# 5.4 Equilateral and Isosceles Triangles

**Rewrite the definition of the term as a biconditional statement.**

**1.** In an isosceles triangle, the legs are of equal length.

A △ is isosceles iff the legs are equal length.

**2.** A tangram is a Chinese puzzle made up of seven pieces.

A Chinese puzzle is made up of 7 pieces iff it is a tangram.

**3.** A rectangle is a parallelogram that has four right angles.

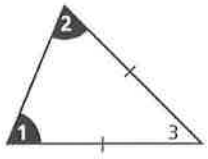
A figure is a rectangle iff it is a p-gram with 4 right ∠'s.

Cumulative Warm Up

Recall that an isosceles triangle has at least two congruent sides. The congruent sides are called the **legs**. The **vertex angle** is the angle formed by the legs. The side opposite the vertex angle is called the **base**, and the **base angles** are the two angles that have the base as a side.

∠3 is the vertex angle.

∠1 and ∠2 are the base angles.



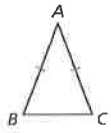

## Theorems

**Theorem 5.6 Base Angles Theorem**

If two sides of a triangle are congruent, then the angles opposite them are congruent.

If $\overline{AB} \cong \overline{AC}$, then $\angle B \cong \angle C$.

*Proof* p. 252

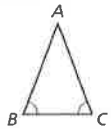



**Theorem 5.7 Converse of the Base Angles Theorem**

If two angles of a triangle are congruent, then the sides opposite them are congruent.

If $\angle B \cong \angle C$, then $\overline{AB} \cong \overline{AC}$.

*Proof* Ex. 27, p. 275

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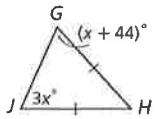
180 − 22 = 158

$\frac{158}{2} = 79°$

**Find m∠F.**


m∠F = 79°

**Find m∠G.**




x + 44 = 3x

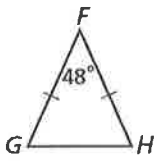
−x −x

$\frac{44}{2} = \frac{2x}{2}$

22 = x

m∠G = 22 + 44 = 66°

**Find m∠H.**

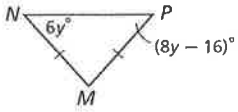



m∠H = 66°

180 − 48 = 132°

$\frac{132°}{2} = 66°$

**Find m∠N.**




6y = 8y − 16

−8y −8y

$\frac{-2y}{-2} = \frac{-16}{-2}$

y = 8

m∠N = 6(8)

m∠N = 48°

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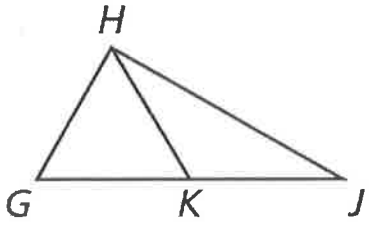
**Copy and complete the statement.**

**1.** If $\overline{HG} \cong \overline{HK}$, then ∠ G ≅ ∠ GKH .

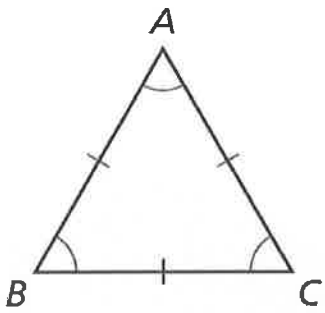
**2.** If ∠KHJ ≅ ∠KJH, then HK ≅ JK .




Monitoring Progress 1-2

If a triangle is equilateral, then it is equiangular.

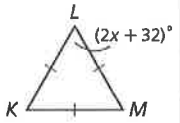
If a triangle is equiangular, then it is equilateral.




Corollary

**Find the value of *x*.**

$\Delta LKM$ is equilateral.




$2x + 32 = 60$

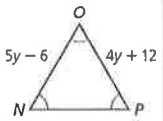
$-32 \quad -32$

$\frac{2x}{2} = \frac{28}{2}$

$x = 14$

**Find the value of *y*.**

$\Delta NPO$ is equiangular.



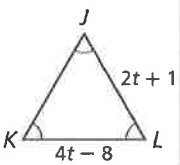

$5y - 6 = 4y + 12$

$-4y + 6 \quad -4y + 6$

$y = 18$

**Find the value of JL.**

$\Delta JKL$ is equiangular.




$JL = 2(4.5) + 1$

$JL = 10$

Example 2

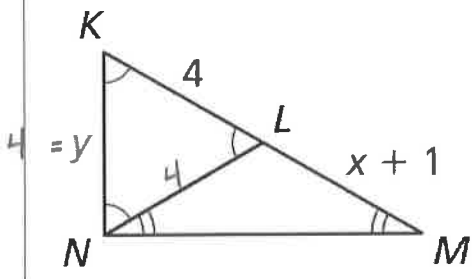
$2t + 1 = 4t - 8$

$-2t + 8 \quad -2t + 8$

$\frac{9}{2} = \frac{2t}{2}$

$4.5 = t$

Find the values of $x$ and $y$ in the diagram.




$x + 1 = 4$

$x = 3$ $y = 4$

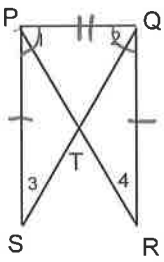
Example 3

| S | R |
|---|---|
| $\overline{PS} \cong \overline{QR}$ | Given |
| $\angle QPS \cong \angle PQR$ | Given |
| $\overline{PQ} \cong \overline{PQ}$ | Reflexive |
| $\triangle QPS \cong \triangle PQR$ | SAS |

$\overline{PS} \cong \overline{QR}$ and $\angle QPS \cong \angle PQR$.

**a. Prove:** $\triangle QPS \cong \triangle PQR$.

**b.** Explain why $\triangle PQT$ is isosceles.




$\angle 3 \cong \angle 4$ by CPCTC

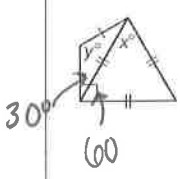
$\angle PTS \cong \angle QTR$ by Vert. $\angle$'s Thm

$\triangle PTS \cong \triangle QTR$ by AAS

$\overline{PT} \cong \overline{QT}$ by CPCTC

$\triangle PQT$ is isosceles - Def. of Isosceles

4. Find the values of $x$ and $y$ in the diagram.




$x = 60°$ ; $y = 120°$

$180 - 30 - 30 = 120°$

Example 4

# Homework

Pg. 256 #4-10 Evens, 13-16, 22-24, 29, 30

Closure