The Triangle Inequality Property

A. Fill in the Blanks

1. The sum of the lengths of any two sides of a triangle is always _____ than the third side.
2. For a triangle to be possible, the sum of the two shorter sides must be greater than the _____ side.
3. If two sides of a triangle are 7 cm and 13 cm, the third side must be greater than _____ cm.
4. _____ and the third side must be less than _____ cm.
5. A triangle with side lengths 5 cm, 12 cm, and 17 cm _____ be formed.

B. Match the Following;

Column A (Given Sides)	Column B (Range for Third Side)
1. 5 cm, 8 cm	A. $1 < x < 25$
2. 12 cm, 13 cm	B. $3 < x < 13$
3. 20 cm, 20 cm	C. $10 < x < 40$
4. 15 cm, 25 cm	D. $0 < x < 40$

C. Practice Problems

Determine if the given side lengths can form a triangle. Show your check.

1. 12 m, 15 m, 25 m
2. 10 ft, 20 ft, 31 ft
3. 8.5 cm, 6.2 cm, 13.5 cm
4. 22 in, 14 in, 35 in
5. 45 mm, 20 mm, 24 mm

D. Warm-up Questions

Can a triangle be formed with the given side lengths? Write 'Yes' or 'No'.

1. 3 cm, 4 cm, 5 cm
2. 1 cm, 2 cm, 3 cm
3. 6 cm, 8 cm, 10 cm
4. 2 cm, 5 cm, 8 cm

5. 7 cm, 7 cm, 7 cm

E. Challenge Questions

1. A triangle has two sides of length 10 cm and 14 cm. Which of the following cannot be the length of the third side: 5 cm, 12 cm, 23 cm, or 24 cm? Explain why.
2. The sides of a triangle have lengths of 5, 12, and x. What is the smallest possible integer value for x?
3. A triangle has a perimeter of 20 cm. If the side lengths are all integers, list one possible set of side lengths for this triangle.
4. In quadrilateral ABCD, a diagonal AC is drawn. Using the triangle inequality property on ΔABC and ΔADC, prove that AB + BC + CD > AD.
5. Can you form a triangle with side lengths of (x+2), (x+3), and (2x+6) if x = 1? If x = 5? Show your work.

F. Word Problems & Application

1. Maria wants to create a triangular garden. She has two pieces of fencing that are 8 feet and 12 feet long. What is the possible range of lengths for the third piece of fencing she needs?
2. Three cities, A, B, and C, form a triangle on a map. The distance from City A to City B is 150 miles. The distance from City B to City C is 200 miles. Which of the following is a possible distance from City A to City C: 40 miles, 350 miles, or 300 miles?
3. John is building a triangular frame. He has one piece of wood that is 15 inches long and another that is 37 inches long. He needs to buy a third piece. The store sells wood in full-inch lengths only. What is the shortest possible length of wood he can buy?
4. Anya is walking from her home to the library. She can walk 4 blocks east and then 3 blocks north, or she can take a diagonal shortcut. Can the shortcut be 8 blocks long? Why or why not?
5. Two radio towers are 40 miles apart. A receiver is located at a third point. The distance from the receiver to one tower is 25 miles. What is the minimum and maximum possible distance (as whole numbers) from the receiver to the second tower?

G. True or False

1. It is possible to have a triangle with sides 8 cm, 2 cm, and 6 cm. _____
2. If two sides of a triangle are 5 and 10, the third side could be 5. _____
3. In any triangle, the longest side is always shorter than the sum of the other two sides. _____
4. The difference between two sides of a triangle can be equal to the third side. _____
5. A triangle with sides 1 cm, 100 cm, and 100 cm is a valid triangle. _____