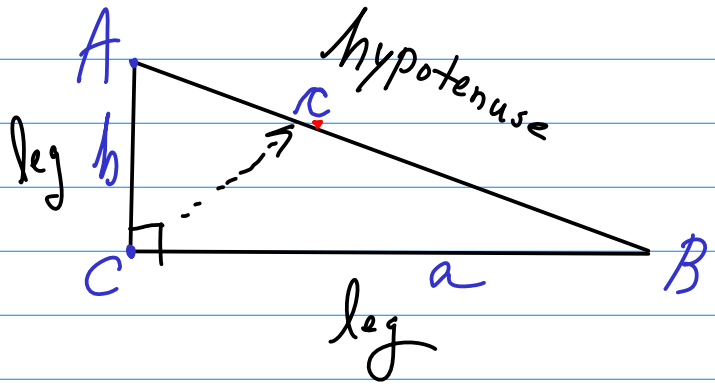
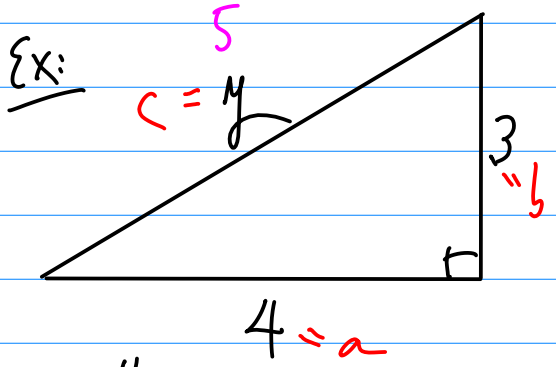
§9.1: Pythagorean Theorem

* **Pythagorean Thm:** In a rt. $\triangle$, the sum of the squares of the lengths of the legs is = to the square of the length of the hypotenuse.

* $\boxed{a^2 + b^2 = c^2}$



Ex:



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

$4^2 + 3^2 = y^2$

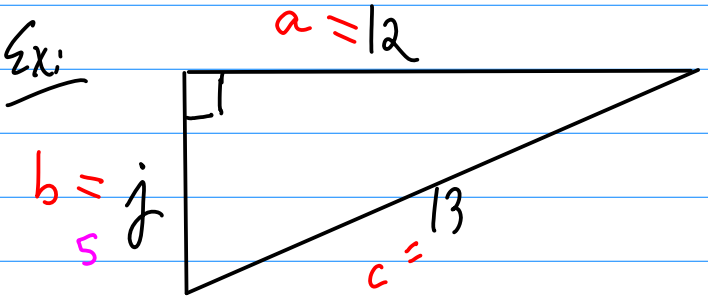
$16 + 9 = y^2$

$\sqrt{25} = \sqrt{y^2}$

$5 = y$

* 3–4–5 Rt $\triangle$
(a Pythagorean Triple)

Ex:



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

$12^2 + j^2 = 13^2$

$144 + j^2 = 169$

$-144 \quad -144$

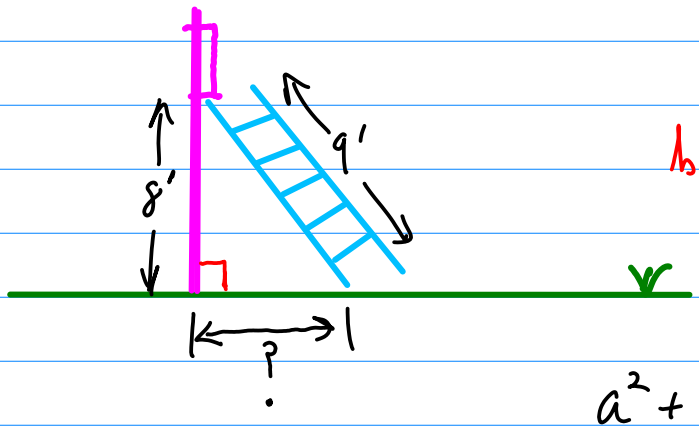
$\sqrt{j^2} = \sqrt{25}$

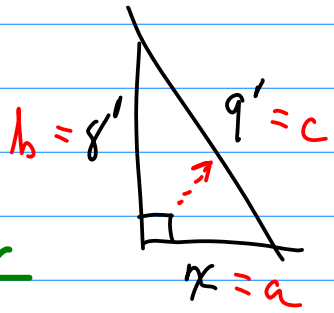
$j = 5$

* 5–12–13 Rt $\triangle$
(another Pythagorean Triple)

Ex:

A 9' ladder needs to reach an 8-foot-high window. How far from the wall should the ladder be placed?





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

$x^2 + 8^2 = 9^2$

$x^2 + 64 = 81$

$-64 \quad -64$

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

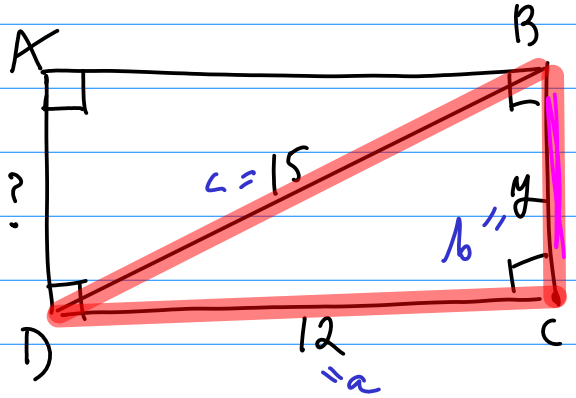
$x = \boxed{\sqrt{17}\text{ ft}}$ ← EXACT answer

$x \approx 4.1\text{ ft}$ ← approximate answer

Ex:

Rect ABCD w/ BD = 15, CD = 12

AD = ?



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

$12^2 + y^2 = 15^2$

$144 + y^2 = 225$

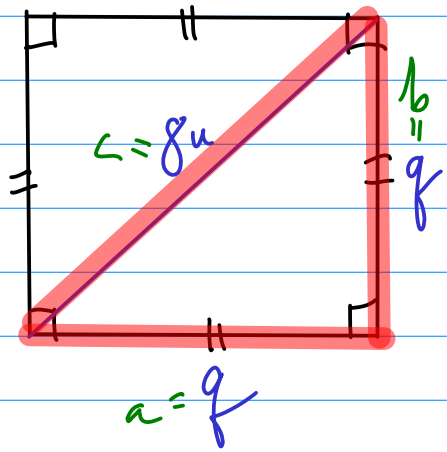
$-144 \quad -144$

$\sqrt{y^2} = \sqrt{81}$

$y = 9$

$\boxed{AD = 9}$

Ex: The diagonals of a square are 8u. Find the length of the sides.



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

$$q^2 + q^2 = 8^2$$

$$\frac{2q^2}{2} = \frac{64}{2}$$

$$\sqrt{q^2} = \sqrt{32}$$

$$\boxed{q = \sqrt{32}}$$ ✓

Proof of Pythagorean Thm:

$A_{\text{INNER QUAD}}$ — 2 ways

I. $A_{\text{INNER QUAD}} = A_{\text{OUTER SQ}} - 4(A_{\triangle})$

	a	b
a	a^2	ab
b	ab	b^2

bh

$(a+b)(a+b)$

$a^2+2ab+b^2$

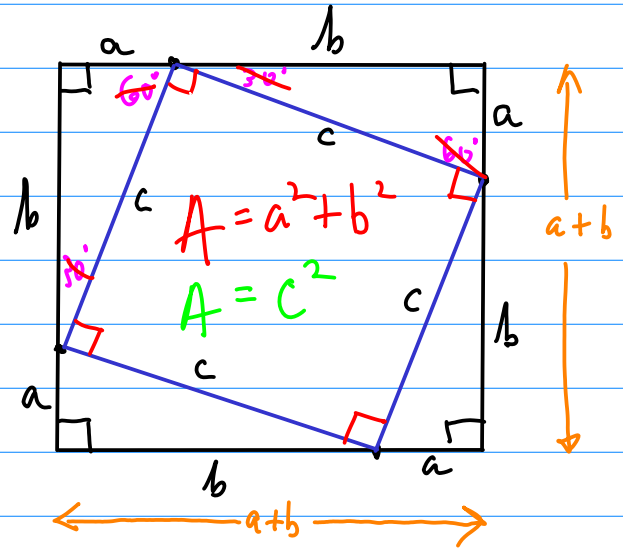
$4\left(\frac{1}{2}bh\right)$

$4\left(\frac{1}{2}ab\right)$

$2ab$

$a^2+2ab+b^2-2ab$

a^2+b^2



II. $A_{\text{INNER QUAD}} = bh$ (RECT!) $= (c)(c) = c^2$

$A = a^2+b^2$

$A = c^2$

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

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