GRADE 7 ACCELERATED · UNIT 6 · LESSONS 1–2

Triangle Inequality Theorem; Converse of the Pythagorean Theorem

MA.8.GR.1.3

I can decide whether three lengths can make a triangle, and whether they make a right triangle.

Warm-Up

1. A car gets 32 miles per gallon. How far does it go on 9 gallons?
2. A figure of area $5\,\text{cm}^2$ is scaled by $k = 3$. The copy's area?
3. Find the value: $\sqrt{100}$
4. Find the value: $6^2 + 8^2$

Warm-Up

1. A car gets 32 miles per gallon. How far does it go on 9 gallons?

   288 mi

2. A figure of area $5\,\text{cm}^2$ is scaled by $k = 3$. The copy's area?

   45 cm²

3. Find the value: $\sqrt{100}$ **10**

4. Find the value: $6^2 + 8^2$ **100**

Vocabulary

triangle inequality

any two sides of a triangle add up to MORE than the third side

legs

the two sides of a right triangle that make the right angle

hypotenuse

the side across from the right angle — always the longest side

converse

a statement turned around: if $a^2 + b^2 = c^2$ for the two shorter sides and the longest, the triangle is right

Notes

I. Two sides together must be longer than the third



3, 4, 9
a gap

4, 5, 9
flat

5, 6, 9
a triangle

Add the two shorter sides. A triangle needs MORE than the longest side.

On the FAST sheet: $a + b > c$, $a + c > b$, $b + c > a$

Notes

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

$$9 - 4 = 5 \qquad 9 + 4 = 13$$

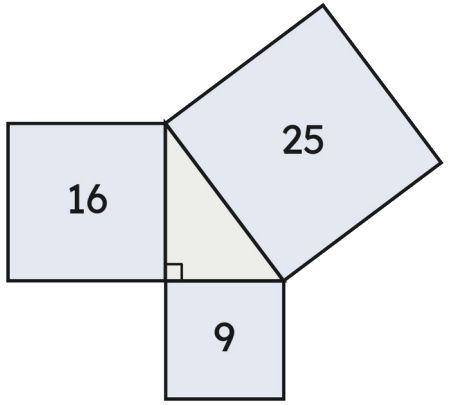
$$5 < x < 13$$

Sides 4 and 9: the third side x is more than 5 and less than 13.

Never $\leq$: at 5 or 13 the sides lie flat.

Notes

III. The Pythagorean Theorem, and its converse



$$3^2 + 4^2 = 9 + 16 = 25 = 5^2$$

Two shorter sides squared and added = the longest side squared: a right triangle.

24, 40, 32: $24^2 + 32^2 = 1{,}600 = 40^2$, right. 5, 6, 8: $5^2 + 6^2 = 61$, not 64.

Example 1

Can sides of 5 cm, 8 cm and 14 cm make a triangle?

Example 1

$5 + 8 = 13$

$13 < 14$

Answer: No — 5 + 8 = 13 is less than 14.

Your Turn

Can sides of 7 inches, 9 inches and 15 inches make a triangle?

Your Turn

Can sides of 7 inches, 9 inches and 15 inches make a triangle?

$7 + 9 = 16$

16 is more than 15: a triangle.

Answer: Yes — 7 + 9 = 16 is more than 15.

Example 2

A triangle has sides of 20 m, 12 m and 16 m.

Is it a right triangle?

Example 2

the two shorter sides: $12^2 + 16^2 = 144 + 256 = 400$

the longest, though listed first: $20^2 = 400$

Answer: Yes — $12^2 + 16^2 = 20^2$.

Your Turn

A triangle has sides of 8 ft, 11 ft and 14 ft.

Is it a right triangle?

Your Turn

A triangle has sides of 8 ft, 11 ft and 14 ft.

Is it a right triangle?

$8^2 + 11^2 = 64 + 121 = 185$

$14^2 = 196$: not equal.

Answer: No — 185 is not 196.

Whiteboards · Question 1 of 9

Can sides of 2 ft, 7 ft and 10 ft make a triangle?

Answer it.

Whiteboards · Question 1 of 9

Can sides of 2 ft, 7 ft and 10 ft make a triangle?

$2 + 7 = 9$

9 is less than 10: no triangle.

Answer: No — 2 + 7 = 9 is less than 10.

Whiteboards · Question 2 of 9

Can sides of 6 m, 6 m and 11 m make a triangle?

Answer it.

Whiteboards · Question 2 of 9

Can sides of 6 m, 6 m and 11 m make a triangle?

$6 + 6 = 12$

12 is more than 11: a triangle.

Answer: Yes — 6 + 6 = 12 is more than 11.

Whiteboards · Question 3 of 9

Which three lengths can make a triangle?

A. 7, 7, 14

B. 5, 11, 8

C. 3, 10, 6

D. 4, 6, 12

Answer it.

Whiteboards · Question 3 of 9

Which three lengths can make a triangle?

$5 + 8 = 13$, more than 11: a triangle.

In each other set the two shorter sides fall short or lie flat.

Answer: B — 5, 11, 8

Whiteboards · Question 4 of 9

Two sides of a triangle are 7 cm and 12 cm.

Write an inequality for the length x, in centimeters, of the third side.

Answer it.

Whiteboards · Question 4 of 9

Two sides of a triangle are 7 cm and 12 cm.

Write an inequality for the length x, in centimeters, of the third side.

$$12 - 7 = 5 \quad \text{and} \quad 12 + 7 = 19$$

$$5 < x < 19$$

Answer: $5 < x < 19$ — more than 5 cm and less than 19 cm.

Whiteboards · Question 5 of 9

Two sides of a triangle are 6 cm and 10 cm.

Which inequality shows every possible length x, in centimeters, of the third side?

A. $6 < x < 10$

B. $4 \leq x \leq 16$

C. $4 < x < 16$

D. $0 < x < 16$

Answer it.

Whiteboards · Question 5 of 9

Two sides of a triangle are 6 cm and 10 cm.

Which inequality shows every possible length x, in centimeters, of the third side?

$10 - 6 = 4$ and $10 + 6 = 16$

$4 < x < 16$ — never equal

Answer: C — $4 < x < 16$

Whiteboards · Question 6 of 9

Do sides of 8 inches, 15 inches and 17 inches make a right triangle?

Answer it.

Whiteboards · Question 6 of 9

Do sides of 8 inches, 15 inches and 17 inches make a right triangle?

$8^2 + 15^2 = 64 + 225 = 289$

$17^2 = 289$: equal — a right triangle.

Answer: Yes — $8^2 + 15^2 = 289 = 17^2$.

Whiteboards · Question 7 of 9

A triangle has sides of 25 cm, 7 cm and 24 cm.

Is it a right triangle? Which answer has the right reason?

A. Yes, because $7^2 + 24^2 = 25^2$

B. Yes, because $7 + 24 > 25$

C. No, because $25^2 + 7^2 \neq 24^2$

D. No, because $7 + 24 \neq 25$

Answer it.

Whiteboards · Question 7 of 9

A triangle has sides of 25 cm, 7 cm and 24 cm.

Is it a right triangle? Which answer has the right reason?

$$7^2 + 24^2 = 49 + 576 = 625$$

$25^2 = 625$: equal — right.

Answer: A — yes, because $7^2 + 24^2 = 25^2$

Whiteboards · Question 8 of 9

A triangular sail has sides of 20 ft, 21 ft and 29 ft, and it weighs 12 pounds.

Does the sail have a right angle?

Answer it.

Whiteboards · Question 8 of 9

A triangular sail has sides of 20 ft, 21 ft and 29 ft, and it weighs 12 pounds.

Does the sail have a right angle?

$$20^2 + 21^2 = 400 + 441 = 841$$

$29^2 = 841$: a right angle.

Answer: Yes — $20^2 + 21^2 = 841 = 29^2$.

Whiteboards · Question 9 of 9

Ana says sides of 6, 7 and 9 make a right triangle because $6 + 7 > 9$.

Is she right? Explain.

Write your answer in sentences.

Whiteboards · Question 9 of 9

Ana says sides of 6, 7 and 9 make a right triangle because 6 + 7 > 9.

Is she right? Explain.

$6^2 + 7^2 = 85$, but $9^2 = 81$.

Answer: No — 6 + 7 > 9 shows only a triangle; 85 is not 81, so it is not right.

Independent Set

1. Can sides of 4 cm, 8 cm and 13 cm make a triangle?
2. Can sides of 9 inches, 9 inches and 18 inches make a triangle?
3. Two sides of a triangle are 5 m and 11 m. Write an inequality for the length x, in meters, of the third side.
4. Do sides of 28 cm, 45 cm and 53 cm make a right triangle?
5. Do sides of 17 ft, 10 ft and 14 ft make a right triangle?
6. A carpenter joins boards of 30 inches, 40 inches and 50 inches into a triangle. Is one corner a right angle?

IXL

1. Open IXL and start today's skills.
2. Work on paper where the question needs work. The answer box does not show it.
3. Every skill listed is required, to a SmartScore of 67. Due by the Unit 6 test.

Today's skills — all required

Triangle inequality — 2N5

Converse of the Pythagorean theorem: is it a right triangle? — EQZ