

Name: _____

Using the Pythagorean Theorem to Determine Distance

The distance between any two points can be found using the **distance formula**, $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. Often, people have trouble remembering this formula. However, it is nowhere near as complicated as some of us might expect it to be. The distance formula is just the **Pythagorean Theorem** after it has been solved for c . Since **c is the distance**, I am going to **substitute** the letter **d for the c** .

$$a^2 + b^2 = d^2, \text{ so } \dots \sqrt{a^2 + b^2} = d$$

What this means is that you don't need to use the formula, if you are not comfortable with it. You can use the Pythagorean Theorem and successfully solve the problem. The only part that is new to the Pythagorean Theorem process is determining a and b . Instead of looking at an image, you have to compare two points.

a is the difference between the two x values (subtract).

b is the difference between the two y values (subtract).

For example:

Determine the distance between $P(5, 7)$ and $Q(-1, 3)$.

First, find a & b :
 $a = \text{difference between the } x\text{'s}$ $b = \text{difference between the } y\text{'s}$
 $a = (5) - (-1) = 5 + 1 = 6$ $b = (7) - (3) = 4$

Now, plug it into $a^2 + b^2 = d^2$ and solve for d .

$$\begin{aligned} 6^2 + 4^2 &= d^2 \\ 36 + 16 &= d^2 \\ 52 &= d^2 \\ \sqrt{52} &= \sqrt{d^2} \\ \sqrt{4}\sqrt{13} &= d \\ 2\sqrt{13} &= d \end{aligned}$$

The distance is $\boxed{2\sqrt{13}}$.

It doesn't matter if you have a point (x, y) or even (x, y, z) . Simply add in the difference between the z 's to the problem and solve, just like you did before.

For example:

Determine the distance between $M(3, -4, 0)$ and $N(6, 2, 1)$.

$a = \text{difference between the } x\text{'s}$ $b = \text{difference between the } y\text{'s}$ $c = \text{difference between the } z\text{'s}$
 $a = (3) - (6) = -3$ $b = (-4) - (2) = -6$ $c = (0) - (1) = -1$

Now, plug it into $a^2 + b^2 + c^2 = d^2$ and solve for d .

$$\begin{aligned} (-3)^2 + (-6)^2 + (-1)^2 &= d^2 \\ 9 + 36 + 1 &= d^2 \\ 46 &= d^2 \\ \sqrt{46} &= \sqrt{d^2} \\ \sqrt{46} &= d \end{aligned}$$

The distance is $\boxed{\sqrt{46}}$.

Determine the distance between the given points. Simplify as much as possible.

1. $G(1, 9)$ & $H(5, 2)$

2. $R(-8, 4)$ & $S(-5, 3)$

3. $A(6, 3)$ & $B(3, 5)$

4. $D(2, 7)$ & $E(2, 10)$	5. $Y(11, 7)$ & $Z(7, 11)$	6. $J(5, 5)$ & $K(5, 5)$
7. $L(0, 2, -4)$ & $M(3, 5, 2)$	8. $T(11, 8, 11)$ & $V(5, 6, 3)$	9. $C(41, 3)$ & $D(39, 10)$
10. $F(2, 12)$ & $G(5, 8)$	11. $W(-9, -5)$ & $X(-4, -10)$	12. $B(20, 1, 4)$ & $C(10, 7, 6)$
13. $L(-19, -14)$ & $M(-7, -9)$	14. $A(-18, 17)$ & $B(-9, 18)$	15. $G(0, 0)$ & $H(-4, 8)$