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# Inside Out

## Triangle Sum, Exterior Angle, and Exterior Angle Inequality Theorems

### Vocabulary

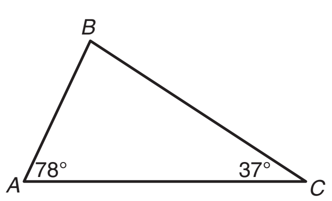
Write the term that best completes each statement.

1. The **Exterior Angle Inequality Theorem** states that the measure of an exterior angle of a triangle is greater than the measure of either of the remote interior angles of the triangle.
2. The **Triangle Sum Theorem** states that the sum of the measures of the interior angles of a triangle is 180°.
3. The **Exterior Angle Theorem** states that the measure of an exterior angle of a triangle is equal to the sum of the measures of the remote interior angles of the triangle.
4. The **remote interior angles of a triangle** are the two angles that are non-adjacent to the specified exterior angle.

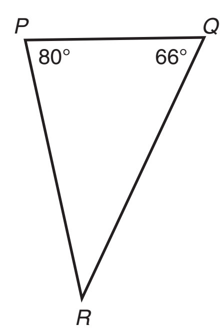
3

### Problem Set

Determine the measure of the missing angle in each triangle.

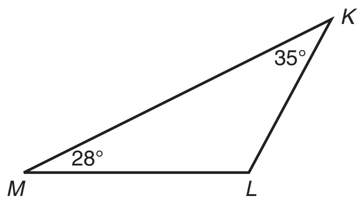
1. 


$m\angle B = 180° - (78° + 37°) = 65°$

2. 

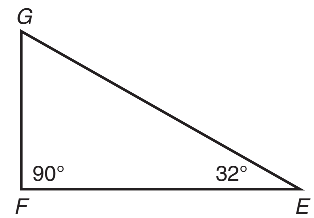

$m\angle R = 180° - (80° + 66°) = 34°$

**3.**



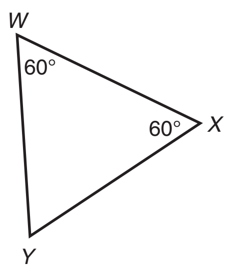

$m\angle L = 180° - (28° + 35°) = 117°$

**4.**



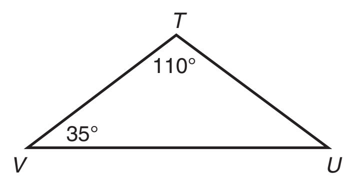

$m\angle G = 180° - (90° + 32°) = 58°$

**5.**




$m\angle Y = 180° - (60° + 60°) = 60°$

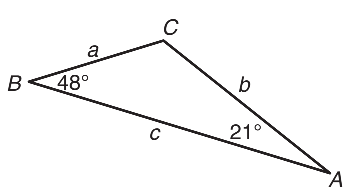
**6.**




$m\angle U = 180° - (110° + 35°) = 35°$

List the side lengths from shortest to longest for each diagram.

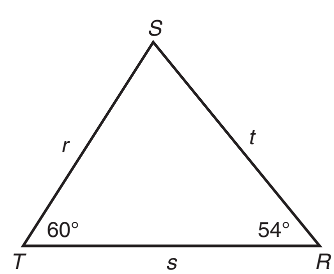
**7.**




$m\angle C = 180° - (48° + 21°) = 111°$

The shortest side of a triangle is opposite the smallest angle. So, the side lengths from shortest to longest are *a*, *b*, *c*.

**8.**




$m\angle S = 180° - (54° + 60°) = 66°$

The shortest side of a triangle is opposite the smallest angle. So, the side lengths from shortest to longest are *r*, *t*, *s*.

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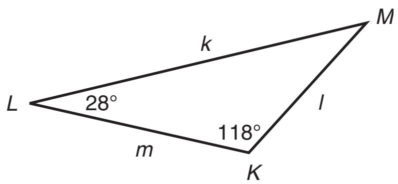
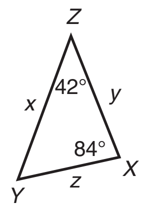
**9.**




$m\angle M = 180° - (118° + 28°) = 34°$

The shortest side of a triangle is opposite the smallest angle. So, the side lengths from shortest to longest are *l*, *m*, *k*.

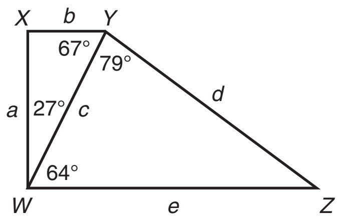
**10.**




$m\angle Y = 180° - (84° + 42°) = 54°$

The shortest side of a triangle is opposite the smallest angle. So, the side lengths from shortest to longest are *z*, *y*, *x*.

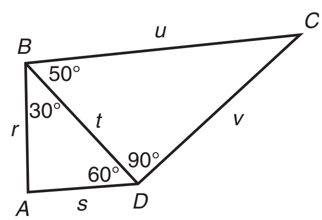
**11.**




$m\angle X = 180° - (67° + 27°) = 86°$
$m\angle Z = 180° - (64° + 79°) = 37°$

The shortest side of a triangle is opposite the smallest angle. Side *c* is the longest side of $\triangle WXY$, and the shortest side of $\triangle WYZ$. So, the side lengths from shortest to longest are *b*, *a*, *c*, *d*, *e*.

**12.**



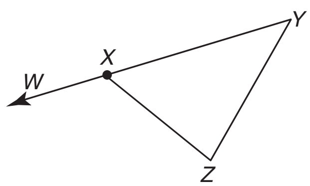

$m\angle A = 180° - (60° + 30°) = 90°$
$m\angle C = 180° - (90° + 50°) = 40°$

The shortest side of a triangle is opposite the smallest angle. Side *t* is the longest side of $\triangle ABD$, and the shortest side of $\triangle BCD$. So, the side lengths from shortest to longest are *s*, *r*, *t*, *v*, *u*.

3

Identify the interior angles, the exterior angle, and the remote interior angles of each triangle.

**13.**

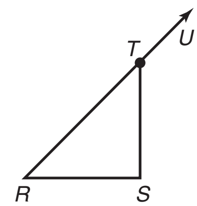



Interior angles: ∠*XYZ*, ∠*YZX*, ∠*ZXY*

Exterior angle: ∠*WXZ*

Remote interior angles: ∠*XYZ*, ∠*YZX*

**14.**



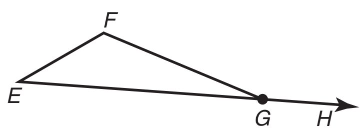

Interior angles: ∠*RST*, ∠*RTS*, ∠*SRT*

Exterior angle: ∠*STU*

Remote interior angles: ∠*RST*, ∠*SRT*



**15.**

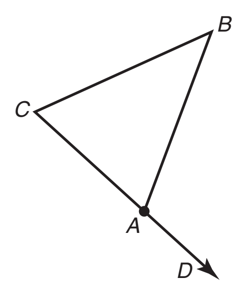



Interior angles: ∠*EFG*, ∠*EGF*, ∠*FEG*

Exterior angle: ∠*FGH*

Remote interior angles: ∠*EFG*, ∠*FEG*

**16.**

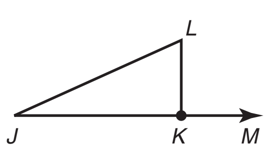



Interior angles: ∠*ABC*, ∠*ACB*, ∠*BAC*

Exterior angle: ∠*BAD*

Remote interior angles: ∠*ABC*, ∠*ACB*

**17.**

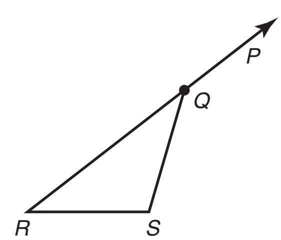



Interior angles: ∠*JKL*, ∠*JLK*, ∠*KJL*

Exterior angle: ∠*LKM*

Remote interior angles: ∠*JLK*, ∠*KJL*

**18.**




Interior angles: ∠*QRS*, ∠*QSR*, ∠*RQS*

Exterior angle: ∠*PQS*

Remote interior angles: ∠*QRS*, ∠*QSR*

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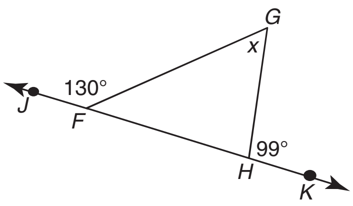
Solve for $x$ in each diagram.

**19.**



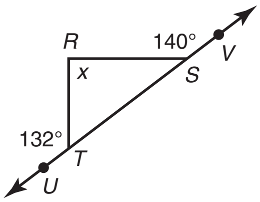

$m\angle GFH = 180° - 130° = 50°$

$m\angle GHK = m\angle GFH + m\angle FGH$

$99° = 50° + x$

$49° = x$

**20.**



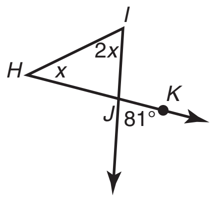

$m\angle RTS = 180° - 132° = 48°$

$m\angle RSV = m\angle RTS + m\angle SRT$

$140° = 48° + x$

$92° = x$

**21.**




$m\angle IJK = 180° - 81° = 99°$

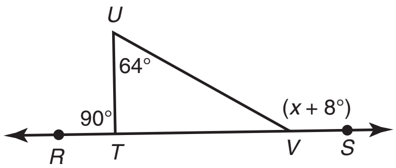
$m\angle IJK = m\angle HIJ + m\angle IHJ$

$99° = 2x + x$

$99° = 3x$

$33° = x$

**22.**




$m\angle UTV = 180° - 90° = 90°$

$m\angle SVU = m\angle UTV + m\angle TUV$

$x + 8° = 90° + 64°$

$x + 8° = 154°$

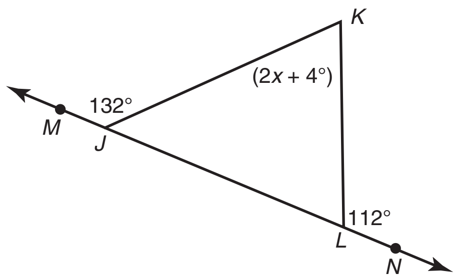
$x = 146°$





3

**23.**




$m\angle KJL = 180° - 132° = 48°$

$m\angle KLN = m\angle KJL + m\angle JKL$

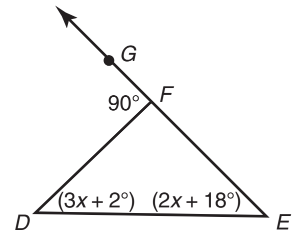
$112° = 48° + (2x + 4°)$

$112° = 52° + 2x$

$60° = 2x$

$30° = x$

**24.**




$m\angle DFE = 180° - 90° = 90°$

$m\angle DFG = m\angle DEF + m\angle EDF$

$90° = (2x + 18°) + (3x + 2°)$

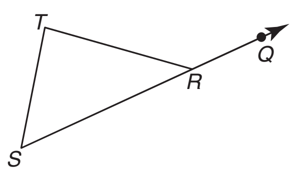
$90° = 5x + 20°$

$70° = 5x$

$14° = x$

Use the given information for each triangle to write two inequalities that you would need to prove the Exterior Angle Inequality Theorem.

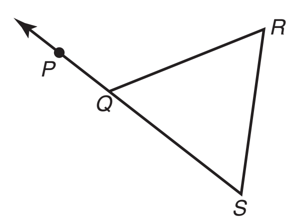
**25.**




Given: Triangle *RST* with exterior $\angle TRQ$

Prove: $m\angle TRQ > m\angle S$ and
$m\angle TRQ > m\angle T$

**26.**




Given: Triangle *QRS* with exterior $\angle PQR$

Prove: $m\angle PQR > m\angle R$ and
$m\angle PQR > m\angle S$

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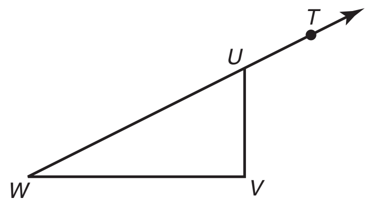
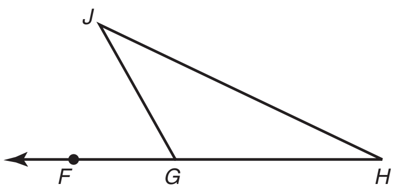
27. 


Given: Triangle *UVW* with exterior $\angle TUV$

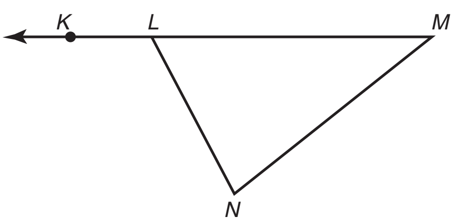
Prove: $m\angle TUV > m\angle V$ and $m\angle TUV > m\angle W$

28. 


Given: Triangle *GHJ* with exterior $\angle FGJ$

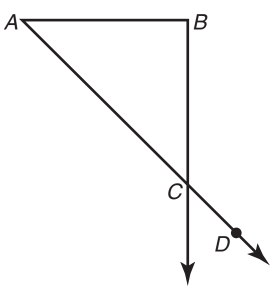
Prove: $m\angle FGJ > m\angle H$ and $m\angle FGJ > m\angle J$



29. 


Given: Triangle *LMN* with exterior $\angle KLN$

Prove: $m\angle KLN > m\angle M$ and $m\angle KLN > m\angle N$

30. 


Given: Triangle *ABC* with exterior $\angle BCD$

Prove: $m\angle BCD > m\angle A$ and $m\angle BCD > m\angle B$

3

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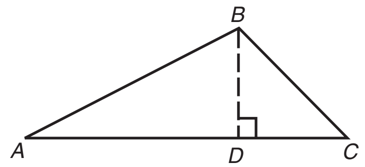
# Trade Routes and Pasta, Anyone?
## The Triangle Inequality Theorem

### Vocabulary

Identify an example of each term in the diagram of triangle *ABC*.

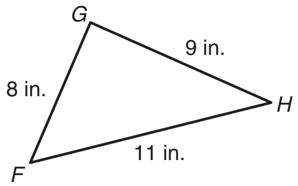
1. Triangle Inequality Theorem
   $AB + BC > AC$




### Problem Set

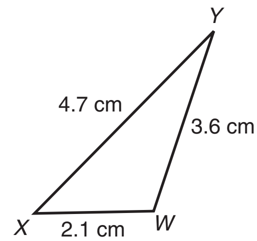
Without measuring the angles, list the angles of each triangle in order from least to greatest measure.

1.



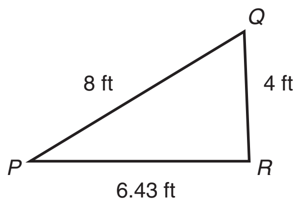

The smallest angle of a triangle is opposite the shortest side. So, the angles from least to greatest are $\angle H$, $\angle F$, $\angle G$.

2.



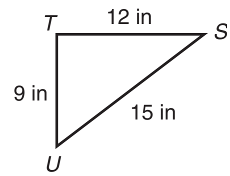

The smallest angle of a triangle is opposite the shortest side. So, the angles from least to greatest are $\angle Y$, $\angle X$, $\angle W$.

**3.**



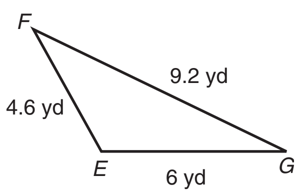

The smallest angle of a triangle is opposite the shortest side. So, the angles from least to greatest are $\angle P$, $\angle Q$, $\angle R$.

**4.**



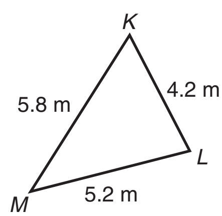

The smallest angle of a triangle is opposite the shortest side. So, the angles from least to greatest are $\angle S$, $\angle U$, $\angle T$.

**5.**




The smallest angle of a triangle is opposite the shortest side. So, the angles from least to greatest are $\angle G$, $\angle F$, $\angle E$.

**6.**




The smallest angle of a triangle is opposite the shortest side. So, the angles from least to greatest are $\angle M$, $\angle K$, $\angle L$.

Determine whether it is possible to form a triangle using each set of segments with the given measurements. Explain your reasoning.

**7.** 3 inches, 2.9 inches, 5 inches

Yes. A triangle can be formed because the sum of the two shortest sides is greater than the longest side.
Sum of the Two Shortest Sides: $3 + 2.9 = 5.9$
Longest Side: 5

**8.** 8 feet, 9 feet, 11 feet

Yes. A triangle can be formed because the sum of the two shortest sides is greater than the longest side.
Sum of the Two Shortest Sides: $8 + 9 = 17$
Longest Side: 11

**9.** 4 meters, 5.1 meters, 12.5 meters

No. A triangle cannot be formed because the sum of the two shortest sides is less than the longest side.
Sum of the Two Shortest Sides: $4 + 5.1 = 9.1$
Longest Side: 12.5

**10.** 7.4 centimeters, 8.1 centimeters, 9.8 centimeters

Yes. A triangle can be formed because the sum of the two shortest sides is greater than the longest side.
Sum of the Two Shortest Sides: $7.4 + 8.1 = 15.5$
Longest Side: 9.8

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**11.** 10 yards, 5 yards, 21 yards

No. A triangle cannot be formed because the sum of the two shortest sides is less than the longest side.
Sum of the Two Shortest Sides: 10 + 5 = 15
Longest Side: 21

**12.** 13.8 kilometers, 6.3 kilometers, 7.5 kilometers

No. A triangle cannot be formed because the sum of the two shortest sides is equal to the longest side.
Sum of the Two Shortest Sides: 6.3 + 7.5 = 13.8
Longest Side: 13.8

**13.** 112 millimeters, 300 millimeters, 190 millimeters

Yes. A triangle can be formed because the sum of the two shortest sides is greater than the longest side.
Sum of the Two Shortest Sides: 112 + 190 = 302
Longest Side: 300

**14.** 20.2 inches, 11 inches, 8.2 inches

No. A triangle cannot be formed because the sum of the two shortest sides is less than the longest side.
Sum of the Two Shortest Sides: 11 + 8.2 = 19.2
Longest Side: 20.2

**15.** 30 cm, 12 cm, 17 cm

No. A triangle cannot be formed because the sum of the two shortest sides is less than the longest side.
Sum of the Two Shortest Sides: 12 + 17 = 29
Longest Side: 30

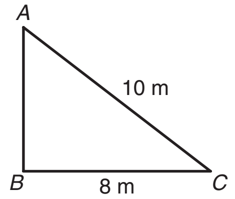
**16.** 8 ft, 8 ft, 8 ft

Yes. A triangle can be formed because the sum of the two shortest sides is greater than the longest side.
Sum of the Two Shortest Sides: 8 + 8 = 16
Longest Side: 8

3

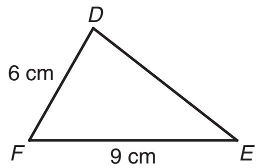
Write an inequality that expresses the possible lengths of the unknown side of each triangle.

**17.** What could be the length of $\overline{AB}$?



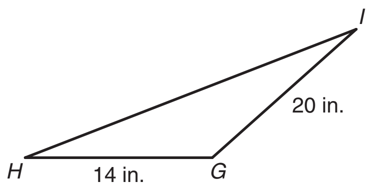

$AB < AC + BC$
$AB <$ 10 meters + 8 meters
$AB <$ 18 meters

**18.** What could be the length of $\overline{DE}$?



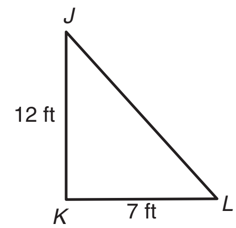

$DE < DF + EF$
$DE <$ 6 centimeters + 9 centimeters
$DE <$ 15 centimeters

**19.** What could be the length of $\overline{HI}$?




$HI < GH + GI$
$HI <$ 14 inches + 20 inches
$HI <$ 34 inches

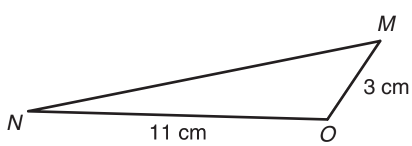
**20.** What could be the length of $\overline{JL}$?




$JL < JK + KL$
$JL <$ 12 feet + 7 feet
$JL <$ 19 feet

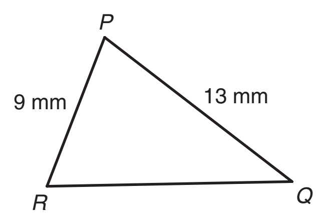


**21.** What could be the length of $\overline{MN}$?




$MN < NO + MO$
$MN <$ 11 centimeters + 3 centimeters
$MN <$ 14 centimeters

**22.** What could be the length of $\overline{QR}$?




$QR < PR + PQ$
$QR <$ 9 millimeters + 13 millimeters
$QR <$ 22 millimeters

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# Stamps Around the World
## Properties of a 45°–45°–90° Triangle



### Vocabulary

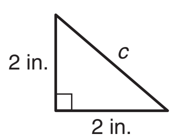
Define the term in your own words.

1. 45°–45°–90° Triangle Theorem
   **The 45°–45°–90° Triangle Theorem states that the length of the hypotenuse in a 45°–45°–90° triangle is $\sqrt{2}$ times the length of a leg.**

### Problem Set

Determine the length of the hypotenuse of each 45°–45°–90° triangle.
Write your answer as a radical in simplest form.

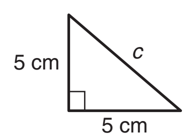
**1.**




$c = 2\sqrt{2}$

The length of the hypotenuse is $2\sqrt{2}$ inches.

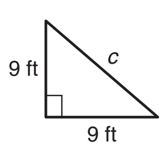
**2.**




$c = 5\sqrt{2}$

**The length of the hypotenuse is $5\sqrt{2}$ centimeters.**

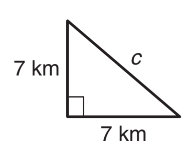
**3.**




$c = 9\sqrt{2}$

**The length of the hypotenuse is $9\sqrt{2}$ feet.**

**4.**

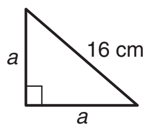



$c = 7\sqrt{2}$

**The length of the hypotenuse is $7\sqrt{2}$ kilometers.**

Determine the lengths of the legs of each 45°–45°–90° triangle. Write your answer as a radical in simplest form.

**5.**




$a\sqrt{2} = 16$

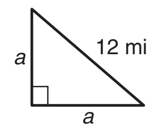
$a = \frac{16}{\sqrt{2}}$

$a = \frac{16\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$a = \frac{16\sqrt{2}}{2} = 8\sqrt{2}$

The length of each leg is $8\sqrt{2}$ centimeters.

**6.**




$a\sqrt{2} = 12$

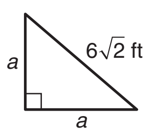
$a = \frac{12}{\sqrt{2}}$

$a = \frac{12\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$a = \frac{12\sqrt{2}}{2} = 6\sqrt{2}$

The length of each leg is $6\sqrt{2}$ miles.

**7.**



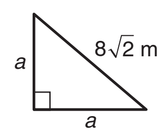

$a\sqrt{2} = 6\sqrt{2}$

$a = \frac{6\sqrt{2}}{\sqrt{2}}$

$a = 6$

The length of each leg is 6 feet.

**8.**




$a\sqrt{2} = 8\sqrt{2}$

$a = \frac{8\sqrt{2}}{\sqrt{2}}$

$a = 8$

The length of each leg is 8 meters.

Use the given information to answer each question. Round your answer to the nearest tenth, if necessary.

**9.** Soren is flying a kite on the beach. The string forms a 45° angle with the ground. If he has let out 16 meters of line, how high above the ground is the kite?

$a\sqrt{2} = 16$

$a = \frac{16}{\sqrt{2}}$

$a = \frac{16\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$a = \frac{16\sqrt{2}}{2} = 8\sqrt{2} \approx 11.3$

The kite is approximately 11.3 meters above the ground.

3

Name ____________________ Date ____________

**10.** Meena is picking oranges from the tree in her yard. She rests a 12-foot ladder against the tree at a 45° angle. How far is the top of the ladder from the ground?

$a\sqrt{2} = 12$

$a = \frac{12}{\sqrt{2}}$

$a = \frac{12\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$a = \frac{12\sqrt{2}}{2} = 6\sqrt{2} \approx 8.5$

**The top of the ladder is approximately 8.5 feet from the ground.**



**11.** Emily is building a square bookshelf. She wants to add a diagonal support beam to the back to strengthen it. The diagonal divides the bookshelf into two 45°–45°–90° triangles. If each side of the bookshelf is 4 feet long, what must the length of the support beam be?

$c = 4\sqrt{2} \approx 5.7$

**The support beam must be approximately 5.7 feet long.**

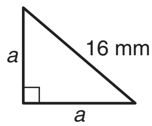
**12.** Prospect Park is a square with side lengths of 512 meters. One of the paths through the park runs diagonally from the northeast corner to the southwest corner, and it divides the park into two 45°–45°–90° triangles. How long is that path?

$c = 512\sqrt{2} \approx 724.1$

**The path is approximately 724.1 meters long.**

Determine the area of each triangle.

**13.**




$a\sqrt{2} = 16$

$a = \frac{16}{\sqrt{2}}$

$a = \frac{16\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$a = \frac{16\sqrt{2}}{2}$

$a = 8\sqrt{2}$

$A = \frac{1}{2}(8\sqrt{2})(8\sqrt{2})$

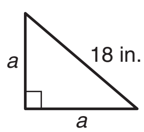
$A = \frac{64(\sqrt{2})^2}{2}$

$A = \frac{64(2)}{2}$

$A = 64$

The area of the triangle is 64 square millimeters.

**14.**




$a\sqrt{2} = 18$

$a = \frac{18}{\sqrt{2}}$

$a = \frac{18\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$a = \frac{18\sqrt{2}}{2}$

$a = 9\sqrt{2}$

$A = \frac{1}{2}(9\sqrt{2})(9\sqrt{2})$

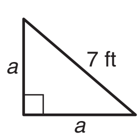
$A = \frac{81(\sqrt{2})^2}{2}$

$A = \frac{81(2)}{2}$

$A = 81$

The area of the triangle is 81 square inches.

**15.**




$a\sqrt{2} = 7$

$a = \frac{7}{\sqrt{2}}$

$a = \frac{7\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$a = \frac{7\sqrt{2}}{2}$

$A = \frac{1}{2}\left(\frac{7\sqrt{2}}{2}\right)\left(\frac{7\sqrt{2}}{2}\right)$

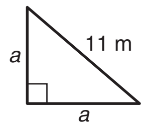
$A = \frac{49(\sqrt{2})^2}{8}$

$A = \frac{49(2)}{8}$

$A = 12.25$

The area of the triangle is 12.25 square feet.

Name ____________________________________________ Date ____________

16. 


$a\sqrt{2} = 11$

$a = \frac{11}{\sqrt{2}}$

$a = \frac{11\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$a = \frac{11\sqrt{2}}{2}$

$A = \frac{1}{2}\left(\frac{11\sqrt{2}}{2}\right)\left(\frac{11\sqrt{2}}{2}\right)$

$A = \frac{121(\sqrt{2})^2}{8}$

$A = \frac{121(2)}{8}$

$A = 30.25$

The area of the triangle is 30.25 square meters.

3

Use the given information to answer each question.

17. Eli is making a mosaic using tiles shaped like 45°–45°–90° triangles. The length of the hypotenuse of each tile is 13 centimeters. What is the area of each tile?

$a\sqrt{2} = 13$

$a = \frac{13}{\sqrt{2}} = \frac{13(\sqrt{2})}{\sqrt{2}(\sqrt{2})}$

$a = \frac{13\sqrt{2}}{2}$

$A = \frac{1}{2}\left(\frac{13\sqrt{2}}{2}\right)\left(\frac{13\sqrt{2}}{2}\right)$

$A = \frac{169(\sqrt{2})^2}{8} = \frac{169(2)}{8}$

$A = \frac{169}{4} = 42.25$

The area of each tile is 42.25 square centimeters.

18. Baked pita chips are often in the shape of 45°–45°–90° triangles. Caitlyn determines that the longest side of a pita chip in one bag measures 3 centimeters. What is the area of the pita chip?

$a\sqrt{2} = 3$

$a = \frac{3}{\sqrt{2}}$

$a = \frac{3\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$a = \frac{3\sqrt{2}}{2}$

$A = \frac{1}{2}\left(\frac{3\sqrt{2}}{2}\right)\left(\frac{3\sqrt{2}}{2}\right)$

$A = \frac{9(\sqrt{2})^2}{8}$

$A = \frac{9(2)}{8}$

$A = 2.25$

The area of each pita chip is 2.25 square centimeters.

**19.** Annika is making a kite in the shape of a 45°–45°–90° triangle. The longest side of the kite is 28 inches. What is the area of the piece of fabric needed for the kite?

$a\sqrt{2} = 28$

$a = \frac{28}{\sqrt{2}}$

$a = \frac{28\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$a = \frac{28\sqrt{2}}{2}$

$a = 14\sqrt{2}$

$A = \frac{1}{2}(14\sqrt{2})(14\sqrt{2})$

$A = \frac{196(\sqrt{2})^2}{2}$

$A = \frac{196(2)}{2}$

$A = 196$

The area of the piece of fabric needed for the kite is 196 square inches.

3

**20.** A tent has a mesh door that is shaped like a 45°–45°–90° triangle. The longest side of the door is 36 inches. What is the area of the mesh door?

$a\sqrt{2} = 36$

$a = \frac{36}{\sqrt{2}}$

$a = \frac{36\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$a = \frac{36\sqrt{2}}{2}$

$a = 18\sqrt{2}$

$A = \frac{1}{2}(18\sqrt{2})(18\sqrt{2})$

$A = \frac{324(\sqrt{2})^2}{2}$

$A = \frac{324(2)}{2}$

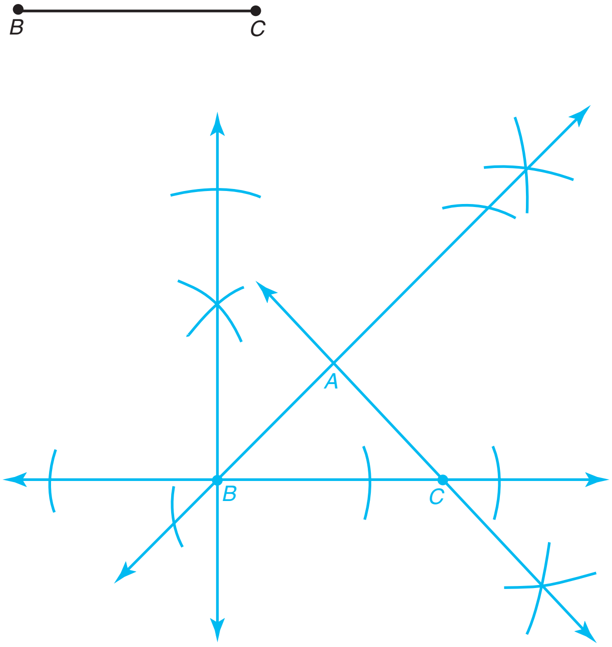
$A = 324$

The area of the mesh door is 324 square inches.

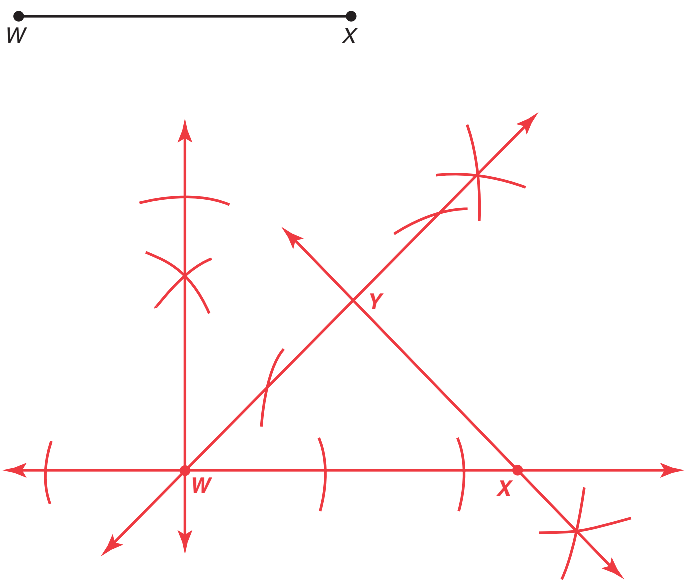
Name ______________________________ Date ____________

Construct each isosceles triangle described using the given segment.

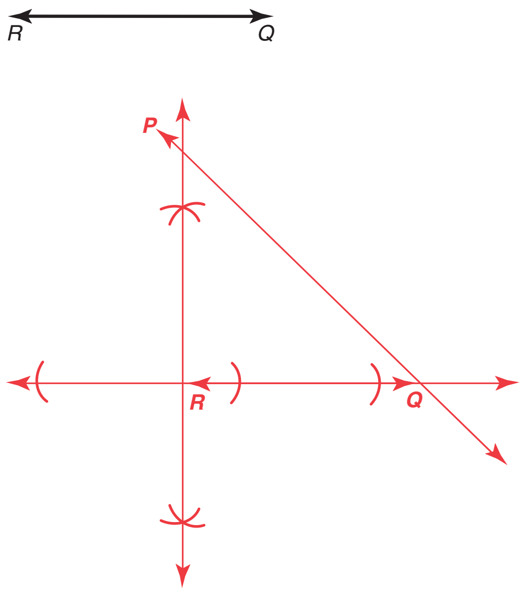
**21.** Construct right isosceles triangle *ABC* with segment *BC* as the hypotenuse by constructing 45° angles at *B* and *C*.



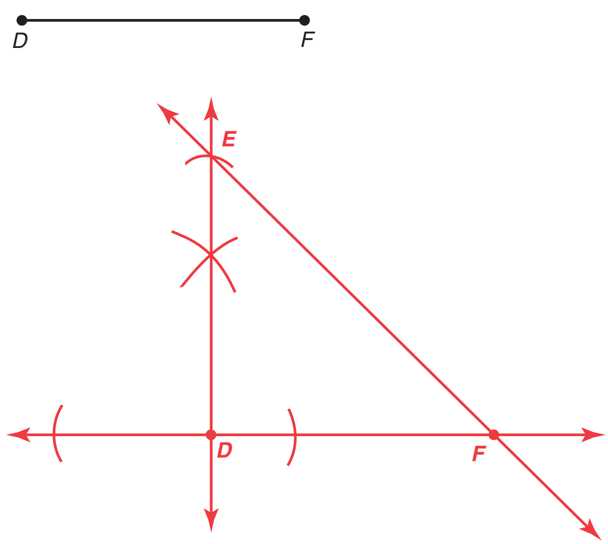

**22.** Construct right isosceles triangle *WXY* with segment *WX* as the hypotenuse by constructing 45° angles at *W* and *X*.



23. Construct right isosceles triangle *PQR* with $\overline{RQ}$ as a leg and $\angle R$ as the right angle.




24. Construct right isosceles triangle *DEF* with $\overline{DF}$ as a leg and $\angle D$ as the right angle.



Name ______________________ Date __________

# More Stamps, Really?
## Properties of a 30°–60°–90° Triangle

### Vocabulary

Write the term that best completes each statement.

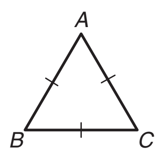
**1.** The 30°–60°–90° Triangle Theorem states that the length of the hypotenuse in a 30°–60°–90° triangle is two times the length of the shorter leg, and the length of the longer leg is $\sqrt{3}$ times the length of the shorter leg.



### Problem Set

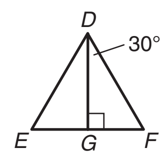
Determine the measure of the indicated interior angle.

**1.**



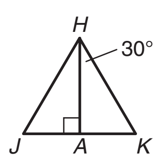

$m\angle ABC = 60°$

**2.**



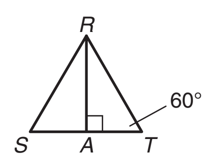

$m\angle DFE = 60°$

**3.**




$m\angle HAK = 90°$

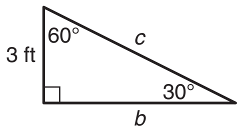
**4.**




$m\angle TRA = 30°$

Given the length of the short leg of a 30°–60°–90° triangle, determine the lengths of the long leg and the hypotenuse. Write your answers as radicals in simplest form.

**5.**

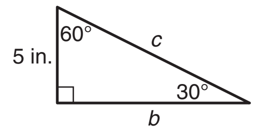



$a = 3$ feet

$b = 3\sqrt{3}$ feet

$c = 2(3) = 6$ feet

**6.**



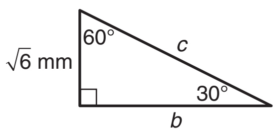

$a = 5$ inches

$b = 5\sqrt{3}$ inches

$c = 2(5) = 10$ inches



**7.**

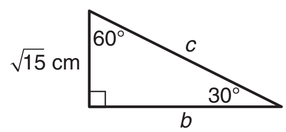



$a = \sqrt{6}$ millimeters

$b = \sqrt{6}\sqrt{3} = \sqrt{18} = 3\sqrt{2}$ millimeters

$c = 2\sqrt{6}$ millimeters

**8.**



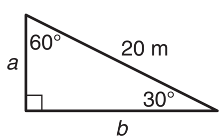

$a = \sqrt{15}$ centimeters

$b = \sqrt{15}\sqrt{3} = \sqrt{45} = 3\sqrt{5}$ centimeters

$c = 2\sqrt{15}$ centimeters

Given the length of the hypotenuse of a 30°–60°–90° triangle, determine the lengths of the two legs. Write your answers as radicals in simplest form.

**9.**

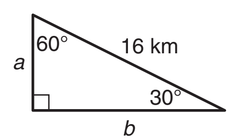



$c = 20$ meters

$a = \frac{20}{2} = 10$ meters

$b = 10\sqrt{3}$ meters

**10.**

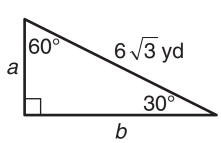



$c = 16$ kilometers

$a = \frac{16}{2} = 8$ kilometers

$b = 8\sqrt{3}$ kilometers

**11.**

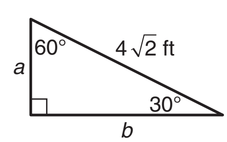



$c = 6\sqrt{3}$ yard

$a = \frac{6\sqrt{3}}{2} = 3\sqrt{3}$ yard

$b = (3\sqrt{3})\sqrt{3} = 3\sqrt{3^2} = 9$ yard

**12.**




$c = 4\sqrt{2}$ feet

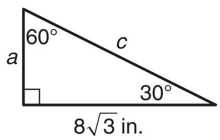
$a = \frac{4\sqrt{2}}{2} = 2\sqrt{2}$ feet

$b = (2\sqrt{2})\sqrt{3} = 2\sqrt{6}$ feet

Name ______________________________ Date ____________

Given the length of the long side of a 30°–60°–90° triangle, determine the lengths of the short leg and the hypotenuse. Write your answers as radicals in simplest form.

**13.**

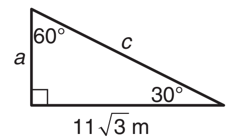



$b = 8\sqrt{3}$ inches

$a = \frac{8\sqrt{3}}{\sqrt{3}} = 8$ inches

$c = 2(8) = 16$ inches

**14.**

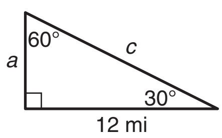



$b = 11\sqrt{3}$ meters

$a = \frac{11\sqrt{3}}{\sqrt{3}} = 11$ meters

$c = 2(11) = 22$ meters

**15.**

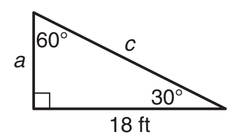



$b = 12$ miles

$a = \frac{12}{\sqrt{3}} = \frac{12\sqrt{3}}{\sqrt{3}\sqrt{3}} = \frac{12\sqrt{3}}{3} = 4\sqrt{3}$ miles

$c = 2(4\sqrt{3}) = 8\sqrt{3}$ miles

**16.**



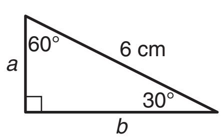

$b = 18$ feet

$a = \frac{18}{\sqrt{3}} = \frac{18\sqrt{3}}{\sqrt{3}\sqrt{3}} = \frac{18\sqrt{3}}{3} = 6\sqrt{3}$ feet

$b = 2(6\sqrt{3}) = 12\sqrt{3}$ feet

Determine the area of each 30°–60°–90° triangle. Round your answer to the nearest tenth, if necessary.

**17.**




$a = \frac{6}{2} = 3$ centimeters

$b = 3\sqrt{3}$ centimeters

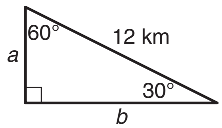
$A = \frac{1}{2} \cdot 3 \cdot 3\sqrt{3}$

$A = \frac{9\sqrt{3}}{2} \approx 7.8$ square centimeters

The area of the triangle is approximately 7.8 square centimeters.

3

**18.**




$a = \frac{12}{2} = 6$ kilometers

$b = 6\sqrt{3}$ kilometers

$A = \frac{1}{2} \cdot 6 \cdot 6\sqrt{3}$

$A = \frac{36\sqrt{3}}{2}$

$A = 18\sqrt{3} \approx 31.2$ square kilometers



The area of the triangle is approximately 31.2 square kilometers.

**19.** Universal Sporting Goods sells pennants in the shape of 30°–60°–90° triangles. The length of the longest side of each pennant is 16 inches.

$c = 16$ inches

$a = \frac{16}{2} = 8$ inches

$b = 8\sqrt{3}$ inches

$A = \frac{1}{2} \cdot 8 \cdot 8\sqrt{3}$

$A = \frac{64\sqrt{3}}{2}$

$A = 32\sqrt{3} \approx 55.4$ square inches

The area of the pennant is approximately 55.4 square inches.

**20.** A factory produces solid drafting triangles in the shape of 30°–60°–90° triangles. The length of the side opposite the right angle is 15 centimeters.

$c = 15$ centimeters

$a = \frac{15}{2}$ centimeters

$b = \frac{15}{2}(\sqrt{3}) = \frac{15\sqrt{3}}{2}$ centimeters

$A = \frac{1}{2} \cdot \frac{15}{2} \cdot \frac{15\sqrt{3}}{2}$

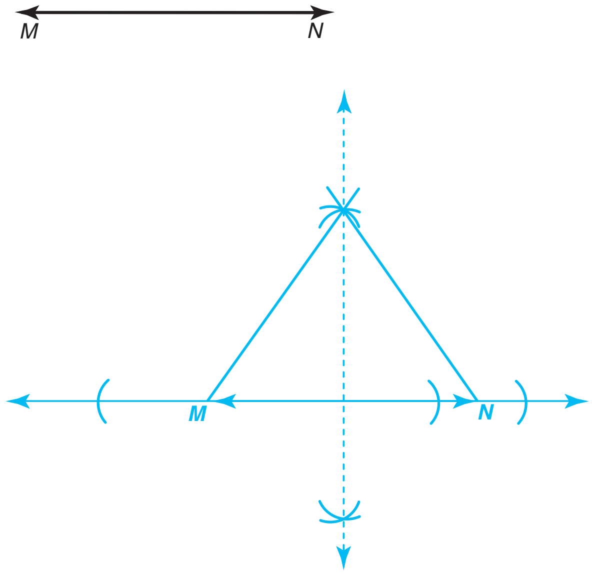
$A = \frac{225\sqrt{3}}{8} \approx 48.7$ square centimeters

The area of the drafting triangle is approximately 48.7 square centimeters.

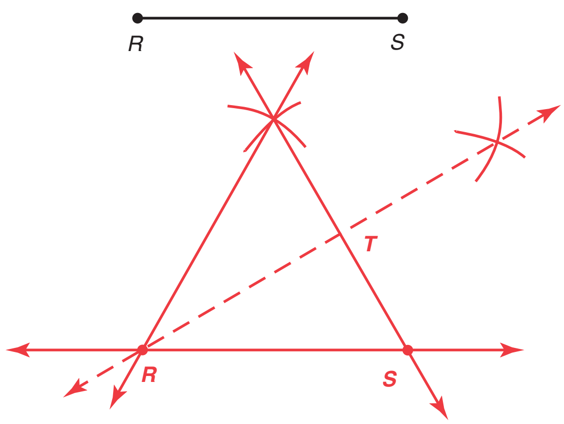
Name ______________________________ Date ____________

Construct each triangle described using the given segment.

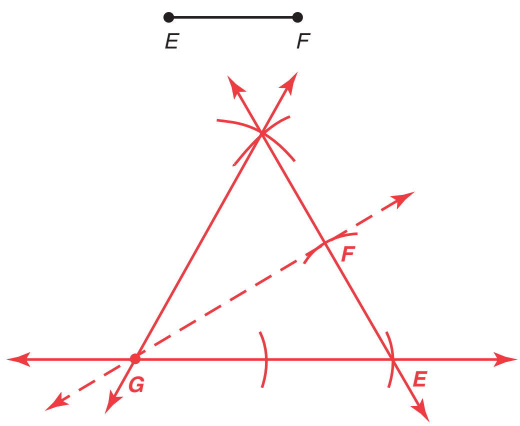
**21.** Construct a 30°–60°–90° triangle by first constructing an equilateral triangle with $\overline{MN}$ as a side and then bisecting one of the sides.




**22.** Construct a 30°–60°–90° triangle *RST* by first constructing an equilateral triangle with $\overline{RS}$ as a side and then bisecting the angle at *R*.



23. Construct a 30°–60°–90° triangle *EFG* with $\overline{EF}$ as the side opposite the 30° angle by first constructing an equilateral triangle.






24. Construct a 30°–60°–90° triangle *ABC* by first copying angle *A* and then drawing $\overline{AB}$ as the hypotenuse.