Teacher's Copy

Skill Review – Simplifying Radicals

Learning Goals: Students will be able to add, subtract, multiply and square radicals with answers being exact and approximate.

A ***Perfect Square*** is: ______________________________

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An expression containing square roots is in simplest form when:

- The radicand has no perfect square factors other than one
- The radicand has no fractions
- There are no square roots in the denominator

Simplifying a Radicals:

$\sqrt{1}=1$ $\sqrt{4}=2$ $\sqrt{9}=3$ $\sqrt{16}=4$ $\sqrt{25}=5$ $\sqrt{36}=6$ $\sqrt{49}=7$ $\sqrt{64}=8$ $\sqrt{81}=9$ $\sqrt{100}=10$ $\sqrt{121}=11$ $\sqrt{144}=12$ $\sqrt{169}=13$ $\sqrt{196}=14$ $\sqrt{225}=15$	$1^2=1$ $2^2=4$ $3^2=9$ $4^2=16$ $5^2=25$ $6^2=36$ $7^2=49$ $8^2=64$ $9^2=81$ $10^2=100$ $11^2=121$ $12^2=144$ $13^2=169$ $14^2=196$ $15^2=225$ $16^2=256$

Example 1

A) $\sqrt{720}$ $\sqrt{144\cdot5}=12\sqrt{5}$ B) $\sqrt{45}$ $\sqrt{9\cdot5}=3\sqrt{5}$ C) $\sqrt{\frac{3}{16}}$ $\frac{\sqrt{3}}{\sqrt{16}}=\frac{\sqrt{3}}{4}$ D) $\sqrt{900}$ $=\sqrt{9\cdot100}=3\cdot10=30$

Adding and Subtracting Radicals:

Same Radical: + or – the Coefficients	**Different Radical: Simplify the Radicals first. If same then see the box at left, If different:**
Simplify: $2\sqrt{3}+3\sqrt{3}$ $=2+3\sqrt{3}=5\sqrt{3}$ $\sqrt{3}+4\sqrt{3}$ $=1+4\sqrt{3}=5\sqrt{3}$	**Simplify:** $\sqrt{9}+\sqrt{25}$ $=3+5=8$ $3\sqrt{3}+2\sqrt{5}+\sqrt{3}$ $=4\sqrt{3}+2\sqrt{5}$

Multiplying Radicals

$$2\sqrt{3}\bullet 4\sqrt{5} = 2\bullet 4\bullet\sqrt{3\bullet 5} = 8\sqrt{15}$$

Dividing Radicals

$$\frac{4\sqrt{15}}{2\sqrt{3}} = \frac{4}{2}\bullet\sqrt{\frac{15}{3}} = 2\sqrt{5}$$

Multiply and simplify: $2\sqrt{18}\bullet 3\sqrt{8}$

$2\cdot 3\sqrt{18\cdot 8} = 6\sqrt{144} = 6\cdot 12$

72

Divide and simplify: $\frac{-12\sqrt{24}}{3\sqrt{2}}$

$-4\sqrt{\frac{24}{2}} = -4\sqrt{\frac{12}{3\cdot 4}}$

$-8\sqrt{3}$

Multiply and simplify: $(5\sqrt{3})\bullet(7\sqrt{2})$

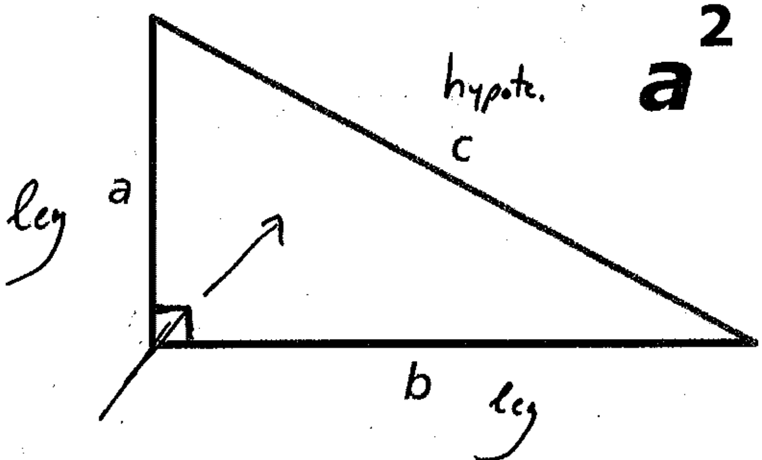
$5\cdot 7\sqrt{3\times 2} = 35\sqrt{6}$

HW: WorkSheet

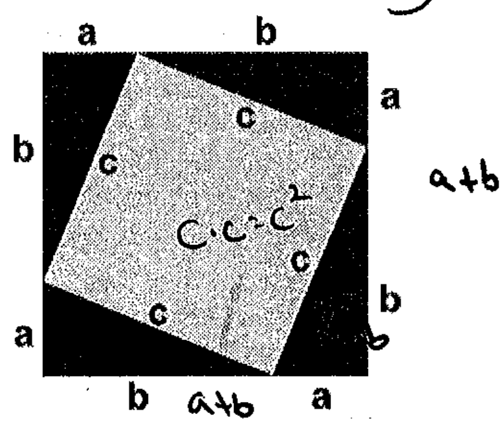
5.7 Pythagoren Theorem

Learning Goals: Students will use the Pythagorean Theorem and its converse to solve problems and classify triangles.

The Pythagorean Theorem is probably the most famous mathematical relationship. As you learned in Lesson 1-6, it states that in a right triangle, the sum of the squares of the lengths of the legs equals the square of the length of the hypotenuse.



$$a^2 + b^2 = c^2$$



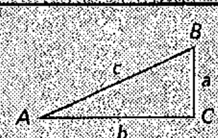
$$(a+b)(a+b) = c^2 + 4\left(\tfrac{1}{2}ab\right)$$

$$a^2 + 2ab + b^2 = c^2 + 2ab$$

$$-2ab \qquad -2ab$$

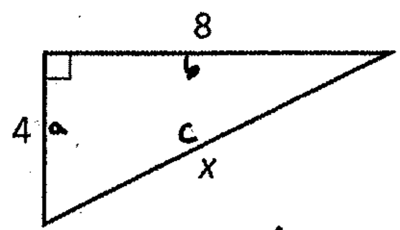
$$a^2 + b^2 = c^2$$

Theorems 5-7-1 Converse of the Pythagorean Theorem

THEOREM	HYPOTHESIS	CONCLUSION
If the sum of the squares of the lengths of two sides of a triangle is equal to the square of the length of the third side, then the triangle is a right triangle.	 $a^2 + b^2 = c^2$	$\triangle ABC$ is a right triangle.

Example #1: Find X

$a^2+b^2=c^2$

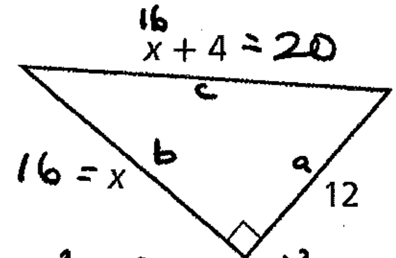


$4^2+8^2=x^2$

$\sqrt{80}=\sqrt{x^2}$

$x=\sqrt{80}$ or $4\sqrt{5}$

Example #2: Find X and All Side Lenghts:



$x^2+12^2=(x+4)^2$

$\cancel{x^2}+144=\cancel{x^2}+8x+16$

$144=8x+16$

$-16 \quad -16$

$\frac{8x}{8}=\frac{128}{8}$ $x=16$

$(x+4)(x+4)$

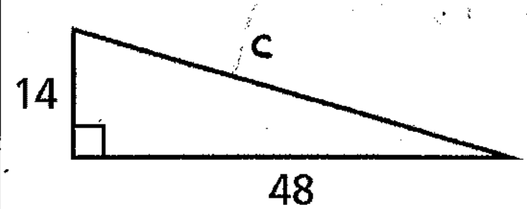
$x^2+4x+4x+16$

$x^2+8x+16$

A set of three nonzero whole numbers a, b, and c such that $a^2 + b^2 = c^2$ is called a Pythagorean triple.

Common Pythagorean Triples			
3, 4, 5	5, 12, 13,	8, 15, 17	7, 24, 25

Example #3: Find the missing side length. Tell if the side lengths form a Pythagorean triple. Explain.

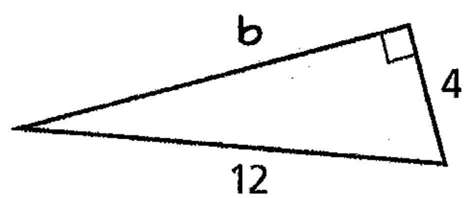


$14^2+48^2=c^2$

$\sqrt{2500}=\sqrt{c^2}$

$c=50$ yes

Example #4: Find the missing side length. Tell if the side lengths form a Pythagorean triple. Explain.



$4^2+b^2=12^2$

$16+b^2=144$

$-16 \quad -16$

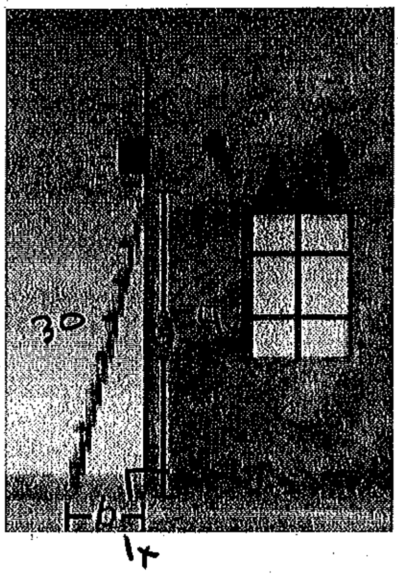
$\sqrt{b^2}=\sqrt{128}$ No

$b=\sqrt{16\cdot 8}$

$=8\sqrt{2}$

HW: Worksheet

Example #5: According to the recommended safety ratio of 4:1, how high will a 30-foot ladder reach when placed against a wall? Round to the nearest inch.



$(4x)^2 + (1x)^2 = 30^2$

$16x^2 + 1x^2 = 900$

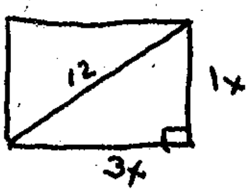
$\frac{17x^2}{17} = \sqrt{\frac{900}{17}}$

$\sqrt{x^2} = \sqrt{52.94}$

$x = 7.28$ ~~ft.~~ ≈ 7.3

$4(7.3) = \boxed{29.2 \text{ ft}}$

Example #6: Randy is building a rectangular picture frame. He wants the ratio of the length to the width to be 3:1 and the diagonal to be 12 centimeters. How wide should the frame be? Round to the nearest tenth of a centimeter.



$(1x)^2 + (3x)^2 = 12^2$

$1x^2 + 9x^2 = 144$

$10x^2 = \sqrt{\frac{144}{10}}$

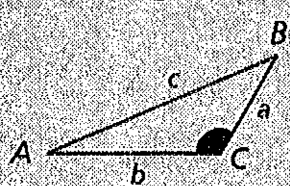
$\sqrt{x^2} = \sqrt{\frac{144}{10}}$ $x = 3.8$

$3(3.8) = 11.4$ cm.

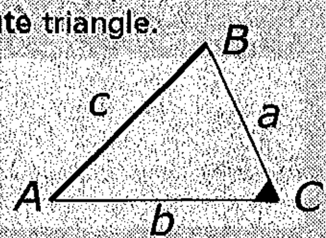
Theorems 5-7-2 Pythagorean Inequalities Theorem

In $\triangle ABC$, c is the length of the longest side.

If $c^2 > a^2 + b^2$, then $\triangle ABC$ is an obtuse triangle.

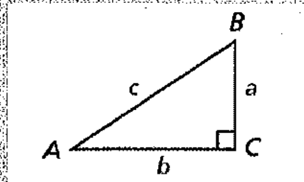


If $c^2 < a^2 + b^2$, then $\triangle ABC$ is an acute triangle.



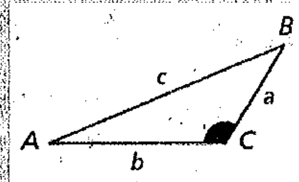
right

If $c^2 = a^2 + b^2$, then $\triangle ABC$ is a right triangle by the Converse of the Pythagorean Theorem. So $m\angle C = 90°$.



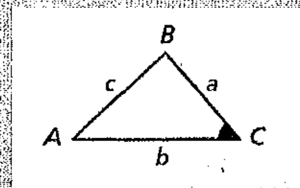
obtuse

If $c^2 > a^2 + b^2$, then c has increased. By the Converse of the Hinge Theorem, $m\angle C$ has also increased. So $m\angle C > 90°$.



Acute

If $c^2 < a^2 + b^2$, then c has decreased. By the Converse of the Hinge Theorem, $m\angle C$ has also decreased. So $m\angle C < 90°$.



Example #7: Tell if the measures can be the side lengths of a triangle. If so, classify the triangle as acute, obtuse, or right. 5, 7, 10

$5+7=12>10$ Yes

$5^2+7^2 \stackrel{?}{=} 10^2$

$74 < 100$

obtuse

Example #8: Tell if the measures can be the side lengths of a triangle. If so, classify the triangle as acute, obtuse, or right. 5, 8, 17

$5+8=13 \ngtr 17$ No.

Example #9: Tell if the measures can be the side lengths of a triangle. If so, classify the triangle as acute, obtuse, or right. 7, 12, 16

$7+12=19>16$ Yes

$7^2+12^2 \stackrel{?}{=} 16^2$

$193 < 256$

~~Acute~~ obtuse

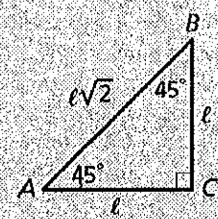
5.8 Special Right Triangles

Learning Goal: Students will justify and apply properties of 45°-45°-90° and 30°- 60°-90° triangles.

Theorem 5-8-1 **45°-45°-90° Triangle Theorem**

In a 45°-45°-90° triangle, both legs are congruent, and the length of the hypotenuse is the length of a leg times $\sqrt{2}$.

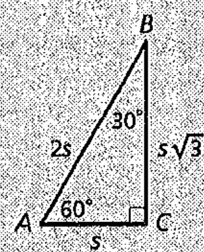
$AC = BC = \ell$ $AB = \ell\sqrt{2}$

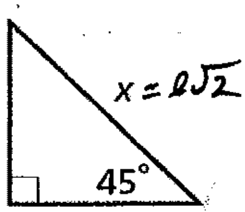
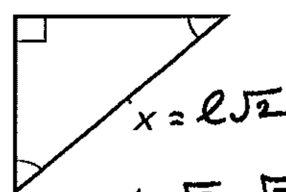


Theorem 5-8-2 **30°-60°-90° Triangle Theorem**

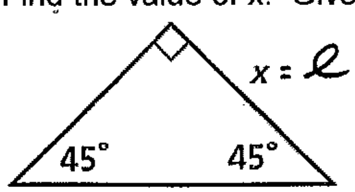
In a 30°-60°-90° triangle, the length of the hypotenuse is is 2 times the length of the shorter leg, and the length of the longer leg is the length of the shorter leg times $\sqrt{3}$.

$AC = s$ $AB = 2s$ $BC = s\sqrt{3}$



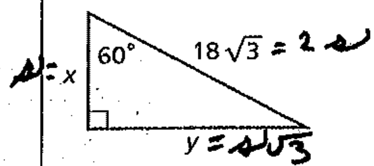
Example#1: Find the value of x. Give your answer in simplest radical form.	Example #2: Find the value of x. Give your answer in simplest radical form.
 $\ell =$ 8, $x = \ell\sqrt{2}$, 45° $x = 8\sqrt{2}$	 $\ell = 10\sqrt{2}$, $x = \ell\sqrt{2}$ $x = 10\sqrt{2}\cdot\sqrt{2}$ $x = 10\cdot 2$ $x = 20$

Find the value of x. Give your answer in simplest radical form.



$\frac{\sqrt{2}}{\sqrt{2}} \cdot \frac{16}{\sqrt{2}} = \frac{\ell\cancel{\sqrt{2}}}{\cancel{\sqrt{2}}}$ $\ell = \frac{16\sqrt{2}}{2} = 8\sqrt{2}$

Example #3 Find the values of x and y. Give your answer in simplest radical form.



$\frac{18\sqrt{3}}{2} = \frac{2s}{2}$

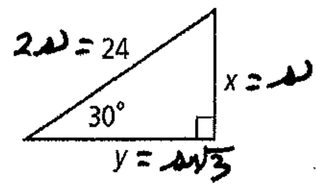
$9\sqrt{3} = s$

$x = 9\sqrt{3}$

$y = 9\sqrt{3} \cdot \sqrt{3}$

$y = 9 \cdot 3 = 27$

Example #4 Find the values of x and y. Give your answer in simplest radical form.



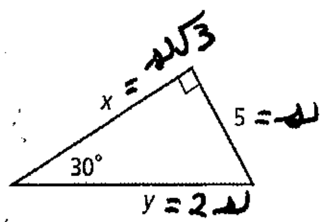
$\frac{2s}{2} = \frac{24}{2}$

$y = 12\sqrt{3}$

$s = 12$

$x = 12$

Example #5 Find the values of x and y. Give your answer in simplest radical form.

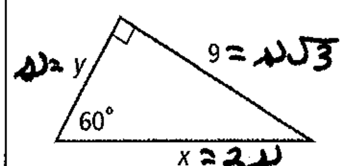


$x = 5\sqrt{3}$

$y = 2 \cdot 5 = 10$

$s = 5$

Example #6 Find the values of x and y. Give your answer in simplest radical form.



$\frac{\sqrt{3}}{\sqrt{3}} \cdot \frac{9}{\sqrt{3}} = \frac{s\sqrt{3}}{\sqrt{3}}$

$\frac{9\sqrt{3}}{3} = 3\sqrt{3} = s$

$x = 2 \cdot 3\sqrt{3}$

$x = 6\sqrt{3}$

$y = 3\sqrt{3}$

HW: Page 360: 9-21