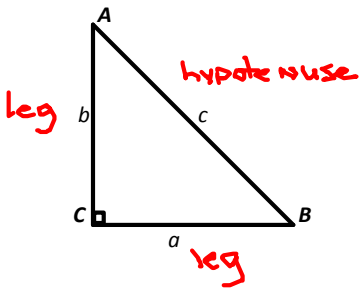
The Pythagorean Theorem

<u>The Pythagorean Theorem</u> - Used to find the third side of a right triangle when two sides are given.



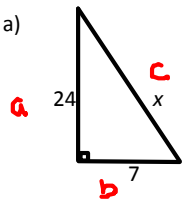
$$a^2 + b^2 = c^2$$

<u>Pythagorean Triples</u>

3 - 4 - 5
6 - 8 - 10
5 - 12 - 13
7 - 24 - 25
8 - 15 - 17
9 - 40 - 41

1. Find the value of each variable.

a)



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

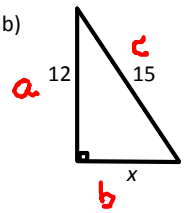
$24^2 + 7^2 = c^2$

$576 + 49 = c^2$

$\sqrt{625} = \sqrt{c^2}$

$\boxed{c = 25}$

b)



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

$12^2 + x^2 = 15^2$

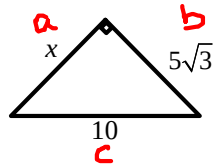
$144 + x^2 = 225$

$-144 \qquad -144$

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

$\boxed{x = 9}$

c)



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

$x^2 + (5\sqrt{3})^2 = 10^2$

$x^2 + 25\sqrt{9} = 100$

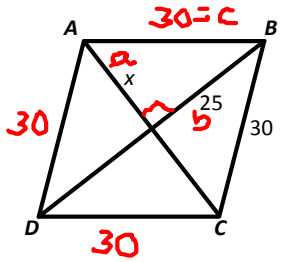
$x^2 + 75 = 100$

$-75 \quad -75$

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

$\boxed{x = 5}$

d) *ABCD* is a rhombus.



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

$x^2 + 25^2 = 30^2$

$x^2 + 625 = 900$

$-625 \quad -625$

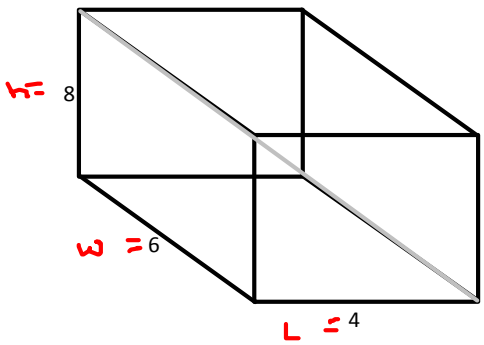
$\sqrt{x^2} = \sqrt{275}$

$x = \sqrt{275}$

$x = \sqrt{25 \cdot 11}$

$\boxed{x = 5\sqrt{11}}$

e) Find the length of the main diagonal of the rectangular prism.



$L^2 + W^2 + H^2 = D^2$

$4^2 + 6^2 + 8^2 = D^2$

$16 + 36 + 64 = D^2$

$\sqrt{116} = \sqrt{D^2}$

$D = \sqrt{116}$

$D = \sqrt{4 \cdot 29}$

$\boxed{D = 2\sqrt{29}}$

Classifying Triangles Using the Pythagorean Theorem

- Right Triangle - $a^2 + b^2 = c^2$
- Acute Triangle - $a^2 + b^2 > c^2$
- Obtuse Triangle - $a^2 + b^2 < c^2$

2. Classify the triangle as right, acute or obtuse.

a) 20, 21, 29 (c)

$20^2 + 21^2 \quad 29^2$

$400 + 441 \quad 841$

$841 = 841$

$\boxed{\text{Right}}$

b) 5, 8, 9 (c)

$5^2 + 8^2 \quad 9^2$

$25 + 64 \quad 81$

$89 > 81$

$\boxed{\text{Acute}}$

c) 2, 10, 11 (c)

$2^2 + 10^2 \quad 11^2$

$4 + 100 \quad 121$

$104 < 121$

$\boxed{\text{obtuse}}$

d) 5, 11, 6

$11 - 5 = 6$

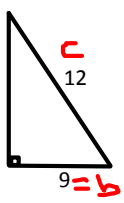
$11 + 5 = 16$

$6 < 3^{rd} < 16$

$\boxed{\text{No } \triangle \text{ is possible}}$

3. Find the area.

a)



$3\sqrt{7} = h$

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(9)(3\sqrt{7})$

$\boxed{A = \frac{27\sqrt{7}}{2}}$

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

$h^2 + 9^2 = 12^2$

$h^2 + 81 = 144$

$-81 \quad -81$

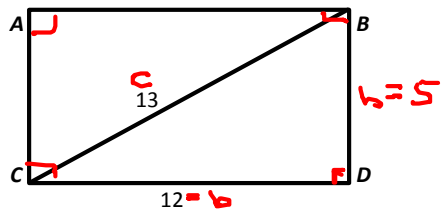
$\sqrt{h^2} = \sqrt{63}$

$h = \sqrt{63}$

$h = \sqrt{9 \cdot 7}$

$h = 3\sqrt{7}$

b) *ABCD* is a rectangle. Find the area of *ΔBCD*.



$A = b \times h$

$A = (12)(5)$

$\boxed{A = 60}$

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

$h^2 + 12^2 = 13^2$

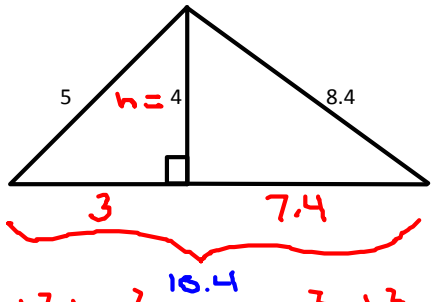
$h^2 + 144 = 169$

$-144 \quad -144$

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

$h = 5$

c)



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

$4^2 + b^2 = 5^2$

$16 + b^2 = 25$

$-16 \qquad -16$

$\sqrt{b^2} = \sqrt{9}$

$b = 3$

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

$4^2 + b^2 = 8.4^2$

$16 + b^2 = 70.56$

$-16 \qquad -16$

$\sqrt{b^2} = \sqrt{54.56}$

$b = 7.4$

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(10.4)(4)$

$\boxed{A = 20.8}$