Algebra 1

Lesson 11.4

The Pythagorean Theorem

Warm-Up

Simplify.

(a) $\sqrt{20}$ $2\sqrt{5}$

(b) $\sqrt{8}$ $2\sqrt{2}$

(c) $\sqrt{18}$ $3\sqrt{2}$

(d) $2\sqrt{24}$ $4\sqrt{6}$

(e) $3\sqrt{12}$ $6\sqrt{3}$

Right Triangle - Triangle that has a right angle (90°)

Hypotenuse - side across from the right angle (Longest side)

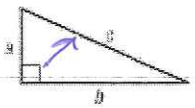
Leg - sides that make up the right angle

KEY CONCEPT *For Your Notebook*

The Pythagorean Theorem

Words If a triangle is a right triangle, then the sum of the squares of the lengths of the legs equals the square of the length of the hypotenuse.

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

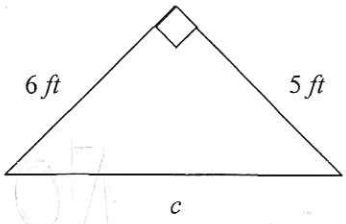


$a < b < c$

Example 1. Use the Pythagorean Theorem to Find the Hypotenuse

For the given triangle find the length of the missing side. Give your answer in simplest form.

(a)



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

$(5)^2 + (6)^2 = c^2$

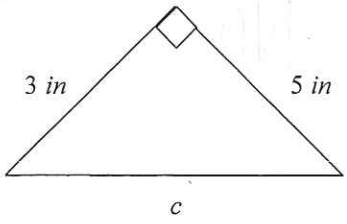
$25 + 36 = c^2$

$\sqrt{c^2} = \sqrt{61}$

$c = \pm\sqrt{61}$

$c = \sqrt{61}$ ft

(b)



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

$(3)^2 + (5)^2 = c^2$

$9 + 25 = c^2$

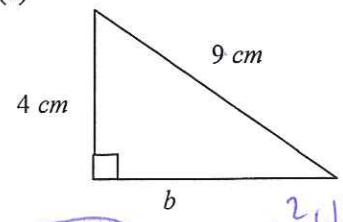
$c^2 = 34$

$c = \sqrt{34}$ in

Example 2. Use the Pythagorean Theorem to Find a Leg

For the given triangle find the length of the missing side. Give your answer in simplest form.

(a)



$b = \sqrt{65}$ cm

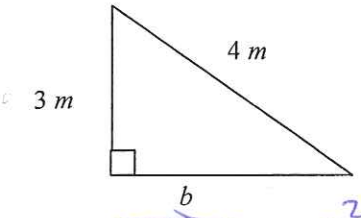
$a^2 + b^2 = c^2$

$(4)^2 + b^2 = (9)^2$

$16 + b^2 = 81$

$b^2 = 65$

(b)



$b = \sqrt{7}$ m

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

$(3)^2 + b^2 = (4)^2$

$9 + b^2 = 16$

$b^2 = 7$

Example 3. Using the Pythagorean Theorem

Let a and b represent the legs of a right triangle and c be the hypotenuse. Find the unknown length.

(a) $a = 2, b = 4$

$(2)^2 + (4)^2 = c^2$

$4 + 16 = c^2$

$\sqrt{c^2} = \sqrt{20}$

$c = 2\sqrt{5}$ units

(b) $a = 9, c = 12$

$(9)^2 + b^2 = (12)^2$

$81 + b^2 = 144$

$-81 \quad -81$

$\sqrt{b^2} = \sqrt{63}$

$b = 3\sqrt{7}$ units

(c) $b = 2, c = 10$

$a^2 + (2)^2 = (10)^2$

$a^2 + 4 = 100$

$-4 \quad -4$

$\sqrt{a^2} = \sqrt{96}$

$a = 4\sqrt{6}$ units

KEY CONCEPT *For Your Notebook*

Converse of the Pythagorean Theorem

If a triangle has side lengths a, b, and c such that $a^2 + b^2 = c^2$, then the triangle is a right triangle.

Example 4. Determining Right Triangles

Tell whether the triangle with given side lengths is a right triangle.

(a) 7, 23, 24

$(7)^2 + (23)^2 = (24)^2$

$49 + 529 = 576$

$578 = 576$

NO

(b) 7, 11, 13

$(7)^2 + (11)^2 = (13)^2$

$49 + 121 = 169$

$170 = 169$

NO

(c) 5, 15, 17

$(5)^2 + (15)^2 = (17)^2$

$25 + 225 = 289$

$250 = 289$

NO

Homework:

New: Pg. 740 #3-11, 23-26

Review:

1. $\sqrt{3}\sqrt{12}$
2. $\sqrt{\frac{2}{3}}$
3. $\sqrt{\frac{48}{8}}$
4. $\sqrt{\frac{9}{25}}$
5. $(5\sqrt{75})(3\sqrt{3})$
6. $\sqrt{125}$