

SCAVENGER HUNT



THE TRIANGLE INEQUALITY AND THE HINGE THEOREM

How Long Can the Third Side Be?

Two sides on every card · the largest or the smallest third side · the cards check the answers

FREE

ANSWER

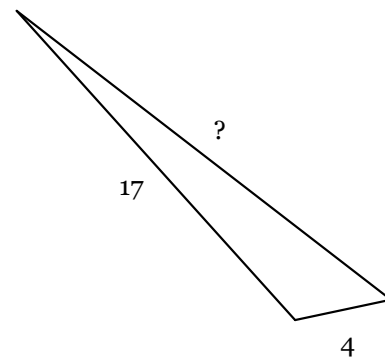
49

Two sides of a triangle are 4 and 17.

The third side is a whole number.

What is the largest it can be?

Equal is not enough. At the exact sum, the three sides lie flat.



C

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1. **Tape the 16 cards around the room**, in any order. Each card has a large letter in its bottom left corner. Start each group at a *different* one of these eight cards: *C K E J R G D H*.
2. **Say this once:** *“Any two sides of a triangle add to more than the third side. Equal is not enough. So the third side is more than the difference of the two sides and less than their sum. On the record sheet, write the sum or the difference before the answer. Eight right answers bring you back to your first card.”*
3. **Each group finds the answer, then walks to the card with that number at the top.** Nothing else is needed.

16 cards	pages 3–10, one copy. There are two cards on each sheet. Cut the whole stack once.
Record sheet	page 11, one per student. It shows a triangle, a gap and a flat set as three small drawings.
Answers	pages 12–13, for you only. Do not put them up in the room.

Every card gives two sides of a triangle, and the third side is a whole number. The third side must be less than the sum of the two sides, and more than their difference. It can never equal either one: then the three sides lie flat in a straight line, and there is no triangle. On three ring cards the question asks for the largest third side, which is one less than the sum. The common mistake is to give the sum itself. On three ring cards it asks for the smallest, which is one more than the difference. The common mistake is to give the difference itself. On two ring cards it asks for the largest perimeter: the two sides plus the largest third side. The common mistake is to use the sum as the third side.

Eight of the sixteen cards make the ring. A group reaches the other eight only by a wrong answer, but all the cards look the same. On every ring card, the common mistake gives the number at the top of one of the eight other cards. The group does that card, and its answer sends the group back to the card it got wrong. If the group makes the same mistake there, it goes one more card back and still does not reach the ring.

The check is the length of the group's list. A clean run is **eight lines**. Each wrong answer adds two. Every card has a line in small type under the question. It tells a group that arrived by a wrong answer what to check. A group that arrived by a right answer skips it. If a group keeps coming back to the same cards, do not give the answer. Ask: *“Put your answer in as the third side. Do the two shorter sides add to more than the longest?”*



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ANSWER

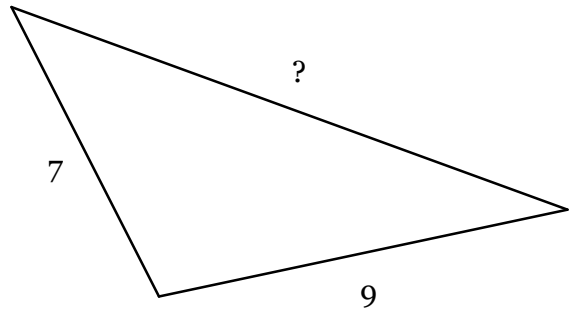
4

Two sides of a triangle are 9 and 7.

The third side is a whole number.

What is the largest it can be?

A flat set of three sides is not a triangle.



A

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ANSWER

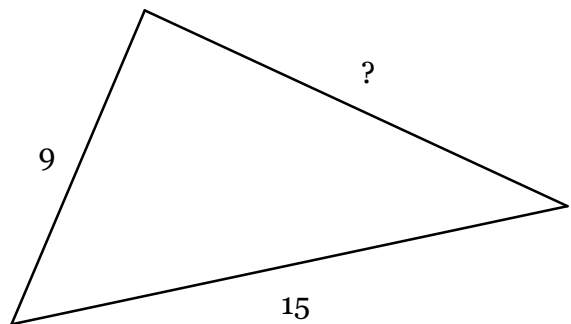
48

Two sides of a triangle are 15 and 9.

The third side is a whole number.

What is the smallest it can be?

Subtract for the smallest side. Add for the largest side.



B

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ANSWER

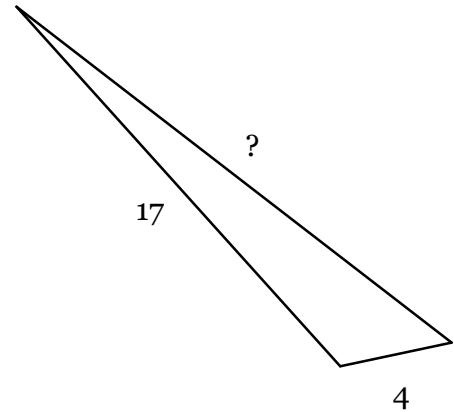
49

Two sides of a triangle are 4 and 17.

The third side is a whole number.

What is the largest it can be?

Equal is not enough. At the exact sum, the three sides lie flat.



C

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ANSWER

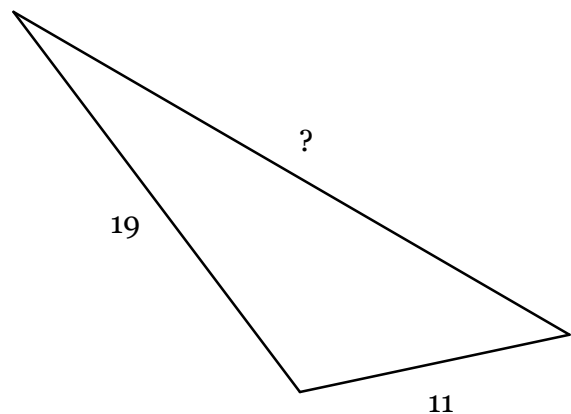
5

Two sides of a triangle are 11 and 19.

The third side is a whole number.

What is the largest it can be?

A whole number just under the sum is the largest third side.



D

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ANSWER

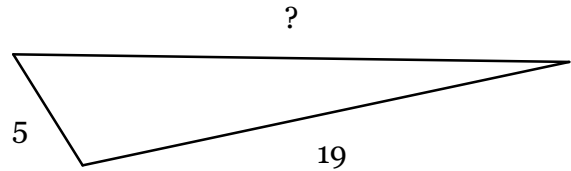
7

Two sides of a triangle are 19 and 5.

The third side is a whole number.

What is the largest perimeter the triangle can have?

A perimeter is one number for the whole triangle. Add all three sides.



E

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ANSWER

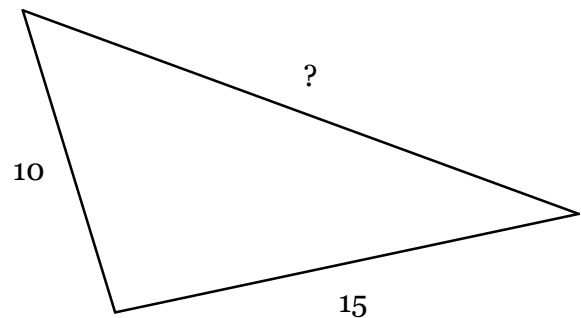
21

Two sides of a triangle are 15 and 10.

The third side is a whole number.

What is the largest perimeter the triangle can have?

Perimeter means all three sides, not only the third one.



F

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ANSWER

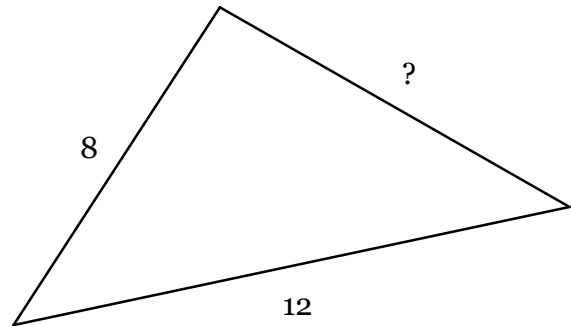
15

Two sides of a triangle are 12 and 8.

The third side is a whole number.

What is the smallest it can be?

At the exact difference, the short side folds flat onto the long one.



G

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ANSWER

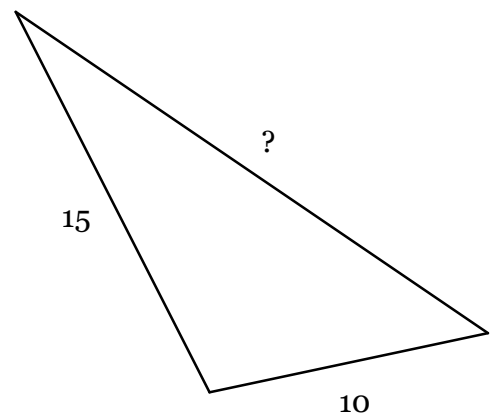
29

Two sides of a triangle are 10 and 15.

The third side is a whole number.

What is the largest perimeter the triangle can have?

Find the largest third side first. Then add the two given sides to it.



H

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ANSWER

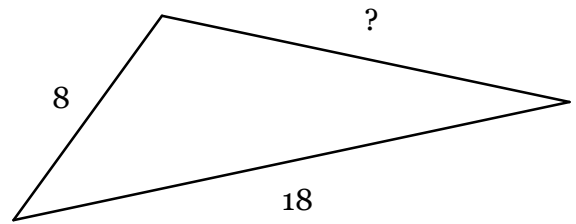
47

Two sides of a triangle are 18 and 8.

The third side is a whole number.

What is the smallest it can be?

Which end of the range does the question ask about?



J

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ANSWER

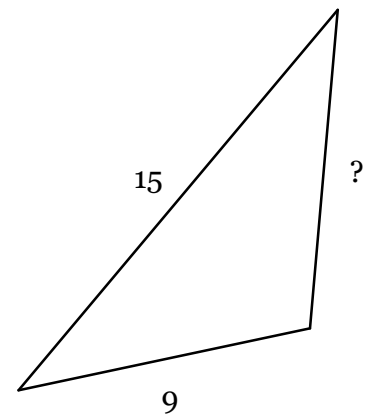
20

Two sides of a triangle are 9 and 15.

The third side is a whole number.

What is the smallest it can be?

The smallest third side is just over the difference of the two sides.



K

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ANSWER

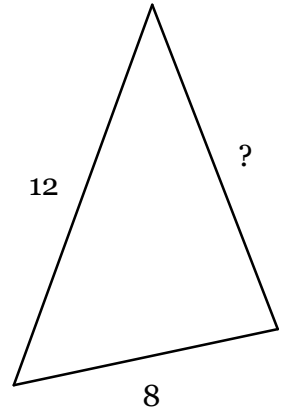
30

Two sides of a triangle are 8 and 12.

The third side is a whole number.

What is the smallest it can be?

Whole numbers only. Step one inside each end of the range.



L

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ANSWER

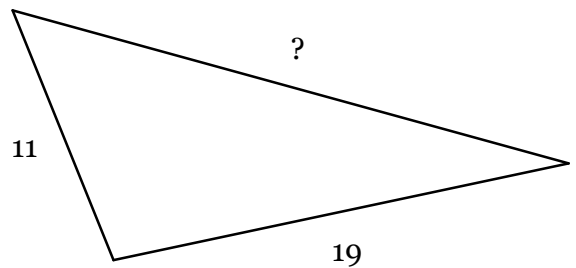
50

Two sides of a triangle are 19 and 11.

The third side is a whole number.

What is the largest it can be?

Does the triangle close? Test the two shorter sides against the longest.



M

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ANSWER

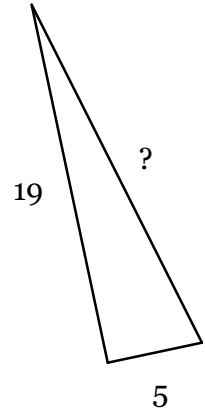
10

Two sides of a triangle are 5 and 19.

The third side is a whole number.

What is the largest perimeter the triangle can have?

Does the question ask for a side or for the perimeter?



N

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ANSWER

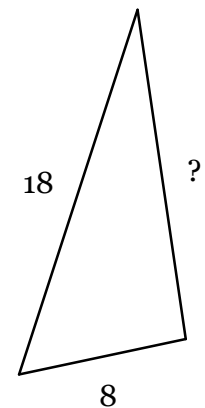
16

Two sides of a triangle are 8 and 18.

The third side is a whole number.

What is the smallest it can be?

The third side is strictly between the difference and the sum.



P

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ANSWER

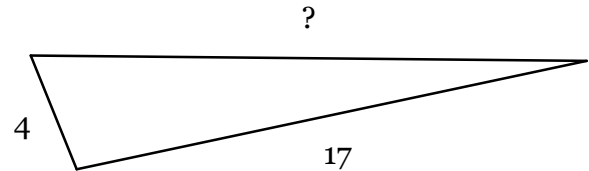
6

Two sides of a triangle are 17 and 4.

The third side is a whole number.

What is the largest it can be?

Two sides can never reach as far as their sum.



Q

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ANSWER

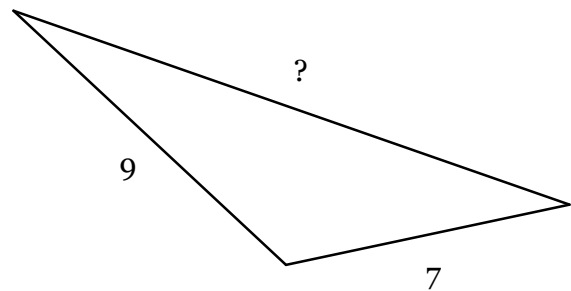
11

Two sides of a triangle are 7 and 9.

The third side is a whole number.

What is the largest it can be?

Try the answer as the third side. Do the two shorter sides add to more than the longest?



R

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Scavenger Hunt — where I went

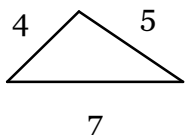
The triangle inequality

Name _____

Period _____

Date _____

Do the card you are at. Fill in one line. Then find the card with your answer at the top. **Before the answer, write the sum or the difference of the two sides.** A clean run is eight lines. Each card has a line in small type under the question. **If you are on a card because you went wrong, its line says what to check. If you were right, skip it.**

 4 + 5 = 9, more than 7. A triangle.	 3 + 4 = 7, less than 10. A gap.	 3 + 7 = 10, exactly. Flat: no triangle.
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Card letter	The sum or the difference of the two sides	My answer
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Three sticks tried to make a triangle, and it did not work. Why not? Two of them were ...

Every number stands for a letter. Write the letter for each of your answers in the box above that number. Leave the other boxes empty. Then read the boxes you filled, left to right. **If they do not spell the answer, one answer is wrong.**

4 = O 5 = T 6 = T 7 = O 10 = S 11 = O 15 = S 16 = O 20 = H 21 = T 29 = O 30 = R 47 = R 48 = H 49 = T
50 = O

4	5	6	7	10	11	15	16	20	21	29	30	47	48	49	50	



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Scavenger Hunt — answers

For the teacher

The ring in order. A group may begin anywhere on it. Wherever it begins, eight right answers bring it back to that card.

C → K → E → J → R → G → D → H → C

Three sticks tried to make a triangle, and it did not work. Why not? Two of them were ...

The answer is *TOO SHORT*. The ring's answers, in the order of the boxes on the record sheet (smallest number first), with their letters: **5 T • 7 O • 11 O • 15 S • 20 H • 29 O • 47 R • 49 T**.

Card	Sides and question	Answer, and why	Wrong answer from the common mistake	Joke letter for the number at its top
1 C	4 and 17: largest third side	20 . The third side must be less than $4 + 17 = 21$. The largest whole number less than 21 is 20.	21, the sum itself. Then the three sides lie flat.	T
2 K	9 and 15: smallest third side	7 . The third side must be more than $15 - 9 = 6$. The smallest whole number more than 6 is 7.	6, the difference itself. Then the three sides lie flat.	H
3 E	19 and 5: largest perimeter	47 . The third side must be less than 24, so the largest is 23. The perimeter is $19 + 5 + 23 = 47$.	48, from using the sum 24 as the third side. That side lies flat.	O
4 J	18 and 8: smallest third side	11 . The third side must be more than $18 - 8 = 10$. The smallest whole number more than 10 is 11.	10, the difference itself. Then the three sides lie flat.	R
5 R	7 and 9: largest third side	15 . The third side must be less than $7 + 9 = 16$. The largest whole number less than 16 is 15.	16, the sum itself. Then the three sides lie flat.	O
6 G	12 and 8: smallest third side	5 . The third side must be more than $12 - 8 = 4$. The smallest whole number more than 4 is 5.	4, the difference itself. Then the three sides lie flat.	S
7 D	11 and 19: largest third side	29 . The third side must be less than $11 + 19 = 30$. The largest whole number less than 30 is 29.	30, the sum itself. Then the three sides lie flat.	T
8 H	10 and 15: largest perimeter	49 . The third side must be less than 25, so the largest is 24. The perimeter is $10 + 15 + 24 = 49$.	50, from using the sum 25 as the third side. That side lies flat.	O

Each wrong answer in the table is the number at the top of a card off the ring. Those cards are on the next page.

Scavenger Hunt — the cards off the ring

For the teacher

A group reaches these eight cards only by a wrong answer. The number at the top of each one is the wrong answer from one ring card. Its right answer is the number at the top of that ring card, so the group goes back to the card it got wrong. If the group makes the same mistake again, it goes to another card off the ring. So a second wrong answer never moves a group forward.

Card	Sides and question	Answer, and why	Wrong answer from the common mistake	Joke letter for the number at its top
F	15 and 10: largest perimeter	49. The third side must be less than 25, so the largest is 24. The perimeter is $15 + 10 + 24 = 49$.	50, from using the sum 25 as the third side. That side lies flat.	T
Q	17 and 4: largest third side	20. The third side must be less than $17 + 4 = 21$. The largest whole number less than 21 is 20.	21, the sum itself. Then the three sides lie flat.	T
B	15 and 9: smallest third side	7. The third side must be more than $15 - 9 = 6$. The smallest whole number more than 6 is 7.	6, the difference itself. Then the three sides lie flat.	H
N	5 and 19: largest perimeter	47. The third side must be less than 24, so the largest is 23. The perimeter is $5 + 19 + 23 = 47$.	48, from using the sum 24 as the third side. That side lies flat.	S
P	8 and 18: smallest third side	11. The third side must be more than $18 - 8 = 10$. The smallest whole number more than 10 is 11.	10, the difference itself. Then the three sides lie flat.	O
A	9 and 7: largest third side	15. The third side must be less than $9 + 7 = 16$. The largest whole number less than 16 is 15.	16, the sum itself. Then the three sides lie flat.	O
L	8 and 12: smallest third side	5. The third side must be more than $12 - 8 = 4$. The smallest whole number more than 4 is 5.	4, the difference itself. Then the three sides lie flat.	R
M	19 and 11: largest third side	29. The third side must be less than $19 + 11 = 30$. The largest whole number less than 30 is 29.	30, the sum itself. Then the three sides lie flat.	O

Other mistakes lead to no card at all. A group might give the difference when the largest side is asked, give the shorter side when the smallest is asked, or forget to add the two sides for a perimeter. Its answer is then not the number at the top of any card, and the group knows to check its work.

Guessing does not work. Every simple rule that uses only the printed numbers, such as always adding the two numbers and taking away one, answers at most six of the sixteen cards correctly.