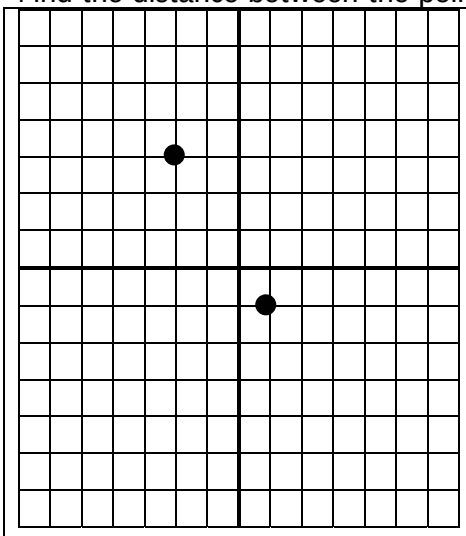
5-5-3 Distance

Find the distance between the points (-2, 3) and (1, -1).

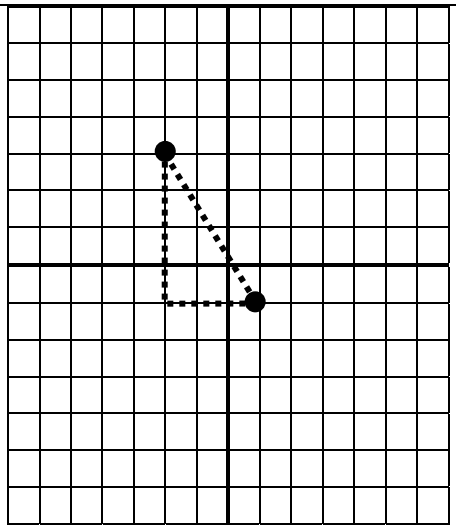


The points are plotted here.

Draw a right triangle using the line between the points as the hypotenuse.

One leg is 3 units long and the other is 4 units long.

Because this is a right triangle, Pythagorean Theorem can be used to find the length of the hypotenuse which is also the distance from one point to the other.



$3^2+4^2=d^2$ $9+16=d^2$ $25=d^2$ so d(the distance) is 5 units

Using the points (-2, 3) and (1, -1) we can do the same thing. Think about the horizontal leg that is 3 units long. Which part of the point, x or y, talks about the horizontal? x.

The x components of the points are -2 and 1. To find a difference, subtract 1-(-2) = 3.

For the vertical use the y values, 3 and -1. -1-3 = -4 This looks like it might be a problem, but the numbers in the Pythagorean theorem are squared and $(-4)^2$ is the same as 4^2.

For any combination of points (x_1, y_1) and (x_2, y_2) subtract to find the lengths of each leg in the right triangle, $x_2 - x_1$ and $y_2 - y_1$.
Square these values, $(x_2 - x_1)^2$ and $(y_2 - y_1)^2$. This is the same as a^2+b^2 part of the Pythagorean Theorem.
The Pythagorean Theorem says $d^2=(x_2 - x_1)^2 + (y_2 - y_1)^2$
The last step in solving for the hypotenuse is taking the square root. This gives the distance formula .

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

It doesn't matter which point you choose for point one or point two.

Example: Find the distance between (2, 8) and (-3, -4).

$$d = \sqrt{(2-(-3))^2 + (8-(-4))^2}$$
$$d = \sqrt{(2+3)^2 + (8+4)^2}$$
$$d = \sqrt{(5)^2 + (12)^2}$$
$$d = \sqrt{25+144}$$
$$d = \sqrt{169}$$
$$d = 13$$

Practice: Find the distance between each set of points. The first two have a set up to follow.

a) (0, 0) and (20, 21)

$$d = \sqrt{((\quad)-(\quad))^2 + ((\quad)-(\quad))^2}$$
$$d = \sqrt{(\quad)^2 + (\quad)^2}$$
$$d = \sqrt{(\quad)+(\quad)}$$
$$d = \sqrt{(\quad)}$$
$$d =$$

(3, 7) and (-5, 1)

$$d = \sqrt{((\quad)-(\quad))^2 + ((\quad)-(\quad))^2}$$
$$d = \sqrt{(\quad)^2 + (\quad)^2}$$
$$d = \sqrt{(\quad)+(\quad)}$$
$$d = \sqrt{(\quad)}$$
$$d =$$

b) (0, 0) and (3, 4) (0, 0) and (-6, -8) (-5, -1) and (7, 4) (-1, 5) and (7, -1)

c) (0, 0) and (-5, -12) (-6, -8) and (1, 16) (5, -8) and (-10,0) (12, 0) and (0, 16)

d) (-4, -5) and (0, -8) (0, 0) and (11, 60) (1, 3) and (3, 4 ½) (½ , ½) and (0,-1 $^3/_8$)

The next problems will not necessarily work out with a rational answer. Round the calculator answer to the nearest hundredth.

e) (5, 8) and (4, 7) (15, 71) and (14, 35) (8, 9) and (42, 36) (15, 15) and (8, 8)

f) (-1, 8) and (-4, 3) (-5, 1) and (-1, 5) (-12, 9) and (-2, 6) (-15, 4) and (-8, 12)

g) (-5, 5) and (4, -8) (-6, 12) and (17, -8) (-8, 0) and (2, -6) (-15, 9) and (7, -8)

h) (-5, -8) and (-4, -7) (-5, -7) (-4, -5) (-8, -14) and (-16, -26) (-3, -3) and (-17, -13)

Work the fractions problems all the way out until the square root step for the fraction practice. Then use the calculator to get an approximate answer. Round to the nearest thousandth.

i) (2 $^1/_3$, $^4/_5$) ($^5/_{10}$, $^2/_3$) ($^3/_8$, $^7/_8$) and ($^3/_4$, ½) ($^5/_8$, $^1/_3$) ($^2/_3$, $^7/_8$) (5 ½, 3 $^2/_5$) (1 $^3/_5$, 2 $^3/_5$)

j) (-2 $^1/_3$, $^4/_5$) ($^5/_{10}$,- $^2/_3$) (-$^3/_8$, $^7/_8$) and ($^3/_4$,- ½) (-$^5/_8$, $^1/_3$) ($^2/_3$,- $^7/_8$) (-5 ½, 3 $^2/_5$) (1 $^3/_5$, -2 $^3/_5$)

For the following, plot the set of points. Find the distance between the points and the slope of the line between the points.

k) (4, 8) and (9, 13) (0, 0) and (2, 5) (10, 18) and (24, 10)

l) (102, 145) and (50, 50) (29, 98) and (42, 38) (14, 75) and 35, 49)

m) (-4, 8) and (-9, 13) (0, 0) and (2, -5) (10, -18) and (-24, 10)

n) (-102, -145) and (-50, -50) (-29, -98) and (42, 38) (14, 75) and (-35, -49)

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3