The distance between 2 points and Midpoint of a line

Lesson 3.5

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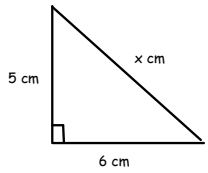
Connect NOTES:

Review of Pythagoras Theorem

Remember the hypotenuse is the longest side of the right angle triangle and directly across from the 90° angle.



$x^2 = 5^2 + 6^2$

$= 25 + 36$

$x^2 = 61$

$x = \sqrt{61}$

$x = 7.81$

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Connect NOTES:

Cartesian coordinate system

Points in the (x,y) plane are defined by their perpendicular distance from the x-and y-axis relative to the orgin, 0

The x-coordinate tells us the horizontal distance from the y-axis to the point.

The y-coordinate tells us the vertical distance from the x-axis to the point.

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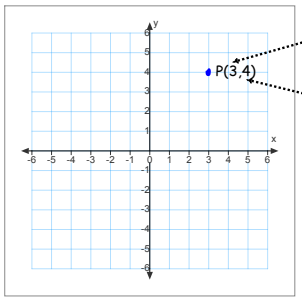
Connect NOTES:

Cartesian coordinate system



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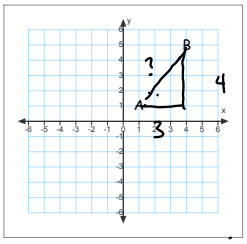
Connect NOTES:

Distance Between two Points



The horizontal distance between the points is $x_2 - x_1$.

$4 - 1 = 3$

The vertical distance between the points is $y_2 - y_1$.

$5 - 1 = 4$

To find the distance between A and B we need to make a third point (C) to create a right angle triangle.

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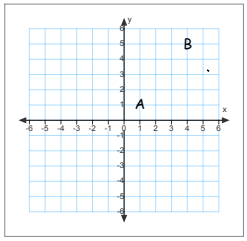
Connect NOTES:

Distance Between two Points



Once we have a right angle triangle we can use Pythagoras Theorem to find the distance between AB

$AB^2 = 3^2 + 4^2$

$AB^2 = 9 + 16$

$AB^2 = 25$

$AB = \sqrt{25}$

$AB = 5$

Length of AC = $4 - 1 = 3$

Length of BC = $5 - 1 = 4$

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Practice — **EXAMPLE 1**

Calculate the distance between the following pair of points

E(3,7) and F(9, 4)

$\Delta x = 9-3 = 6$

$\Delta y = 4-7 = -3$

$D^2 = 6^2 + 3^2$

$= 36 + 9$

$D^2 = 45$

$D = \sqrt{45}$

$D = 6.7$

A(-5,-2) and B(-7, -6)

$\Delta x = -5-(-7)$

$= 2$

$\Delta y = -2-(-6)$

$= 4$

$D^2 = 2^2 + 4^2$

$= 4 + 16$

$D^2 = 20$

$D = \sqrt{20}$

$D = 4.5$

Practice — **YOU TRY!**

Calculate the distance between the following pair of points

C(3,-5) and D(6, -3)

$\Delta x = 3-6 = -3$

$\Delta y = -5-(-3) = -2$

$D^2 = 3^2 + 2^2$

$= 9 + 4$

$D^2 = 13$

$D = \sqrt{13}$

$D = 3.6$

H(-5,-2) and I(-7, -6)

$\Delta x = -5-(-7) = 2$

$\Delta y = -2-(-6) = 4$

$D^2 = 2^2 + 4^2$

$= 4 + 16$

$D^2 = 20$

$D = \sqrt{20}$

$D = 4.5$

Connect — **NOTES:**

A General Formula

The distance between two general points $A(x_1,y_1)$ and $B(x_2,y_2)$

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

EXAMPLE: What is the distance between the points A(5, -1) , B(-4,5)

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

$\sqrt{9^2 + (-6)^2}$

$\sqrt{81+36}$

$\sqrt{117} = 10.8$

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Practice — **YOU TRY!**

Calculate the distance between the following pair of points

A(-3.5,4.7) and D(7.5, 1.3)

$\sqrt{(-3.5-7.5)^2 + (4.7-1.3)^2}$

$\sqrt{(-11)^2 + (3.4)^2}$

$\sqrt{121 + 11.56}$

$\sqrt{132.56}$

11.51

H(2.5,-3.9) and I(-8.7, 0.9)

$\sqrt{(2.5-(-8.7))^2 + (-3.9-0.9)^2}$

$\sqrt{(11.2)^2 + (-4.8)^2}$

$\sqrt{125.44 + 23.04}$

$\sqrt{148.48}$

12.2

Practice — **NOTES:**

The Mid-Point of a Line

In general, the coordinates of the mid-point of the line segment joining (x_1,y_1) and (x_2,y_2) are given by:

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$\left(\frac{x_1 + x_2}{2}\right)$ is the mean (average) of the x-coordinates

$\left(\frac{y_1 + y_2}{2}\right)$ is the mean (average) of the y-coordinates

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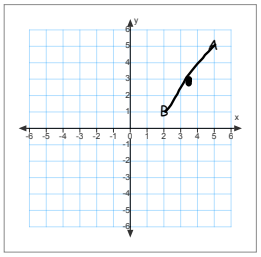
Practice — **NOTES:**

The Mid-Point of a Line



A = (5,5)

B = (2,1)

The x-coordinate mid-point $\left(\frac{x_1 + x_2}{2}\right)$

$\left(\frac{5+2}{2}\right)$

3.5

The y-coordinate mid-point $\left(\frac{y_1 + y_2}{2}\right)$

$\frac{5+1}{2}$

3

Midpoint (3.5, 3)

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Practice — **EXAMPLE 2**

Find the mid-point of each line segment

E(3,7) and F(9, 4)

$\left[\frac{3+9}{2}, \frac{7+4}{2}\right]$

$(6, 5.5)$

A(-5,-2) and B(-7, -6)

$\left[\frac{-5+(-7)}{2}, \frac{-2+(-6)}{2}\right]$

$(-6, -4)$

Practice — **YOU TRY!**

Find the mid-point of each line segment

C(3,-5) and D(6, -3)

$\left[\frac{3+6}{2}, \frac{-5+(-3)}{2}\right]$

$(4.5, -4)$

H(-5,-2) and I(-7, -6)

$\left[\frac{-5+(-7)}{2}, \frac{-2+(-6)}{2}\right]$

$(-6, -4)$

Practice — **HOMEWORK!**

Complete Worksheet:

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