

# MYSTERY PICTURE

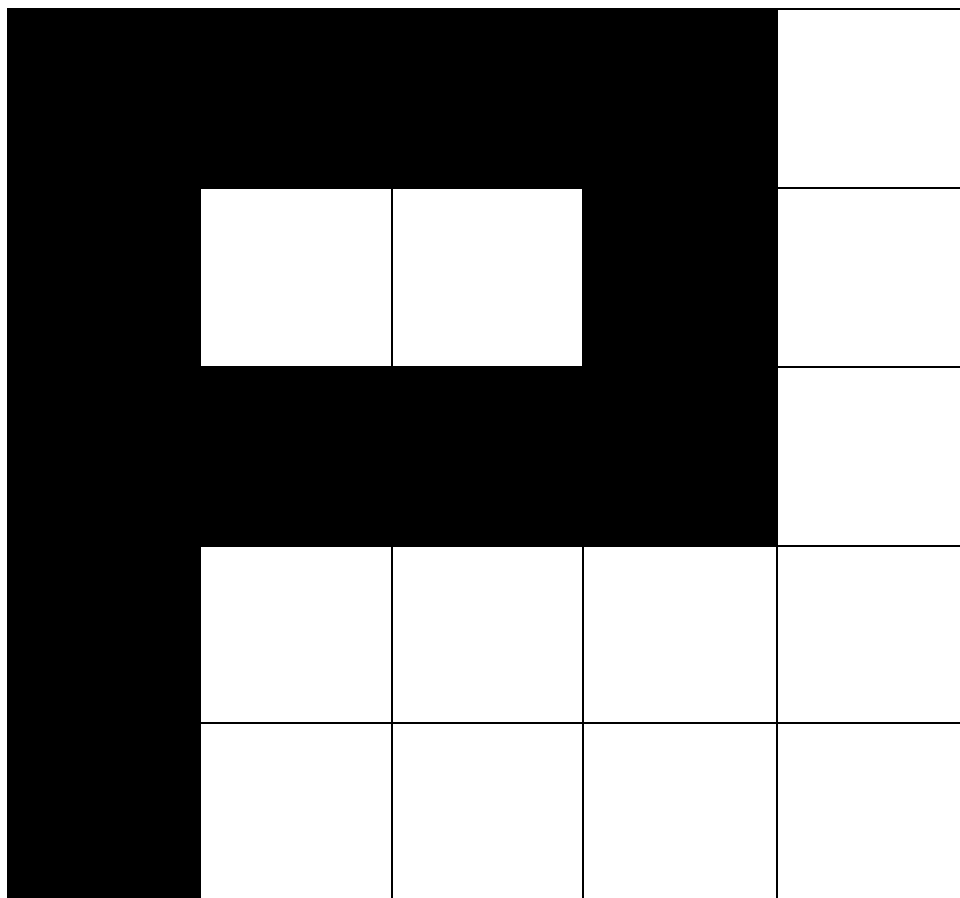


## CPCTC: CORRESPONDING PARTS OF CONGRUENT TRIANGLES

Is the Reason Right? CPCTC or a Criterion

25 rows of a proof · into or out of a congruence

FREE



# Mystery Picture — how to run it

25–35 minutes

1. **Hand out page 3**, one per student. Pencils. Nothing else is needed.
2. **Say this once:** *“A criterion like SAS proves the triangles congruent. CPCTC comes after that, and it proves one pair of parts. In each square, is the reason right for the row? If yes, fill the square.”*
3. **When a student finishes, look at the picture.** If it is not the letter P, a square is wrong. The student finds it and checks it again.

|                      |                                                                                                                      |
|----------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Student sheet</b> | page 3, one per student. The box at the top shows the four criteria as small marked triangles, and what CPCTC means. |
| <b>Answers</b>       | page 4: the finished picture and the reason for every square.                                                        |

**This sheet practices one idea: which way each reason works.** A criterion (SSS, SAS, ASA or AAS) gets a proof into a congruence: it is the reason for the row  $\triangle ABC \cong \triangle DEF$ . CPCTC gets a proof out of it: after the triangles are proved congruent, it is the reason for one pair of matching parts. CPCTC stands for “corresponding parts of congruent triangles are congruent.” Many students read the last words, “triangles are congruent,” and write “ $\triangle ABC \cong \triangle DEF$ , by CPCTC.” Four squares show that row, and the answer is always white.

**In seven squares the facts decide the answer.** CPCTC can be used only after the triangles are proved congruent. Two sides and an angle that is not between them (SSA), or three angles, prove nothing, so CPCTC cannot follow them. A criterion must also be the one the facts really are. A student who only checks the direction of the reason gets seven squares wrong, and the picture shows it.

**Twelve squares are filled and thirteen are white.** Guessing does not work. Every simple guessing rule, such as filling every CPCTC row, gets at least nine squares wrong.



**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

Is the reason right?

Name \_\_\_\_\_

Period \_\_\_\_\_

Date \_\_\_\_\_

**INTO a congruence.** These facts prove  $\triangle ABC \cong \triangle DEF$ . The reason is the name.



SSS



SAS



ASA



AAS



SSA



AAA

These prove nothing.

**OUT OF a congruence.** After  $\triangle ABC \cong \triangle DEF$  is proved, every matching part is congruent. The reason is **CPCTC**: Corresponding Parts of Congruent Triangles are Congruent.  
A matches D. B matches E. C matches F.

Every square is about  $\triangle ABC$  and  $\triangle DEF$ . Above the line are three given facts. Below the line is one row of a proof, with its reason. Is the reason right for that row? If yes, fill the square with slanted lines. If no, leave it white.  
When you finish, look at the picture. If part of it is missing, or one square does not fit, check that square again.

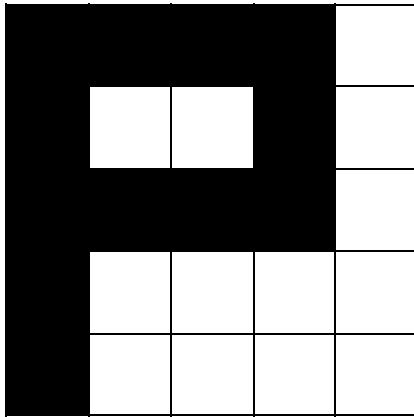
|                                                                                                                         |                                                                                                                              |                                                                                                                                        |                                                                                                                                                  |                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| 1<br>$AB \cong DE$<br>$\angle B \cong \angle E$<br>$BC \cong EF$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by SAS | 2<br>$AB \cong DE$<br>$BC \cong EF$<br>$CA \cong FD$<br><hr/> $\angle B \cong \angle E$<br>by CPCTC                          | 3<br>$\angle A \cong \angle D$<br>$AB \cong DE$<br>$\angle B \cong \angle E$<br><hr/> $\angle C \cong \angle F$<br>by CPCTC            | 4<br>$\angle A \cong \angle D$<br>$\angle B \cong \angle E$<br>$BC \cong EF$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by AAS              | 5<br>$AB \cong DE$<br>$BC \cong EF$<br>$CA \cong FD$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by CPCTC                          |
| 6<br>$AB \cong DE$<br>$\angle A \cong \angle D$<br>$AC \cong DF$<br><hr/> $BC \cong EF$<br>by CPCTC                     | 7<br>$AB \cong DE$<br>$BC \cong EF$<br>$\angle C \cong \angle F$<br><hr/> $AC \cong DF$<br>by CPCTC                          | 8<br>$AB \cong DE$<br>$\angle B \cong \angle E$<br>$BC \cong EF$<br><hr/> $\angle A \cong \angle D$<br>by SAS                          | 9<br>$\angle B \cong \angle E$<br>$BC \cong EF$<br>$\angle C \cong \angle F$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by ASA              | 10<br>$AC \cong DF$<br>$BC \cong EF$<br>$\angle A \cong \angle D$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by SAS               |
| 11<br>$\angle B \cong \angle E$<br>$\angle C \cong \angle F$<br>$AB \cong DE$<br><hr/> $AC \cong DF$<br>by CPCTC        | 12<br>$AB \cong DE$<br>$BC \cong EF$<br>$CA \cong FD$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by SSS                 | 13<br>$BC \cong EF$<br>$\angle C \cong \angle F$<br>$CA \cong FD$<br><hr/> $\angle A \cong \angle D$<br>by CPCTC                       | 14<br>$AB \cong DE$<br>$\angle A \cong \angle D$<br>$AC \cong DF$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by SAS                         | 15<br>$\angle A \cong \angle D$<br>$AB \cong DE$<br>$\angle B \cong \angle E$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by CPCTC |
| 16<br>$\angle A \cong \angle D$<br>$\angle B \cong \angle E$<br>$BC \cong EF$<br><hr/> $AB \cong DE$<br>by CPCTC        | 17<br>$\angle A \cong \angle D$<br>$\angle B \cong \angle E$<br>$\angle C \cong \angle F$<br><hr/> $AB \cong DE$<br>by CPCTC | 18<br>$\angle B \cong \angle E$<br>$\angle C \cong \angle F$<br>$AB \cong DE$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by CPCTC | 19<br>$\angle A \cong \angle D$<br>$\angle B \cong \angle E$<br>$\angle C \cong \angle F$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by ASA | 20<br>$AC \cong DF$<br>$BC \cong EF$<br>$\angle A \cong \angle D$<br><hr/> $\angle B \cong \angle E$<br>by CPCTC                       |
| 21<br>$\angle B \cong \angle E$<br>$BC \cong EF$<br>$\angle C \cong \angle F$<br><hr/> $AB \cong DE$<br>by CPCTC        | 22<br>$AB \cong DE$<br>$BC \cong EF$<br>$CA \cong FD$<br><hr/> $\angle C \cong \angle F$<br>by SSS                           | 23<br>$\angle A \cong \angle D$<br>$AB \cong DE$<br>$\angle B \cong \angle E$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by AAS   | 24<br>$AB \cong DE$<br>$BC \cong EF$<br>$\angle C \cong \angle F$<br><hr/> $\angle A \cong \angle D$<br>by CPCTC                                 | 25<br>$BC \cong EF$<br>$\angle C \cong \angle F$<br>$CA \cong FD$<br><hr/> $\triangle ABC \cong \triangle DEF$<br>by CPCTC             |



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# Mystery Picture — answers

For the teacher



The finished picture is **the letter P**: a bar down the left side, with a closed loop at the top.

A square is filled when the reason is right. The row  $\triangle ABC \cong \triangle DEF$  needs the criterion the three facts are. A row about one pair of parts needs CPCTC, and only when the facts prove the triangles congruent.

A matches D, B matches E and C matches F in every square.

|       |                                                                                                                                                                                                      |                                                                                                                                                                                       |                                                                                                                                                                                                        |                                                                                                                                                              |                                                                                                                                                              |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1–5   | <b>1 · FILL</b><br>The facts are SAS: two sides and the angle between them. So SAS proves the triangles congruent.                                                                                   | <b>2 · FILL</b><br>The facts are SSS: three pairs of sides. So the triangles are congruent. $\angle B \cong \angle E$ is a matching pair that is not a given fact, so CPCTC gives it. | <b>3 · FILL</b><br>The facts are ASA: two angles and the side between them. So the triangles are congruent. $\angle C \cong \angle F$ is a matching pair that is not a given fact, so CPCTC gives it.  | <b>4 · FILL</b><br>The facts are AAS: two angles and a side that is not between them. So AAS proves the triangles congruent.                                 | <b>5 · white</b><br>CPCTC cannot prove the triangles congruent. It is used after they are proved. The reason here is SSS.                                    |
| 6–10  | <b>6 · FILL</b><br>The facts are SAS: two sides and the angle between them. So the triangles are congruent. $BC \cong EF$ is a matching pair that is not a given fact, so CPCTC gives it.            | <b>7 · white</b><br>The facts are SSA: two sides and an angle that is not between them. They do not prove the triangles congruent, so CPCTC cannot be used.                           | <b>8 · white</b><br>SAS proves two triangles congruent, not one pair of parts. The reason for $\angle A \cong \angle D$ is CPCTC, after the triangles are proved congruent.                            | <b>9 · FILL</b><br>The facts are ASA: two angles and the side between them. So ASA proves the triangles congruent.                                           | <b>10 · white</b><br>The facts are SSA: two sides and an angle that is not between them. That is not a criterion, so nothing proves the triangles congruent. |
| 11–15 | <b>11 · FILL</b><br>The facts are AAS: two angles and a side that is not between them. So the triangles are congruent. $AC \cong DF$ is a matching pair that is not a given fact, so CPCTC gives it. | <b>12 · FILL</b><br>The facts are SSS: three pairs of sides. So SSS proves the triangles congruent.                                                                                   | <b>13 · FILL</b><br>The facts are SAS: two sides and the angle between them. So the triangles are congruent. $\angle A \cong \angle D$ is a matching pair that is not a given fact, so CPCTC gives it. | <b>14 · FILL</b><br>The facts are SAS: two sides and the angle between them. So SAS proves the triangles congruent.                                          | <b>15 · white</b><br>CPCTC cannot prove the triangles congruent. It is used after they are proved. The reason here is ASA.                                   |
| 16–20 | <b>16 · FILL</b><br>The facts are AAS: two angles and a side that is not between them. So the triangles are congruent. $AB \cong DE$ is a matching pair that is not a given fact, so CPCTC gives it. | <b>17 · white</b><br>The facts are AAA: three pairs of angles. They do not prove the triangles congruent, so CPCTC cannot be used.                                                    | <b>18 · white</b><br>CPCTC cannot prove the triangles congruent. It is used after they are proved. The reason here is AAS.                                                                             | <b>19 · white</b><br>The facts are AAA: three pairs of angles. That is not a criterion, so nothing proves the triangles congruent.                           | <b>20 · white</b><br>The facts are SSA: two sides and an angle that is not between them. They do not prove the triangles congruent, so CPCTC cannot be used. |
| 21–25 | <b>21 · FILL</b><br>The facts are ASA: two angles and the side between them. So the triangles are congruent. $AB \cong DE$ is a matching pair that is not a given fact, so CPCTC gives it.           | <b>22 · white</b><br>SSS proves two triangles congruent, not one pair of parts. The reason for $\angle C \cong \angle F$ is CPCTC, after the triangles are proved congruent.          | <b>23 · white</b><br>The facts are ASA: two angles and the side between them. The reason should be ASA, not AAS.                                                                                       | <b>24 · white</b><br>The facts are SSA: two sides and an angle that is not between them. They do not prove the triangles congruent, so CPCTC cannot be used. | <b>25 · white</b><br>CPCTC cannot prove the triangles congruent. It is used after they are proved. The reason here is SAS.                                   |