

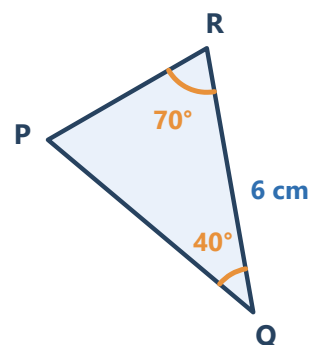
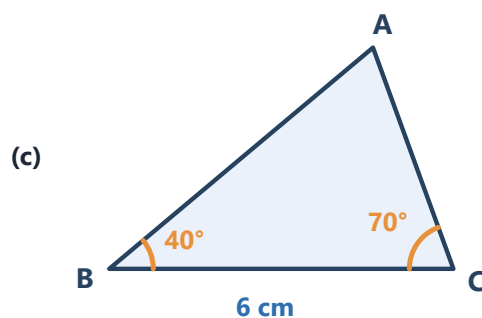
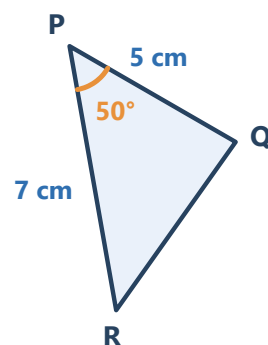
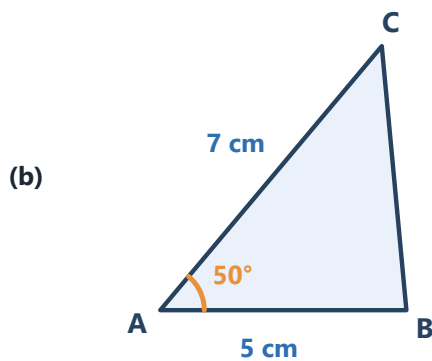
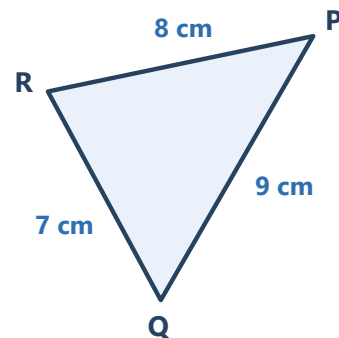
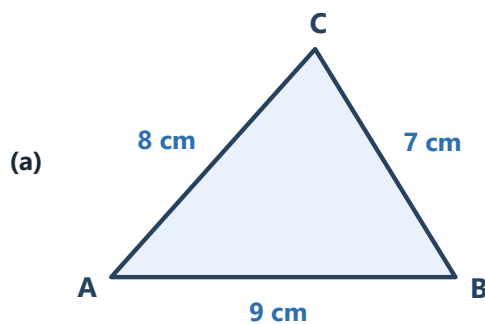
GCSE Maths: Congruent shapes and triangles (Higher): answers

GCSE Maths - Transformations and Similarity - Higher - Lesson 21.7

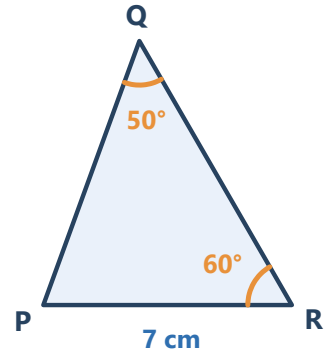
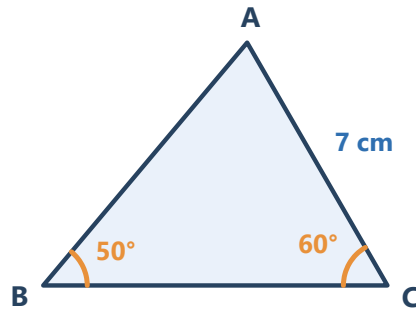
Answers. Final answers to the worksheet questions. Full step-by-step solutions for every question are free at websink.site/gcse/maths/ch21-transformations-congruence-similarity/higher/congruent-shapes-and-triangles/

Exercise 21G Congruent triangles Non-calculator

- 1 In each pair of triangles, the lengths and angles are shown. Say whether the triangles are congruent, and give the condition (SSS, SAS, ASA, AAS or RHS) if they are.



(d)



(a) Pair a

Answer: Congruent (SSS)

(b) Pair b

Answer: Congruent (SAS)

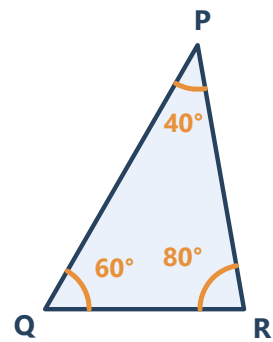
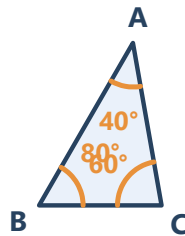
(c) Pair c

Answer: Congruent (ASA)

(d) Pair d

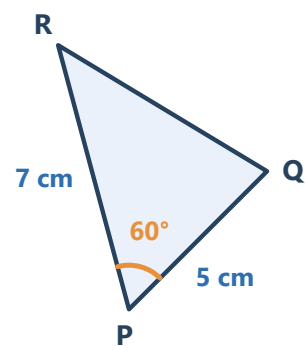
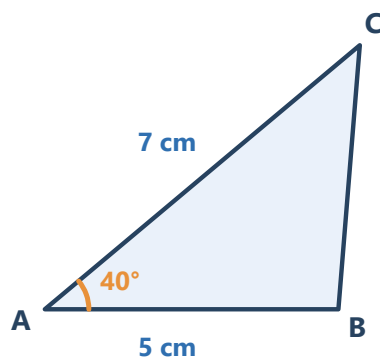
Answer: Congruent (AAS)

2 Are these two triangles congruent? Give a reason.



Answer: Not necessarily congruent

3 Are these two triangles congruent? Give a reason.



Answer: Not necessarily congruent

- 4 Triangle ABC has sides $AB = 5$ cm, $BC = 6$ cm and $CA = 7$ cm. Triangle PQR has $PQ = 5$ cm, $QR = 6$ cm and $RP = 8$ cm. Are the triangles congruent? Give a reason.

Answer: Not necessarily congruent

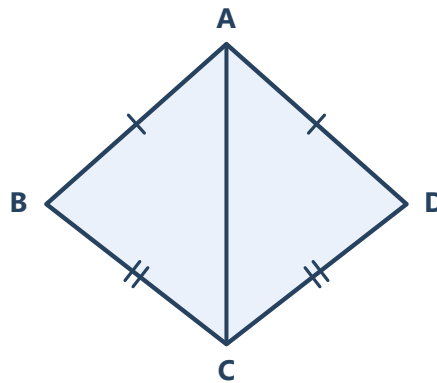
- 5 Triangle ABC has angles 50° , 60° and 70° . Triangle PQR has angles 50° , 60° and 70° and the side $PQ = 5$ cm. Anita says the triangles must be congruent. Explain why Anita could be wrong.

Answer: AAA is not enough: no side is known in ABC

- 6 Triangle ABC has $AB = 8$ cm, $AC = 6$ cm and angle $B = 40^\circ$. Triangle PQR has $PQ = 8$ cm, $PR = 6$ cm and angle $Q = 40^\circ$. Are these triangles necessarily congruent? Explain.

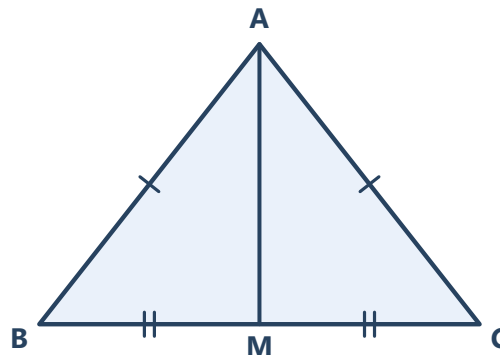
Answer: Not necessarily: the angle is not between the two sides (SSA)

- 7 The diagram shows a kite ABCD with $AB = AD$ and $CB = CD$. Prove that triangles ABC and ADC are congruent.



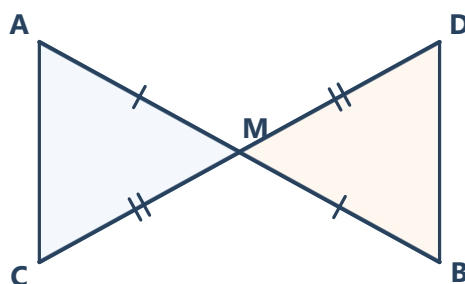
Answer: SSS: $AB = AD$, $CB = CD$, AC common

- 8 In isosceles triangle ABC, $AB = AC$. M is the midpoint of BC, and AM is drawn. Prove that triangles ABM and ACM are congruent.



Answer: SSS: $AB = AC$, $BM = CM$, AM common

- 9 Lines AB and CD cross at M. M is the midpoint of AB and the midpoint of CD. Prove that triangles AMC and BMD are congruent.



Answer: SAS: $AM = BM$, $\angle AMC = \angle BMD$, $CM = DM$

- 10 Challenge.** Two congruent triangles are placed together to make a quadrilateral. Triangle ABC has $AB = 6$ cm, $BC = 8$ cm and $AC = 10$ cm. A second triangle, congruent to ABC, is fitted along AC to make a parallelogram. What is the area of the parallelogram?

Answer: 48 cm^2

Exercise 21H Congruence: more practice and proof Non-calculator

- 1** For each pair of triangles ABC and PQR, say whether the triangles are congruent. If they are, write the condition (SSS, SAS, ASA, AAS or RHS). If not, say "not enough information". (The lengths are in cm.)

- (a) $AB = 5$, $BC = 7$, $CA = 9$ and $PQ = 5$, $QR = 7$, $RP = 9$

Answer: Congruent (SSS)

- (b) $AB = 6$, $\angle B = 50^\circ$, $BC = 8$ and $PQ = 6$, $\angle Q = 50^\circ$, $QR = 8$

Answer: Congruent (SAS)

- (c) $\angle A = 40^\circ$, $\angle B = 60^\circ$, $AB = 7$ and $\angle P = 40^\circ$, $\angle Q = 60^\circ$, $PQ = 7$

Answer: Congruent (ASA)

- (d) $\angle A = 30^\circ$, $\angle B = 70^\circ$, $\angle C = 80^\circ$ and $\angle P = 30^\circ$, $\angle Q = 70^\circ$, $\angle R = 80^\circ$

Answer: Not enough information (AAA)

- (e) $\angle B = 90^\circ$, $AC = 10$, $AB = 6$ and $\angle Q = 90^\circ$, $PR = 10$, $PQ = 6$

Answer: Congruent (RHS)

- 2** Ella says: "Triangles ABC and PQR both have angles of 50° and 60° , so they are congruent." Is she right? Explain.

Answer: No. Equal angles only show the triangles are similar.

- 3** Two rectangles each have a perimeter of 16 cm. One is 6 cm by 2 cm and the other is 5 cm by 3 cm. Are they congruent? Explain.

Answer: No: the sides are different, even though the perimeters are equal

- 4** Triangle A is reflected in a line to give triangle B. Triangle B is then rotated about a point to give triangle C. Explain why triangles A and C are congruent.

Answer: Reflections and rotations do not change size or shape, so A, B and C are all congruent

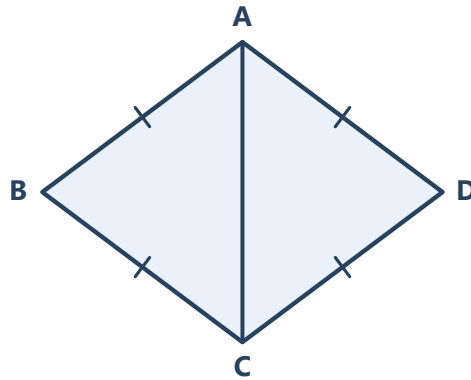
- 5 Triangle ABC is congruent to triangle PQR. The perimeter of ABC is 24 cm. In triangle PQR, $PQ = 7$ cm and $QR = 9$ cm. Work out the length of PR.

Answer: 8 cm

- 6 Show that two squares, each with a perimeter of 20 cm, are congruent.

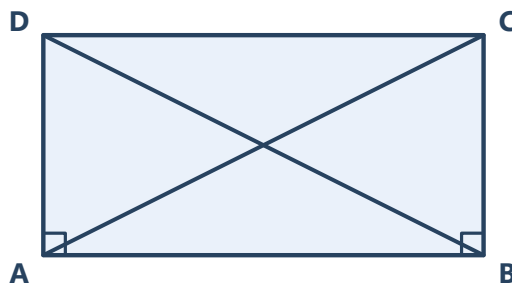
Answer: Both have sides 5 cm and four right angles

- 7 ABCD is a rhombus, so $AB = BC = CD = DA$. The diagonal AC is drawn. Prove that triangles ABC and ADC are congruent.



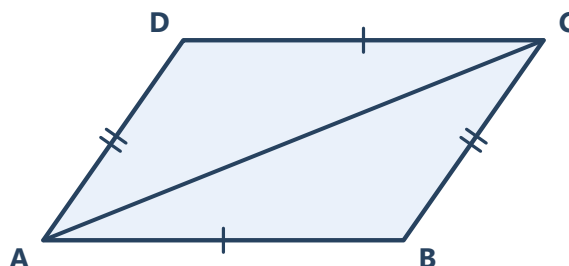
Answer: SSS: $AB = AD$, $BC = DC$, AC common

- 8 ABCD is a rectangle. Prove that triangles ABC and DCB are congruent, and hence show that the diagonals AC and DB are equal in length.



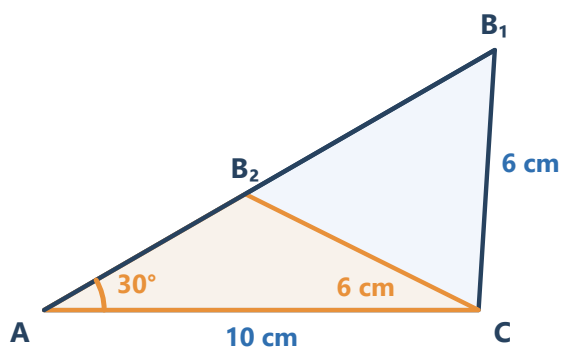
Answer: SAS: $AB = DC$, angle $ABC = \text{angle } DCB = 90^\circ$, BC common; so $AC = DB$

- 9 ABCD is a parallelogram with AB parallel to DC and $AB = DC$. Prove that triangles ABC and CDA are congruent.



Answer: SAS: $AB = CD$, angle $BAC = \text{angle } DCA$ (alternate), AC common

- 10 Challenge.** Triangle ABC has $AC = 10$ cm, $BC = 6$ cm and angle $A = 30^\circ$. Triangle PQR has $PR = 10$ cm, $QR = 6$ cm and angle $P = 30^\circ$. Explain why this is not enough to show that the triangles are congruent. (The diagram shows triangle ABC and a second triangle drawn on the same base.)



Answer: The angle is not between the two given sides (SSA): two different triangles are possible