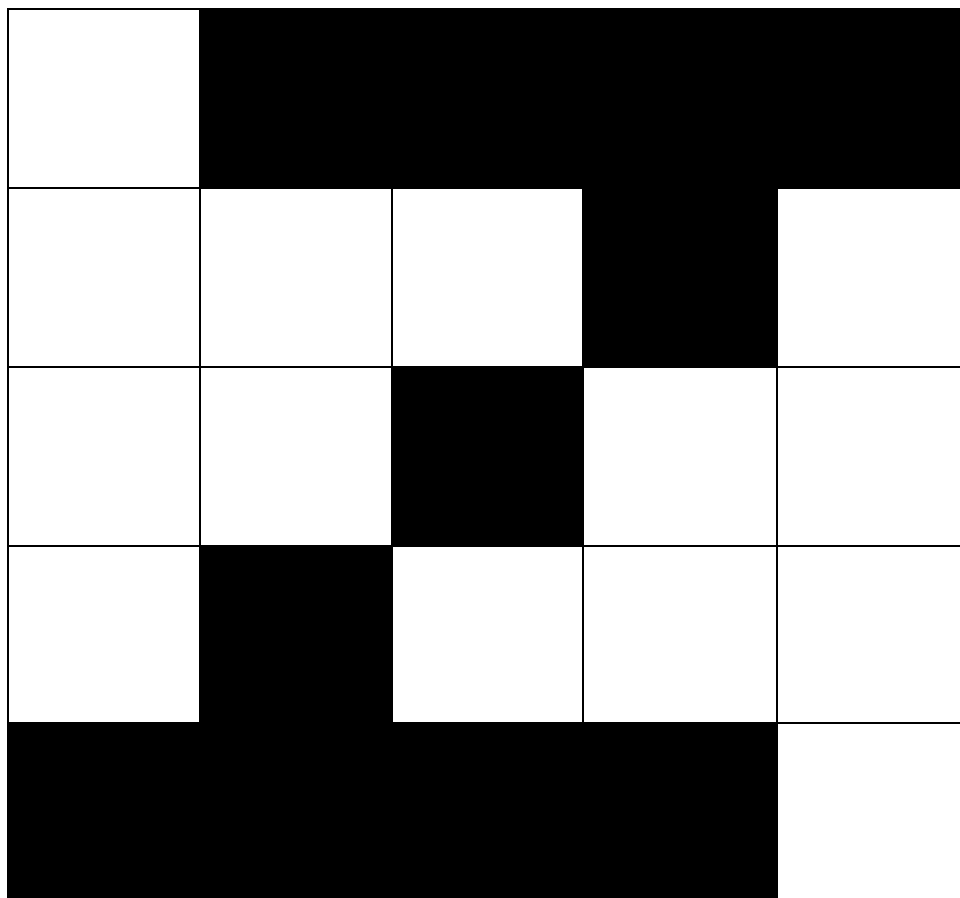


## SSS AND SAS SIMILARITY

### Do the Facts Prove It?

25 squares of sides, ratios and angles · SSS Similarity, SAS Similarity, AA, or nothing

**FREE**



1. **Hand out page 3**, one per student. Pencils. Calculators are not needed.
2. **Say this once:** *“Do the facts prove the two triangles similar? Use SSS Similarity, SAS Similarity or AA. Sort the sides from longest to shortest before you divide. If the facts prove it, fill the square. If not, leave it white.”*
3. **When a student finishes, look at the picture.** If it is not the letter Z, a square is wrong. The student finds it and checks it again.

|                      |                                                                                            |
|----------------------|--------------------------------------------------------------------------------------------|
| <b>Student sheet</b> | page 3, one per student. It shows SSS Similarity, SAS Similarity and AA as small drawings. |
| <b>Answers</b>       | page 4: the finished picture and the reason for every square.                              |

**This sheet practices one decision: is there a criterion?** A square is filled when SSS Similarity, SAS Similarity or AA proves the triangles similar. It is white when no criterion fits. In nine squares there are no numbers at all, only ratios and equal angles. The student reads which sides the ratios use, and where the equal angle is. For SAS Similarity, the equal angle must be at the letter that the two sides share.

**The numbers are easy on purpose.** Every factor is 2, 3, one half or one third, so the work is the deciding, not the dividing. Three mistakes turn squares the wrong way. A student who divides the sides in the order they are printed, without sorting them, gets four squares wrong. A student who checks whether every side grew by the same amount gets six squares wrong. Students also take two equal ratios and any equal angle as enough. One square holds the two familiar right triangles 6, 8, 10 and 5, 12, 13. They are not similar. One square holds two four-sided shapes. These criteria are only about triangles, so it stays white.

**Eleven squares are filled and fourteen are white.** Guessing does not work. Every simple guessing rule, such as filling the squares that show an angle, gets at least ten squares wrong.

**The names on these sheets.** The sheets write SSS Similarity and SAS Similarity, so that they are not mixed up with the congruence criteria SSS and SAS. The angle criterion is written AA. Some textbooks write SSS~ and SAS~, or use other definitions, so tell the class which ones this sheet uses.



**This is the free lesson this activity came from.** The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.  
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# Mystery Picture

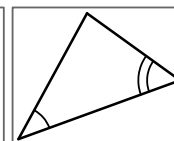
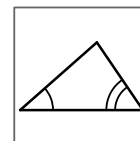
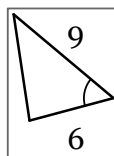
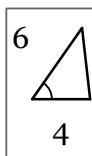
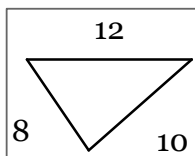
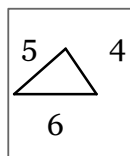
Do the facts prove it?

Name \_\_\_\_\_

Period \_\_\_\_\_

Date \_\_\_\_\_

Each square gives facts about two triangles,  $\triangle ABC$  and  $\triangle DEF$ . Do the facts prove that the two triangles are similar? If yes, fill the square with slanted lines. If no, leave it white.



**SSS Similarity.** All three pairs of sides are in the same ratio.

**SAS Similarity.** Two pairs of sides are in the same ratio, and the angles **between** them are equal.

**AA.** Two pairs of angles are equal.

Match the sides by size, not by the letters. Write each triangle's sides from longest to shortest. Then divide longest by longest, middle by middle, and shortest by shortest. The angle **between** two sides is at the corner where they meet. It is at the letter the two side names share. These criteria are about triangles only.

When you finish, look at the picture. If part of it is missing, or one square does not fit, check that square again.

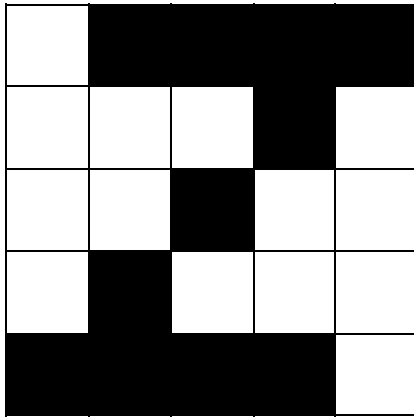
|                                                                     |                                                                                          |                                                                                          |                                                     |                                                                                          |
|---------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------|
| 1<br>DE/AB = EF/BC<br>$\angle A = \angle D$                         | 2<br>AB = 4, BC = 6, CA = 5<br>DE = 12, EF = 8, FD = 10                                  | 3<br>DE/AB = DF/AC<br>$\angle A = \angle D$                                              | 4<br>$\angle B = \angle E$<br>$\angle C = \angle F$ | 5<br>AB = 5, AC = 8, $\angle A = 40^\circ$<br>DE = 10, DF = 16,<br>$\angle D = 40^\circ$ |
| 6<br>Triangle sides<br>3, 4, 5<br>and 5, 6, 7                       | 7<br>DE/AB = EF/BC                                                                       | 8<br>AB = 6, BC = 4, $\angle A = 35^\circ$<br>DE = 12, EF = 8,<br>$\angle D = 35^\circ$  | 9<br>DE/AB = EF/BC =<br>FD/CA                       | 10<br>Triangle sides<br>4, 6, 7<br>and 8, 12, 15                                         |
| 11<br>Two four-sided shapes.<br>Sides 2, 3, 2, 3<br>and 4, 6, 4, 6. | 12<br>AB = 4, AC = 6, $\angle A = 70^\circ$<br>DE = 8, DF = 10,<br>$\angle D = 70^\circ$ | 13<br>Triangle sides<br>2, 3, 4<br>and 9, 6, 12                                          | 14<br>AB = 5<br>DE = 10<br>$\angle A = \angle D$    | 15<br>Triangle sides<br>6, 8, 10<br>and 5, 12, 13                                        |
| 16<br>EF/BC = FD/CA<br>$\angle B = \angle E$                        | 17<br>EF/BC = FD/CA<br>$\angle C = \angle F$                                             | 18<br>AB = 3, AC = 5, $\angle A = 60^\circ$<br>DE = 6, DF = 10,<br>$\angle D = 65^\circ$ | 19<br>Triangle sides<br>8, 10, 12<br>and 4, 5, 7    | 20<br>DE/AB = FD/CA<br>$\angle B = \angle E$                                             |
| 21<br>AB = 6, BC = 9, CA = 8<br>DE = 16, EF = 12,<br>FD = 18        | 22<br>AB = 9, AC = 6, $\angle A = 80^\circ$<br>DE = 3, DF = 2, $\angle D = 80^\circ$     | 23<br>$\angle A = \angle F$<br>$\angle B = \angle D$                                     | 24<br>Triangle sides<br>10, 6, 8<br>and 5, 4, 3     | 25<br>AB = 2, BC = 3, CA = 4<br>DE = 4, EF = 5, FD = 6                                   |



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# Mystery Picture — answers

For the teacher



The finished picture is **the letter Z**: a top bar, a slanted stroke, and a bottom bar.

A square is filled when SSS Similarity, SAS Similarity or AA proves the triangles similar. To compare sides, sort each triangle's sides from longest to shortest, then divide. For SAS Similarity the equal angle must be where the two sides meet.

A square is white when no criterion fits.

|       |                                                                                                                                                                                                                                                                                                                |                                                                                                                              |                                                                                                                                                                                                            |                                                                                                       |                                                                                                                                            |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| 1–5   | <b>1 · white</b><br>The equal angle is at A, and AB and BC do not meet at A. No criterion fits.                                                                                                                                                                                                                | <b>2 · FILL</b><br>Sorted: 6, 5, 4 and 12, 10, 8. $12 \div 6 = 10 \div 5 = 8 \div 4$ : SSS Similarity.                       | <b>3 · FILL</b><br>$\angle A$ is between AB and AC, where they meet. Two ratios and the angle between them: SAS Similarity.                                                                                | <b>4 · FILL</b><br>$\angle B = \angle E$ and $\angle C = \angle F$ : two pairs of equal angles, AA.   | <b>5 · FILL</b><br>$\angle A = \angle D = 40^\circ$ , between the two sides. $10 \div 5 = 16 \div 8$ : SAS Similarity.                     |
| 6–10  | <b>6 · white</b><br>Sorted: 5, 4, 3 and 7, 6, 5. Every side is longer by the same amount, but $6 \div 4$ is not $7 \div 5$ : not similar.                                                                                                                                                                      | <b>7 · white</b><br>Only two ratios and no angle. SSS Similarity needs all three ratios.                                     | <b>8 · white</b><br>The equal angle is at A, and AB and BC do not meet at A. No criterion fits. Two different triangles fit these facts.                                                                   | <b>9 · FILL</b><br>Three ratios, one for each pair of sides: SSS Similarity.                          | <b>10 · white</b><br>Sorted: 7, 6, 4 and 15, 12, 8. $12 \div 6$ is not $15 \div 7$ : not similar.                                          |
| 11–15 | <b>11 · white</b><br>These are four-sided shapes, and the criteria are only about triangles. The sides fit a 2-by-3 rectangle, with $90^\circ$ corners, and a slanted 4-by-6 shape, with $60^\circ$ and $120^\circ$ corners. The sides are in one ratio, but the corners differ, so these two are not similar. | <b>12 · white</b><br>The angle is between the sides, but $8 \div 4$ is not $10 \div 6$ . Not proved.                         | <b>13 · FILL</b><br>Sorted: 4, 3, 2 and 12, 9, 6. $12 \div 4 = 9 \div 3 = 6 \div 2$ : SSS Similarity.                                                                                                      | <b>14 · white</b><br>One pair of equal angles and one pair of sides. No criterion fits.               | <b>15 · white</b><br>Sorted: 10, 8, 6 and 13, 12, 5. $12 \div 8$ is not $13 \div 10$ : not similar.                                        |
| 16–20 | <b>16 · white</b><br>The equal angle is at B, and BC and CA do not meet at B. No criterion fits.                                                                                                                                                                                                               | <b>17 · FILL</b><br>$\angle C$ is between BC and CA, where they meet. Two ratios and the angle between them: SAS Similarity. | <b>18 · white</b><br>Two pairs of sides are in one ratio: $6 \div 3 = 10 \div 5$ . But the angle between them differs, $\angle A = 60^\circ$ and $\angle D = 65^\circ$ , so SAS Similarity does not apply. | <b>19 · white</b><br>Sorted: 12, 10, 8 and 7, 5, 4. $5 \div 10$ is not $7 \div 12$ : not similar.     | <b>20 · white</b><br>The equal angle is at B, and AB and CA do not meet at B. No criterion fits.                                           |
| 21–25 | <b>21 · FILL</b><br>Sorted: 9, 8, 6 and 18, 16, 12. $18 \div 9 = 16 \div 8 = 12 \div 6$ : SSS Similarity.                                                                                                                                                                                                      | <b>22 · FILL</b><br>$\angle A = \angle D = 80^\circ$ , between the two sides. $3 \div 9 = 2 \div 6$ : SAS Similarity.        | <b>23 · FILL</b><br>$\angle A = \angle F$ and $\angle B = \angle D$ : two pairs of equal angles, AA.                                                                                                       | <b>24 · FILL</b><br>Sorted: 10, 8, 6 and 5, 4, 3. $5 \div 10 = 4 \div 8 = 3 \div 6$ : SSS Similarity. | <b>25 · white</b><br>Sorted: 4, 3, 2 and 6, 5, 4. Every side is longer by the same amount, but $5 \div 3$ is not $6 \div 4$ : not similar. |