Geometry Triangles Workbook

4 lessons · printable · answer key at the back

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Name _____ Date _____

Contents

The Triangle Inequality

WORKED EXAMPLE

6

12

12

Yes No

1. Can these be the sides of a triangle?

Can these three lengths form a triangle? Answer Yes or No.

1

6

10

11

Yes No

2

7

8

9

Yes No

3

4

6

12

Yes No

4

11

16

16

Yes No

5

9

10

11

Yes No

6

3

11

16

Yes No

7

14

14

14

Yes No

8

10

11

13

Yes No

9

3

9

11

Yes No

10

13

13

13

Yes No

11

3

15

15

Yes No

12

8

13

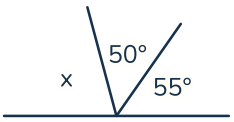
16

Yes No

2. Angles on a line and around a point

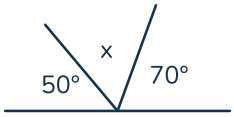
Find the angle marked x. The angles on each line add to 180°.

13



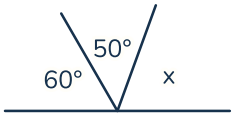
_____ degrees

14



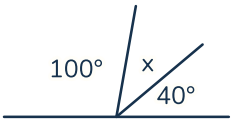
_____ degrees

15



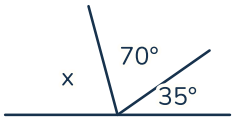
_____ degrees

16



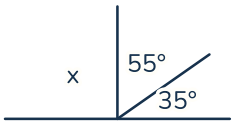
_____ degrees

17



_____ degrees

18



_____ degrees

Isosceles Triangles

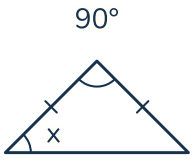
WORKED EXAMPLE

110 degrees

3. Angles in an isosceles triangle

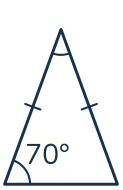
Find the angle marked x. The ticks mark the two equal sides.

1



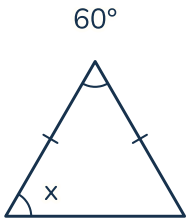
_____ degrees

2



_____ degrees

3



_____ degrees

4

_____ degrees

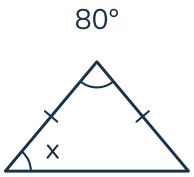
5

_____ degrees

6

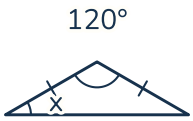
_____ degrees

7



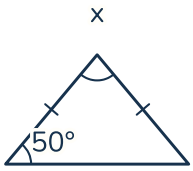
_____ degrees

8



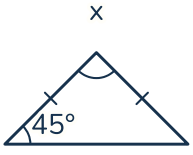
_____ degrees

9



_____ degrees

10

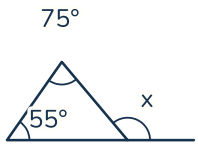


_____ degrees

4. The exterior angle of a triangle

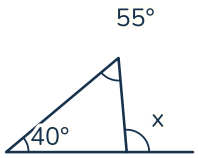
Find the angle marked x. Give each answer in degrees.

11



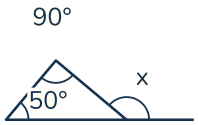
_____ degrees

12



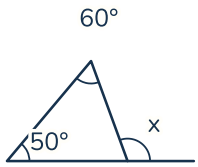
_____ degrees

13



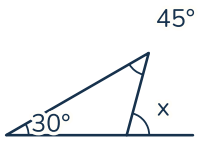
_____ degrees

14



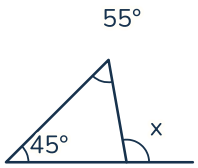
_____ degrees

15



_____ degrees

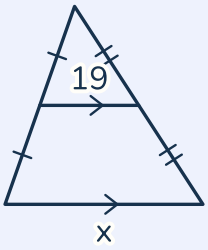
16



_____ degrees

Midsegments

WORKED EXAMPLE

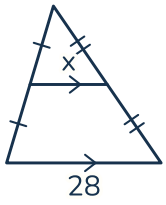


38 cm

5. The midsegment of a triangle

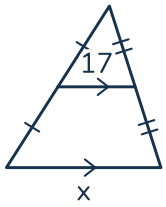
Find the length marked x. The dashes mark equal halves.

1



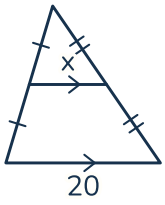
_____ cm

2



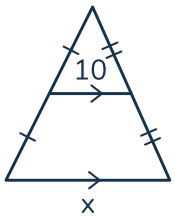
_____ cm

3



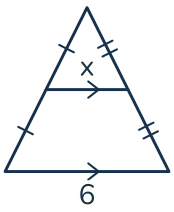
_____ cm

4



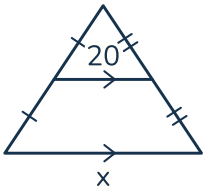
_____ cm

5



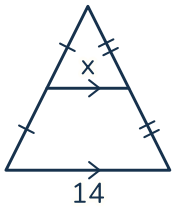
_____ cm

6



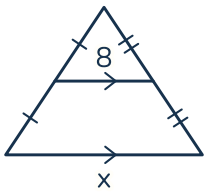
_____ cm

7



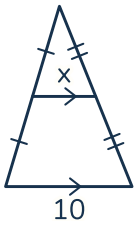
_____ cm

8



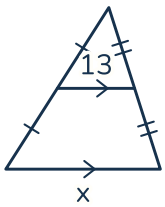
_____ cm

9



_____ cm

10

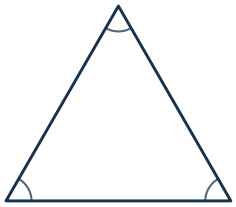


_____ cm

6. Angles inside a polygon

Work out the angle each shape is asking for. Give every answer in degrees.

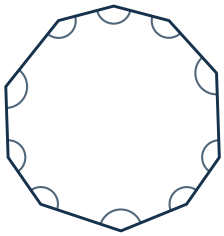
11



All the angles together

_____ degrees

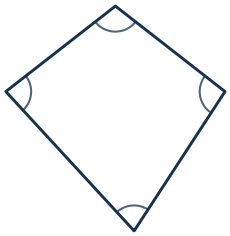
12



All the angles together

_____ degrees

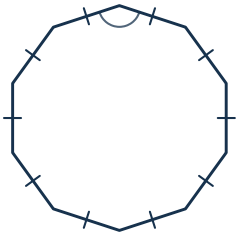
13



All the angles together

_____ degrees

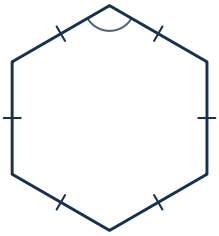
14



Each of its angles

_____ degrees

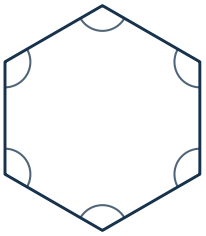
15



Each of its angles

_____ degrees

16

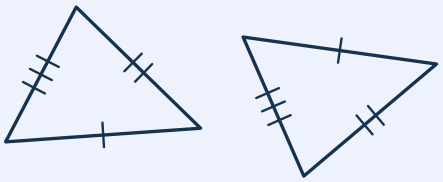


All the angles together

_____ degrees

Congruence Criteria

WORKED EXAMPLE

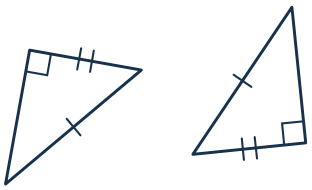


SSS SAS ASA AAS HL

7. Which congruence rule (SSS, SAS, ASA, AAS, HL)

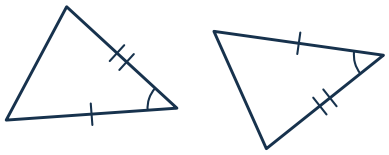
Which rule shows each pair of triangles is congruent?

1



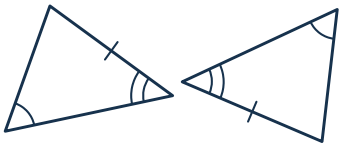
SSS SAS ASA AAS HL

2



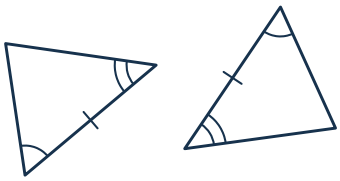
SSS SAS ASA AAS HL

3



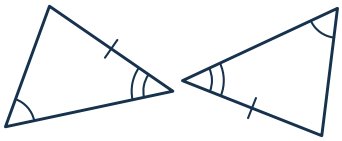
SSS SAS ASA AAS HL

4



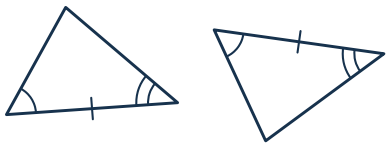
SSS SAS ASA AAS HL

5



SSS SAS ASA AAS HL

6

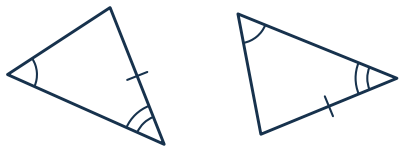


SSS SAS ASA AAS HL

7. Which congruence rule (SSS, SAS, ASA, AAS, HL) (continued)

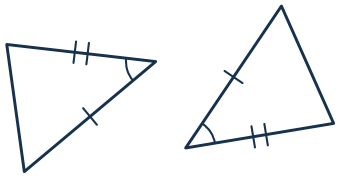
Which rule shows each pair of triangles is congruent?

7



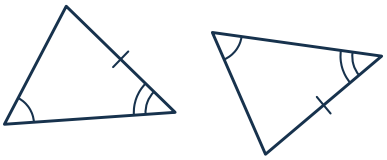
SSS SAS ASA AAS HL

8



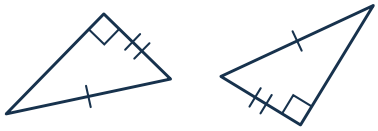
SSS SAS ASA AAS HL

9



SSS SAS ASA AAS HL

10



SSS SAS ASA AAS HL

8. Can these be the sides of a triangle?

Can these three lengths form a triangle? Answer Yes or No.

11

4

8

8

Yes No

12

12

14

15

Yes No

13

6

9

16

Yes No

14

5

6

8

Yes No

15

3

4

7

Yes No

16

4

14

15

Yes No

Answer Key

The Triangle Inequality

Can these be the sides of a triangle?

1. 6, 10, 11: Yes
2. 7, 8, 9: Yes
3. 4, 6, 12: No
4. 11, 16, 16: Yes
5. 9, 10, 11: Yes
6. 3, 11, 16: No
7. 14, 14, 14: Yes
8. 10, 11, 13: Yes
9. 3, 9, 11: Yes
10. 13, 13, 13: Yes
11. 3, 15, 15: Yes
12. 8, 13, 16: Yes

Angles on a line and around a point

13. 180° (55°, 50°, x): 75°
14. 180° (70°, x, 50°): 60°
15. 180° (x, 50°, 60°): 70°
16. 180° (40°, x, 100°): 40°
17. 180° (35°, 70°, x): 75°
18. 180° (35°, 55°, x): 90°

Isosceles Triangles

Angles in an isosceles triangle

1. apex 90°: 45°
2. base 70°: 40°
3. apex 60°: 60°
4. apex 40°: 70°
5. base 75°: 30°
6. base 30°: 120°
7. apex 80°: 50°
8. apex 120°: 30°
9. base 50°: 80°
10. base 45°: 90°

The exterior angle of a triangle

11. 55° + 75°: 130°
12. 40° + 55°: 95°
13. 50° + 90°: 140°
14. 50° + 60°: 110°
15. 30° + 45°: 75°
16. 45° + 55°: 100°

Midsegments

The midsegment of a triangle

1. base 28: 14 cm

Midsegments (continued)

The midsegment of a triangle (continued)

2. midsegment 17: 34 cm
3. base 20: 10 cm
4. midsegment 10: 20 cm
5. base 6: 3 cm
6. midsegment 20: 40 cm
7. base 14: 7 cm
8. midsegment 8: 16 cm
9. base 10: 5 cm
10. midsegment 13: 26 cm

Angles inside a polygon

11. 3-sided, all the angles: 180°
12. 10-sided, all the angles: 1440°
13. 4-sided, all the angles: 360°
14. regular 10-sided, each angle: 144°
15. regular 6-sided, each angle: 120°
16. 6-sided, all the angles: 720°

Congruence Criteria

Which congruence rule (SSS, SAS, ASA, AAS, HL)

1. marked a right angle, 2 sides: HL
2. marked 2 sides, 1 angle: SAS
3. marked 1 side, 2 angles: AAS
4. marked 1 side, 2 angles: ASA
5. marked 1 side, 2 angles: AAS
6. marked 1 side, 2 angles: ASA
7. marked 1 side, 2 angles: AAS
8. marked 2 sides, 1 angle: SAS
9. marked 1 side, 2 angles: AAS
10. marked a right angle, 2 sides: HL

Can these be the sides of a triangle?

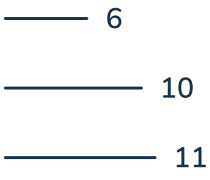
11. 4, 8, 8: Yes
12. 12, 14, 15: Yes
13. 6, 9, 16: No
14. 5, 6, 8: Yes
15. 3, 4, 7: No
16. 4, 14, 15: Yes

Solutions (1 of 8)

The Triangle Inequality

Can these be the sides of a triangle?

1.



Yes No

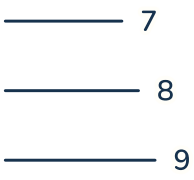
Yes

Three lengths make a triangle only when the two shorter sides add to more than the longest. The two shorter are 6 and 10; the longest is 11.

6 + 10 = 16, which is more than 11.

The two shorter sides reach past the longest, so they close into a triangle. Yes.

2.



Yes No

Yes

Three lengths make a triangle only when the two shorter sides add to more than the longest. The two shorter are 7 and 8; the longest is 9.

7 + 8 = 15, which is more than 9.

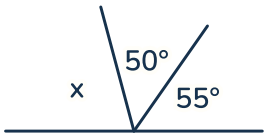
The two shorter sides reach past the longest, so they close into a triangle. Yes.

Solutions (2 of 8)

The Triangle Inequality (continued)

Angles on a line and around a point

13.



___ degrees

$55° + 50° + x = \mathbf{180°}$

$55° + 50° = \mathbf{105°}$

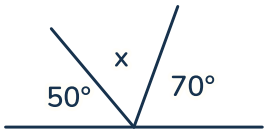
$180° - 105° = \mathbf{75°}$

The angles on a straight line add up to 180°, so all three together make 180°.

Add the two you are given first: 55 + 50 = 105.

Then take that from 180°: 180 – 105 = 75. So x = 75°.

14.



___ degrees

$70° + 50° + x = \mathbf{180°}$

$70° + 50° = \mathbf{120°}$

$180° - 120° = \mathbf{60°}$

The angles on a straight line add up to 180°, so all three together make 180°.

Add the two you are given first: 70 + 50 = 120.

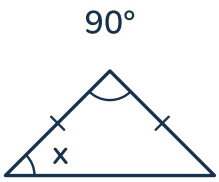
Then take that from 180°: 180 – 120 = 60. So x = 60°.

Solutions (3 of 8)

Isosceles Triangles

Angles in an isosceles triangle

1.



___ degrees

base	=	**base**	and	
sum	=	180°		
90	÷ 2	**=**	45	
x	=	**45°**		

The two ticked sides are equal, so the two base angles are equal — and the three angles still add to 180°.

The apex is 90°, so the two base angles share the other 90° equally: (180 – 90) ÷ 2 = 45.

So x = 45°.

2.

___ degrees

base	=	**base**	and	
sum	=	180°		
180	–	140	=	**40**
x	=	**40°**		

The two ticked sides are equal, so the two base angles are equal — and the three angles still add to 180°.

Both base angles are 70°, so together they are 140°. The apex is what is left of 180°: 180 – 140 = 40.

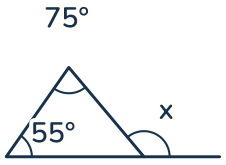
So x = 40°.

Solutions (4 of 8)

Isosceles Triangles (continued)

The exterior angle of a triangle

11.



____ degrees

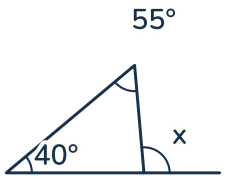
$$x = 55° + 75°$$
$$55° + 75° = 130°$$
$$x = 130°$$

An exterior angle of a triangle equals the sum of the two remote interior angles — the two it does not sit against. Here those are 55° and 75°.

Add them: 55 + 75 = 130.

So x = 130°.

12.



____ degrees

$$x = 40° + 55°$$
$$40° + 55° = 95°$$
$$x = 95°$$

An exterior angle of a triangle equals the sum of the two remote interior angles — the two it does not sit against. Here those are 40° and 55°.

Add them: 40 + 55 = 95.

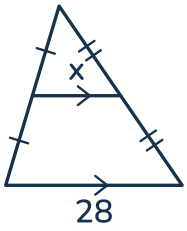
So x = 95°.

Solutions (5 of 8)

Midsegments

The midsegment of a triangle

1.



____ cm

midsegment = **half the base**

28 ÷ 2 = **14**

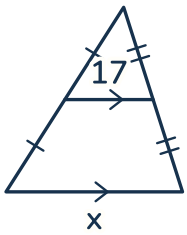
x = **14 cm**

A midsegment joins the midpoints of two sides, and it is half the length of the third side — so the base is always twice the midsegment.

The base is 28 cm, so the midsegment is half of it: 28 ÷ 2 = 14.

So x = 14 cm.

2.



____ cm

midsegment = **half the base**

17 × 2 = **34**

x = **34 cm**

A midsegment joins the midpoints of two sides, and it is half the length of the third side — so the base is always twice the midsegment.

The midsegment is 17 cm, so the base is twice it: 17 × 2 = 34.

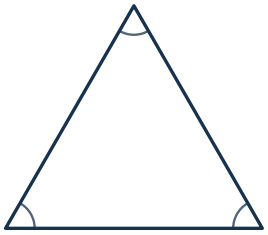
So x = 34 cm.

Solutions (6 of 8)

Midsegments (continued)

Angles inside a polygon

11.



All the angles together

____ degrees

180°

There is no separate rule for each shape. Pick one corner of the triangle and draw a line from it to every corner it is not already joined to — the whole shape falls into triangles, and you already know what a triangle's angles come to.

Counting them: the corner you started from reaches every other corner except its own two neighbors, so a 3-sided shape splits into 3 − 2 = 1 triangles.

Every triangle's angles add to 180°, and between them the triangles use up every angle of the shape and nothing else. So the whole lot comes to 1 × 180 = 180°.

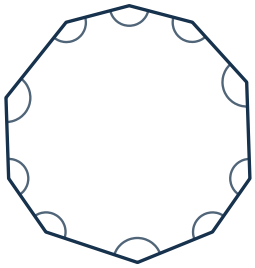
So the angles of a triangle add up to 180°.

Solutions (7 of 8)

Midsegments (continued)

Angles inside a polygon (continued)

12.



All the angles together

_____ degrees

1440°

There is no separate rule for each shape. Pick one corner of the 10-sided shape and draw a line from it to every corner it is not already joined to — the whole shape falls into triangles, and you already know what a triangle's angles come to.

Counting them: the corner you started from reaches every other corner except its own two neighbors, so a 10-sided shape splits into 10 − 2 = 8 triangles.

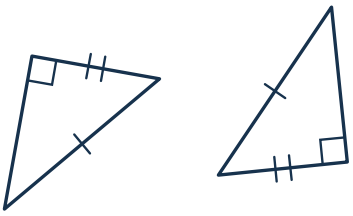
Every triangle's angles add to 180°, and between them the triangles use up every angle of the shape and nothing else. So the whole lot comes to 8 × 180 = 1440°.

So the angles of a 10-sided shape add up to 1440°.

Congruence Criteria

Which congruence rule (SSS, SAS, ASA, AAS, HL)

1.



SSS SAS ASA AAS HL

HL

Read the marks first — they are the givens. Here there are a right angle in each, and the hypotenuse with one leg marked equal.

In a right triangle the hypotenuse and one leg give the other leg by Pythagoras, so the two triangles have to match.

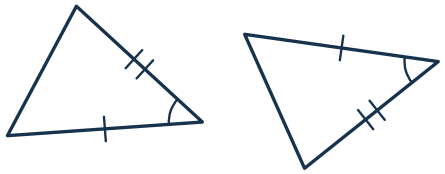
So the rule is HL.

Solutions (8 of 8)

Congruence Criteria (continued)

Which congruence rule (SSS, SAS, ASA, AAS, HL) (continued)

2.



SSS SAS ASA AAS HL

SAS

Read the marks first — they are the givens. Here there are two pairs of equal sides and one pair of equal angles.

The marked angle sits BETWEEN the two marked sides — an included angle — and two sides with the angle between them fix the third side.

So the rule is SAS.