4.1 Triangle Sum Theorem

Answers

1. $m\angle 1 = 41^\circ$
2. $m\angle 1 = 86^\circ$
3. $m\angle 1 = 61^\circ$
4. $m\angle 1 = 51^\circ$
5. $m\angle 1 = 13^\circ$
6. $m\angle 1 = 60^\circ$
7. $m\angle 1 = 70^\circ$
8. 84°
9. 57°
10. 21°
11. $x = 14^\circ$
12. $x = 9^\circ$
13. $x = 22^\circ$
14. $x = 17^\circ$
15. $x = 12^\circ$

4.2 Exterior Angles Theorem

Answers

1. $m\angle 1 = 118^\circ$
2. $m\angle 1 = 68^\circ$
3. $m\angle 1 = 116^\circ$
4. $m\angle 1 = 161^\circ$
5. $m\angle 1 = 141^\circ$
6. $m\angle 1 = 135^\circ$
7. 180°
8. 360°
9. 360°
10. $x = 30^\circ$
11. $x = 25^\circ$
12. $x = 7^\circ$

4.3 Congruent Triangles

Answers

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

4.4 Congruence Statements

Answers

1. $\Delta FGH \cong \Delta KLM$

2. No, we do not know if $\overline{AC} \cong \overline{BD}$, so we cannot say that the triangles are congruent.

3. $\Delta ABE \cong \Delta DCE$

4. No, we only know that one pair of sides and one pair of angles are congruent. This is not enough information to determine if the triangles are congruent.

5. Line up the congruent sides: $\Delta BCD \cong \Delta ZYX$

6. Corresponding Parts of Congruent Triangles are Congruent or CPCTC.

7. $\angle T \cong \angle F$, $\angle B \cong \angle A$, $\angle S \cong \angle M$, $\overline{TB} \cong \overline{FA}, \overline{BS} \cong \overline{AM}, \overline{TS} \cong \overline{FM}$

8. $\angle P \cong \angle S$, $\angle A \cong \angle T$, $\angle M \cong \angle E$, $\overline{PA} \cong \overline{ST}, \overline{AM} \cong \overline{TE}, \overline{PM} \cong \overline{SE}$

9. $\angle I \cong \angle W$, $\angle N \cong \angle E$, $\angle T \cong \angle B$, $\overline{IN} \cong \overline{WE}, \overline{NT} \cong \overline{EB}, \overline{IT} \cong \overline{WB}$

10. $\angle E$

4.5 Third Angle Theorem

Answers

1. 88°
2. 42°
3. 50°
4. 42°
5. 47°
6. 43°
7. 47°
8. 37°
9. Lines are not marked parallel, we cannot assume that $m\angle HIJ = 108^\circ$.
10. 35°
11. Lines are not marked parallel, we cannot assume that $m\angle IHJ = 37^\circ$.
12. 55°
13. 63°
14. 62°
15. 63°

4.6 SSS Triangle Congruence

Answers

1. Yes, $\Delta DEF \cong \Delta HJI$, SSS

2. No, one triangle is SSS and the other is SAS.

3. Yes, $\Delta ABC \cong \Delta FED$, SSS

4. Yes, $\Delta ATD \cong \Delta ETD$, SSS

5. $\overline{AB} \cong \overline{HI}$

6. $\overline{AB} \cong \overline{JL}$

7.

Statement	***Reason***
1. B is the midpoint of $\overline{DC}$, $\overline{AD} \cong \overline{AC}$	Given
2. $\overline{DB} \cong \overline{BC}$	Definition of a Midpoint
3. $\overline{AB} \cong \overline{AB}$	Reflexive PoC
4. $\Delta ABD \cong \Delta ABC$	SSS

8. Triangle #1: (-8, 0), (0, 3), and (-5, 9), Side #1 $= \sqrt{73}$, Side #2 $= \sqrt{90}$, Side #3 $= \sqrt{61}$

   Triangle #2: (2, 5), (10, 2), and (5, -4), Side #1 $= \sqrt{90}$, Side #2 $= \sqrt{73}$, Side #3 $= \sqrt{61}$

   The triangles are congruent by SSS.

9. Triangle #1: (-7, 2), (1, 6), and (4, 5), Side #1 = $\sqrt{80}$, Side #2 = $\sqrt{130}$, Side #3 = $\sqrt{10}$

   Triangle #2: (-1, -10), (-5, -2), and (-8, -1), Side #1 = $\sqrt{80}$, Side #2 = $\sqrt{130}$, Side #3 = $\sqrt{10}$

   The triangles are congruent by SSS.

10. ΔABC: $AB = \sqrt{18}$, $AC = \sqrt{58}$, $BC = \sqrt{52}$, ΔDEF: $DF = \sqrt{17}$, $DE = \sqrt{58}$, $EF = \sqrt{137}$

    The triangles are not congruent because not all the corresponding sides are congruent.

11. ΔABC: $AB = \sqrt{37}$, $AC = \sqrt{45}$, $BC = \sqrt{34}$, ΔDEF: $DE = \sqrt{37}$, $DF = \sqrt{45}$, $EF = \sqrt{34}$

    The triangles are congruent by SSS.

4.7 SAS Triangle Congruence

Answers

1. No, these are both SSA, which is not a congruence postulate.

2. Yes, $\triangle ABC \cong \triangle YXZ$, SAS

3. No, these are both SSA, which is not a congruent postulate

4. $\angle C \cong \angle G$

5. $\angle C \cong \angle K$

6. $\overline{AB} \cong \overline{ON}$

7.

Statement	***Reason***
1. B is a midpoint of $\overline{DC}$, $\overline{AB} \perp \overline{DC}$	Given
2. $\overline{DB} \cong \overline{BC}$	Definition of a midpoint
3. $\angle ABD$ and $\angle ABC$ are right angles	$\perp$ lines create 4 right angles
4. $\angle ABD \cong \angle ABC$	All right angles are $\cong$
5. $\overline{AB} \cong \overline{AB}$	Reflexive PoC
6. $\triangle ABD \cong \triangle ABC$	SAS

8.

Statement	***Reason***
1. $\overline{AB}$ is an angle bisector of $\angle DAC$, $\overline{AD} \cong \overline{AC}$	Given
2. $\angle DAB \cong \angle BAC$	Definition of an Angle Bisector
3. $\overline{AB} \cong \overline{AB}$	Reflexive PoC
4. $\Delta ABD \cong \Delta ABC$	SAS

9.

Statement	***Reason***
1. B is the midpoint of $\overline{DE}$ and $\overline{AC}$, $\angle ABE$ is a right angle	Given
2. $\overline{DB} \cong \overline{BE}, \overline{AB} \cong \overline{BC}$	Definition of a Midpoint
3. $m\angle ABE = 90^\circ$	Definition of a Right Angle
4. $m\angle ABE = m\angle DBC$	Vertical Angle Theorem
5. $\Delta ABE \cong \Delta CBD$	SAS

10.

Statement	***Reason***
1. $\overline{DB}$ is the angle bisector of $\angle ADC$, $\overline{AD} \cong \overline{DC}$	Given
2. $\angle ADB \cong \angle BDC$	Definition of an Angle Bisector
3. $\overline{DB} \cong \overline{DB}$	Reflexive PoC
4. $\Delta ABD \cong \Delta CBD$	SAS

4.8 ASA and AAS Triangle Congruence

Answers

1. Yes, AAS, $\Delta ABC \cong FDE$

2. Yes, ASA, $\Delta ABC \cong \Delta IHG$

3. No, the triangles have congruent parts that would be SSA. This is not a congruence theorem.

4. $\angle DBC \cong \angle DBA$ because they are both right angles and created by perpendicular lines.

5. $\angle CDB \cong \angle ADB$

6. $\overline{DB} \cong \overline{DB}$ from the Reflexive Property. We have enough to say that the triangles are congruent by ASA.

7.

Statement	***Reason***
1. $\overline{DB} \perp \overline{AC}$, $\overline{DB}$ is the angle bisector of $\angle CDA$	Given
2. $\angle DBC$ and $\angle ADB$ are right angles	Definition of perpendicular
3. $\angle DBC \cong \angle ADB$	All right angles are $\cong$
4. $\angle CDB \cong \angle ADB$	Definition of an angle bisector
5. $\overline{DB} \cong \overline{DB}$	Reflexive PoC
6. $\Delta CDB \cong \Delta ADB$	ASA

8. $\angle C \cong \angle A$ by CPCTC (corresponding parts of congruent triangles are congruent)

9. $\angle L \cong \angle O$ and $\angle P \cong \angle N$ by the Alternate Interior Angles Theorem.

10. $\angle LMP \cong \angle NMO$ by the Vertical Angles Theorem.

11. *There is more than one correct proof, this is one possible answer.*

Statement	***Reason***
1. $\overline{LP} \parallel \overline{NO}$, $\overline{LP} \cong \overline{NO}$	Given
2. $\angle L \cong \angle O$, $\angle P \cong \angle N$	Alternate Interior Angles Theorem
3. $\Delta LMP \cong \angle OMN$	ASA

12. CPCTC

13. *Start with the proof from #11 and continue.*

Statement	***Reason***
1. $\overline{LP} \parallel \overline{NO}$, $\overline{LP} \cong \overline{NO}$	Given
2. $\angle L \cong \angle O$, $\angle P \cong \angle N$	Alternate Interior Angles
3. $\Delta LMP \cong \angle OMN$	ASA
4. $\overline{LM} \cong \overline{MO}$	CPCTC
5. *M* is the midpoint of $\overline{PN}$.	Definition of a midpoint

14. $\angle A \cong \angle N$

15. $\angle C \cong \angle M$

16. $\overline{PM} \cong \overline{MN}$

17. $\overline{LM} \cong \overline{MO}$ or $\overline{LP} \cong \overline{NO}$

4.9 HL Triangle Congruence

Answers

1. $\overline{NM} \cong \overline{ZX}$
2. $\overline{FG} \cong \overline{RS}$ or $\overline{FE} \cong \overline{RQ}$
3. $\overline{VW} \cong \overline{DC}$ and $\overline{WX} \cong \overline{CB}$ or $\overline{VX} \cong \overline{DB}$
4. Given/Definition of Perpendicular Lines
5. $\overline{AC} \cong \overline{CD}$
6. $\overline{ED} \cong \overline{AB}$
7. HL Congruence
8. No
9. Yes, by SAS
10. No
11. Yes, by HL
12. No
13. No
14. Yes, by SSS
15. No

4.10 Isosceles Triangles

Answers

1. $x = 13°$
2. $y = 16°$
3. $x = 1$
4. $y = 3$
5. $x = 4°$, $y = 11°$
6. True
7. False, only in an isosceles right triangle.
8. False, only in the case of an equilateral triangle.
9. True
10.

Statement	***Reason***
1. Isosceles ΔCIS, with base angles $\angle C$ and $\angle S$ $\overline{IO}$ is the angle bisector of $\angle CIS$	Given
2. $\angle C \cong \angle S$	Base Angles Theorem
3. $\angle CIO \cong \angle SIO$	Definition of an Angle Bisector
4. $\overline{IO} \cong \overline{IO}$	Reflexive PoC
5. $\Delta CIO \cong \Delta SIO$	ASA
6. $\overline{CO} \cong \overline{OS}$	CPCTC
7. $\angle IOC \cong \angle IOS$	CPCTC
8. $\angle IOC$ and $\angle IOS$ are supplementary	Linear Pair Postulate
9. $m\angle IOC = m\angle IOS = 90°$	Congruent Supplements Theorem
10. $\overline{IO}$ is the perpendicular bisector of $\overline{CS}$	Definition of a $\perp$ bisector (Steps 6 and 9)

11.

Statement	***Reason***
1. Isosceles ΔICS with $\angle C$ and $\angle S$, $\overline{IO}$ is the perpendicular bisector of $\overline{CS}$	Given
2. $\angle C \cong \angle S$	Base Angle Theorem
3. $\overline{CO} \cong \overline{OS}$	Definition of a $\perp$ bisector
4. $m\angle IOC = m\angle IOS = 90^\circ$	Definition of a $\perp$ bisector
5. $\Delta CIO \cong \Delta SIO$	ASA
6. $\angle CIO \cong \angle SIO$	CPCTC
7. $\overline{IO}$ is the angle bisector of $\angle CIS$	Definition of an Angle Bisector

12. Side #1 = $\sqrt{18}$, Side #2 = $\sqrt{18}$, Side #3 = 6

This is an isosceles triangle because Side #1 and Side #2 are equal.

13. Side #1 = $\sqrt{17}$, Side #2 = $\sqrt{40}$, Side #3 = $\sqrt{9}$

No sides are equal, so this is a scalene triangle.

14. Side #1 = $\sqrt{72}$, Side #2 = $\sqrt{234}$, Side #3 = $\sqrt{162}$

No sides are equal, so this is a scalene triangle.

15. Side #1 = $\sqrt{104}$, Side #2 = $\sqrt{208}$, Side #3 = $\sqrt{104}$

This is an isosceles triangle because Side #1 and Side #3 are equal.

16. Side #1 = 8, Side #2 = $\sqrt{65}$, Side #3 = $\sqrt{65}$

This is an isosceles triangle because Side #2 and Side #3 are equal.

4.11 Equilateral Triangles

Answers

1. $x = 60^\circ$
2. $y = 68^\circ$
3. $x = 1.5$
4. $y = 17$
5. $z = 17$
6. $n = 25^\circ$
7. $x = \pm 4\sqrt{2}$
8. $x = 3$, $y = 2$
9. $x = 2$, $y = 5$
10. $z = 4$
11. $a = -1, 6$
12. $m = -4^\circ, 15^\circ$
13. $x = 4, -1$
14. $x = \pm 2\sqrt{14}$
15. $x = 25^\circ$, $y = 19^\circ$