

Triangle Build Plans

Use side lengths to plan accurate SSS constructions.

HIGH SCHOOL • HSG-CO.D

CCSS.Math.Content.HSG-CO.D "Make geometric constructions"

NAME _____

DATE _____

CHECK BEFORE YOU CONSTRUCT

A triangle can be constructed from three lengths only when the sum of any two lengths is greater than the third. To plan an SSS construction, use the longest length as a base, then use the other two lengths as arc radii from the base endpoints.

WORKED EXAMPLE

Can a triangle with side lengths 14, 17, and 19 be constructed? Give an SSS construction plan.

1. Check the shortest pair: $14 + 17 > 19$, so the triangle inequality is met.
2. Draw base AB with length 19.
3. Draw an arc centered at A with radius 14 and an arc centered at B with radius 17.
4. Label an arc intersection C, then connect C to A and B.

Answer: Yes. Triangle ABC has side lengths 14, 17, and 19.

PRACTICE 6 problems

- 1** Write an SSS construction plan for a triangle with side lengths 7, 8, and 9. Name the base AB.

ANSWER _____

- 2** Would lengths 3, 7, and 8 make a constructible triangle? State the inequality that decides.

ANSWER _____

- 3** Would lengths 2, 3, and 6 make a constructible triangle? State the inequality that decides.

ANSWER _____

- 4** A student draws base $PQ = 12$. They use an arc with radius 10 centered at P and an arc with radius 11 centered at Q. What three side lengths will triangle PQR have?

ANSWER _____

- 5** For sides 9, 10, and 13, which side should be the base in a standard SSS plan, and what two arc radii should be used?

ANSWER _____

- 6** Two SSS arcs meet at points C and D on opposite sides of base AB. How are triangles ABC and ABD related?

ANSWER _____

APPLY IT Show your work

- 1** Your robotics team is cutting a triangular brace. Two struts are 12 cm and 13 cm. The third strut must have a whole-number length and be as long as possible. What length should it be so an SSS triangle can be built?

WORK SPACE

ANSWER _____

- 2** A student designs a triangular pennant with side lengths 8 cm, 15 cm, and 23 cm. Can the student make this pennant using an SSS construction?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A triangle is planned with side lengths x , $x + 3$, and $2x - 4$, where x is a positive integer. Find all values of x for which an SSS construction is possible. Explain using inequalities.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Write an SSS construction plan for a triangle with side lengths 7, 8, and 9. Name the base AB.	Draw $AB = 9$. Draw an arc centered at A with radius 7 and an arc centered at B with radius 8. Label an intersection C and connect C to A and B.
2	Would lengths 3, 7, and 8 make a constructible triangle? State the inequality that decides.	Yes, because $3 + 7 > 8$.
3	Would lengths 2, 3, and 6 make a constructible triangle? State the inequality that decides.	No, because $2 + 3 < 6$.
4	A student draws base $PQ = 12$. They use an arc with radius 10 centered at P and an arc with radius 11 centered at Q. What three side lengths will triangle PQR have?	$PQ = 12$, $PR = 10$, and $QR = 11$.
5	For sides 9, 10, and 13, which side should be the base in a standard SSS plan, and what two arc radii should be used?	Use 13 as the base. Use arc radii 9 and 10.
6	Two SSS arcs meet at points C and D on opposite sides of base AB. How are triangles ABC and ABD related?	They are congruent mirror images across line AB.

PART 2 • APPLY IT

- 24 cm** The third length must be less than $12 + 13$, or 25. The greatest whole number less than 25 is 24.
- No. The lengths make a degenerate figure, not a triangle.** The two shorter sides add to $8 + 15 = 23$. Their sum must be greater than the longest side.

CHALLENGE

All positive integers $x \geq 4$. The restrictive inequality is $x + (2x - 4) > x + 3$, which gives $x > 3.5$, so x must be at least 4.

Accept either assignment of the two nonbase arc radii to the base endpoints when labels are consistent. For ordered positive side lengths, accept checking whether the two shortest lengths have a sum greater than the longest length.