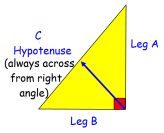
Lesson 8: Pythagorean Theorem
- used to find missing side lengths in right triangles

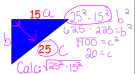


2 Ways to Use Pythagorean Theorem:
* Missing Hypotenuse -> $a^2 + b^2 = c^2$
* Missing Leg -> $c^2 - a^2 = b^2$

Practice:

a) 

Calc: $\sqrt{9^2 + 40^2}$

b) 

Calc $\sqrt{25^2 - 15^2}$

c) a=6 b=8 c=?
$\sqrt{6^2 + 8^2} = \sqrt{36+64}$
c=10

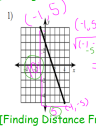
d) a=? b=16 c=20
$\sqrt{20^2 - 16^2}$
a=12

[Converse of the Pythagorean Theorem]
-used to determine if 3 numbers could be a right triangle
- 2 smaller numbers are legs, larger number is the hypotenuse
- plug it into Pythagorean Theorem, numbers must be exact (no rounding)

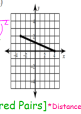
Practice: Answer with a Yes or No
a) 3,4,5 $\sqrt{3^2+4^2} = \sqrt{9+16} = \sqrt{25} = 5$ YES
b) 8, 12, 16 $\sqrt{8^2+12^2}$ NO
c) 32, 254, 257 $\sqrt{32^2+254^2}$ NO
d) 28, 45, 53 $\sqrt{28^2+45^2}$ YES

[Distance Formula]
* helps determine the distance between two points
-can be found using Pythagorean Theorem on a graph
-can also be found using the distance formula and 2 ordered pairs
-> $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ (Distance Formula)

[Finding Distance on a Graph] *Pythagorean Theorem OR *Distance Formula

1) 

$\sqrt{(-1-4)^2 + (5+5)^2}$
$\sqrt{125}$
= 11.2

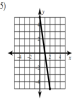
2) 

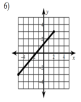
[Finding Distance From 2 Ordered Pairs] *Distance Formula

3) (7, 7), (-3, -8)
$\sqrt{(7-3)^2 + (7-8)^2}$
18.03

4) (0, -2), (-6, 1)
$\sqrt{(0-6)^2 + (-2-1)^2}$
= 6.71

[Practice]

5) 

6) 

7) (2, -1), (-7, 1)
9.22

8) (-4, -3), (-6, 6)

[Finding the Midpoint (Middle) of a Line Segment]
- Use the formula: $\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}$

[Using Midpoint Formula > Given 2 endpoints]

1) $(-1, 4), (8, -1)$
$\frac{-1+8}{2}, \frac{4-1}{2}$
$(\frac{7}{2}, \frac{3}{2}) = (3.5, 1.5)$

2) $(-5, 3), (4, -8)$
$\frac{-5+4}{2}, \frac{3-8}{2}$
$(\frac{-1}{2}, -\frac{5}{2})$

[Using Midpoint Formula > Given an endpoint and midpoint]
1) multiply both coordinates of the midpoint by 2
THEN
2) add the OPPOSITE of each coordinate of the endpoint to the value in step 1.

3) Endpoint: (1, 7), midpoint: $(-7, -2)$
$2(-7) = -14$, $2(-2) = -4$
$-1, -7$
Endpoint: $(-15, -11)$

4) Endpoint: $(-7, -5)$, midpoint: $(-7, 0)$
$2(-7) = -14$, $2(0) = 0$
$+7, +5$
Endpoint: $(-7, 5)$

[Practice]

Find the midpoint of the line segment with the given endpoints.

5) (0, −8), (−1, −8)
$\frac{0-1}{2}, \frac{-8-8}{2} = \frac{-16}{2}$
$(-\frac{1}{2}, -8)$

6) (−2, 6), (1, −7)
$\frac{-2+1}{2}, \frac{6-7}{2}$
$(-\frac{1}{2}, -\frac{1}{2})$

Given the midpoint and one endpoint of a line segment, find the other endpoint.

7) Endpoint: (−2, 3), midpoint: (5, −7)
$5(2) = 10$, $-7(2) = -14$
$+2, -3$
$(12, -17)$

8) Endpoint: (8, 8), midpoint: (2, −2)
$2(2) = 4$, $-2(2) = -4$
$-8, -8$
$(-4, -12)$