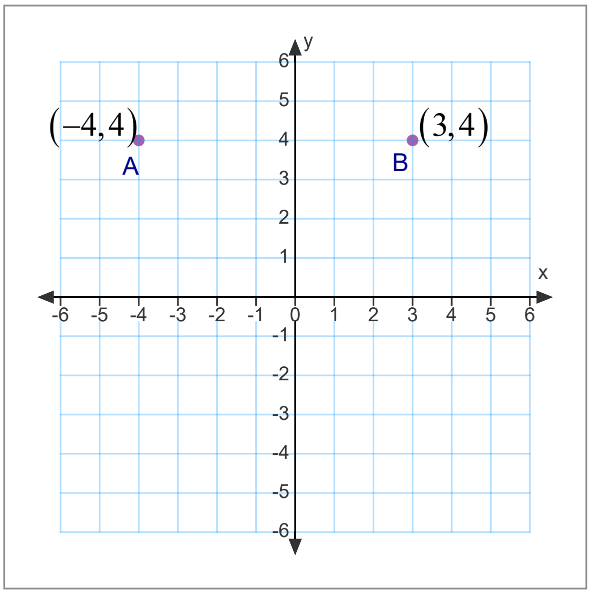
Distance Between Two Points

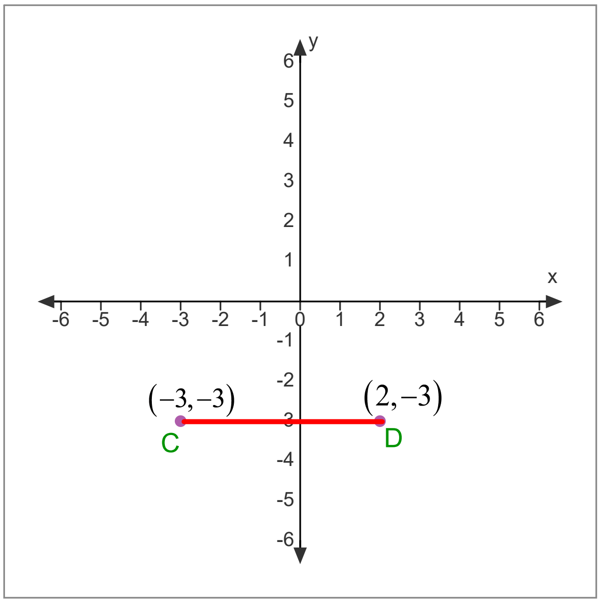
What is the distance from A to B?

$d(A, B) = \boxed{7}$ units



Example:

$$m\overline{CD} = ?$$



$m\overline{CD} = 5$

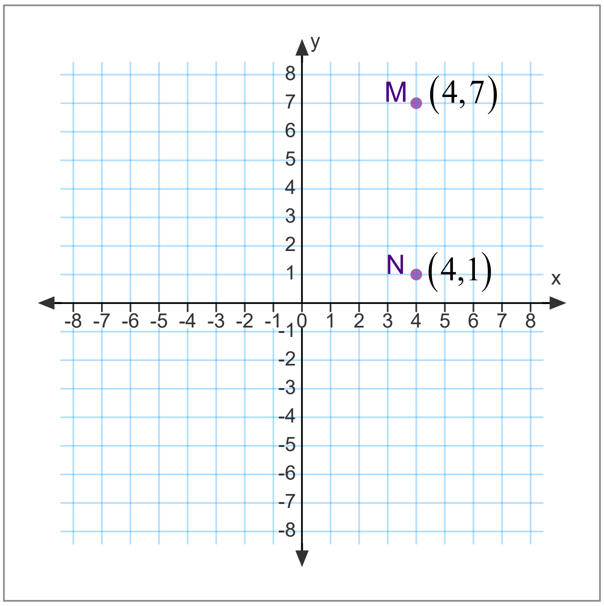
What is the distance between points $M\left(-4,-3\right)$ and $N\left(5,-3\right)$?

Points that have the same y coordinates are in line horizontally , so the distance between these two points is.....

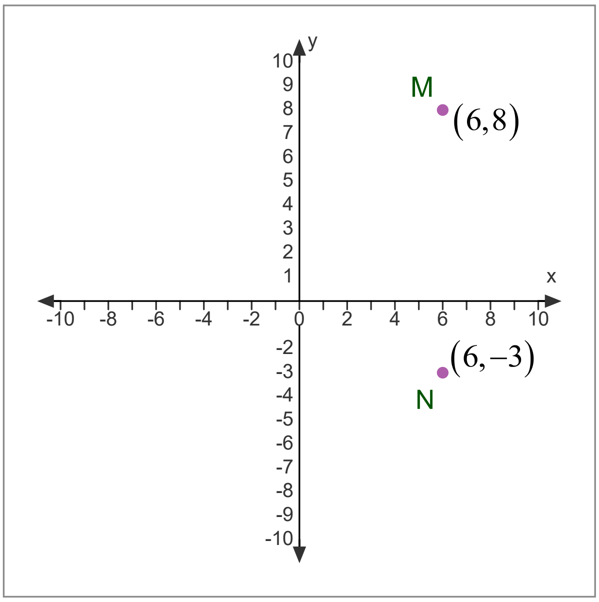
The horizontal distance between two points is the difference between the x co-ordinates: $(x_2 - x_1)$

What is the distance from M to N?

$d(M,N) = \boxed{6}$ units



$d(M,N) = \boxed{11}$ units



What is the distance between points $P(2,17)$ and $Q(2,9)$?

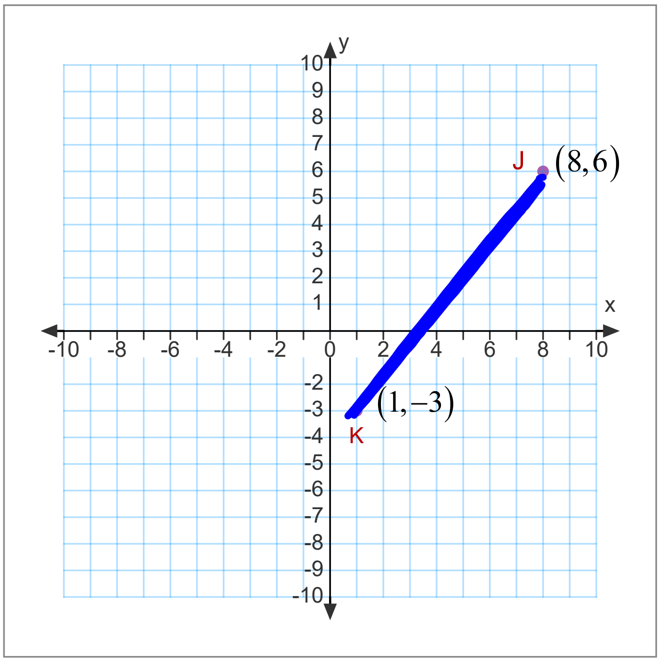
$17 - 9 = 8$

Points that have the same x coordinates are in line vertically, so the distance between these two points is....

The vertical distance between two points is the difference of the y co-ordinates: $(y_2 - y_1)$

For <u>Oblique</u> (slanted) distances:

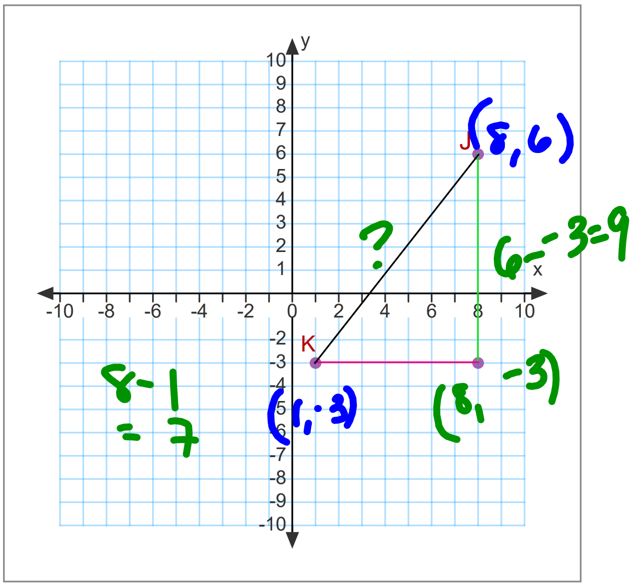
Find the distance from J to K.



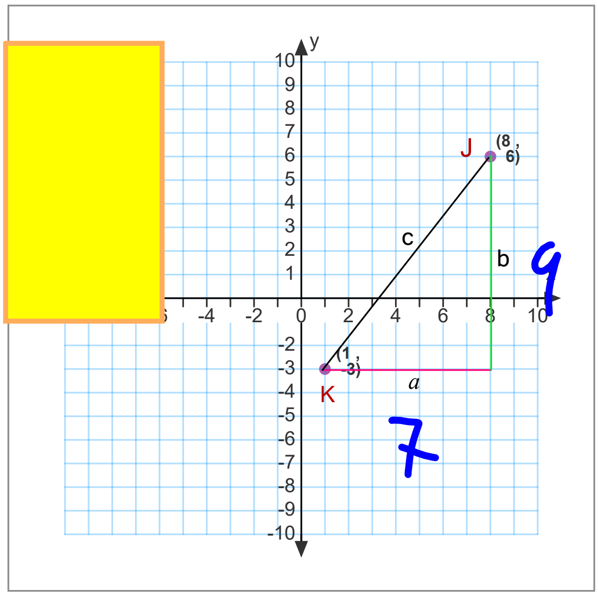
Hint:

Pythagoras' Theorem

On the Cartesian plane, we can make a right triangle whose hypotenuse is the segment JK.



By calculating the vertical and horizontal distances (the lengths of the legs of the triangle) we can use Pythagoras' theorem to find $d(J, K)$.



Pythagoras' Theorem

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

$a = 7$

$b = 9$

$c = ?$

$$7^2 + 9^2 = c^2$$

$$49 + 81 = c^2$$

$$130 = c^2$$

$$\sqrt{130} = c$$

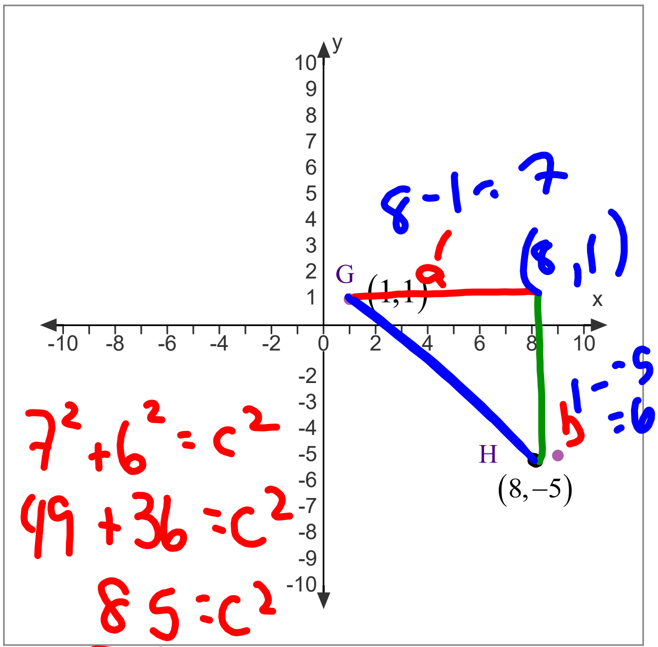
$$11.4 \doteq c \qquad \therefore\ d(J, K) = 11.4\ units$$

Calculate $d(G, H)$

1. Find the horizontal distance $(x_2 - x_1)$.

2. Find the vertical distance $(y_2 - y_1)$.

3. Calculate the distance between the points using Pythagoras' theorem.



$7^2 + 6^2 = c^2$

$49 + 36 = c^2$

$85 = c^2$

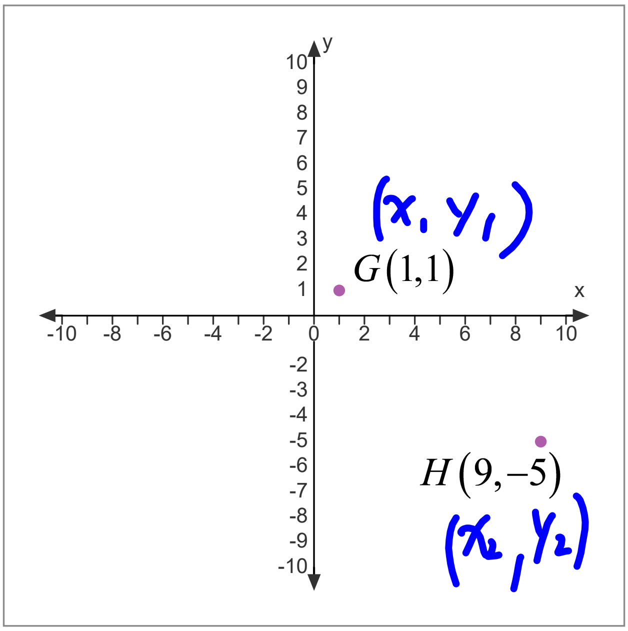
$\sqrt{85} = c$

These steps can be condensed into a single formula called the ...

Distance Formula. $A(x_1, y_1) \quad B(x_2, y_2)$

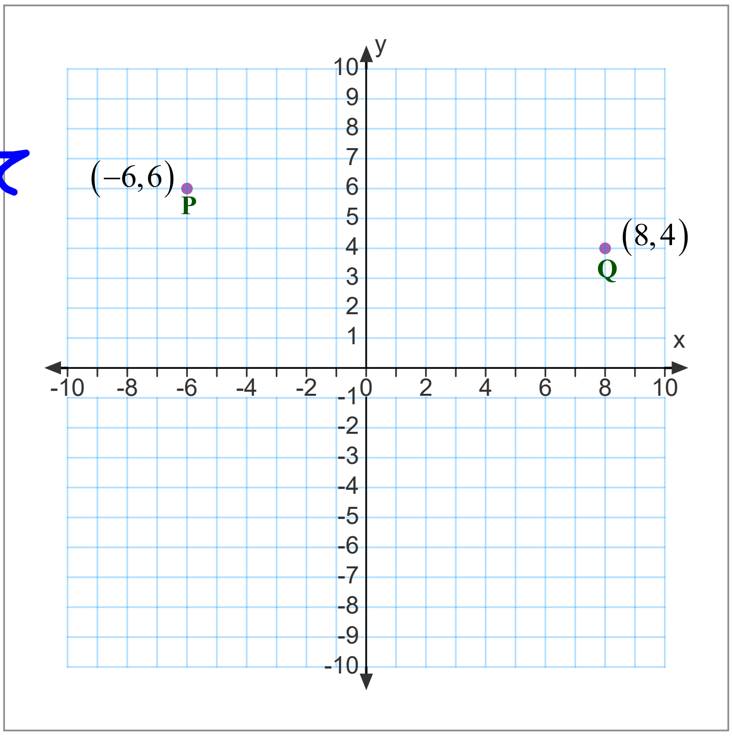
$$\boxed{d(A,B) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}}$$

$$d(G,H)=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$
$$=\sqrt{(9-1)^2+(-5-1)^2}$$
$$=\sqrt{8^2+(-6)^2}$$
$$=\sqrt{64+36}$$
$$=\sqrt{100}$$
$$=10$$



$$d(G,H) = 10\ units$$

Calculate $d(P, Q)$



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

$= \sqrt{(8-(-6))^2 + (4-6)^2}$

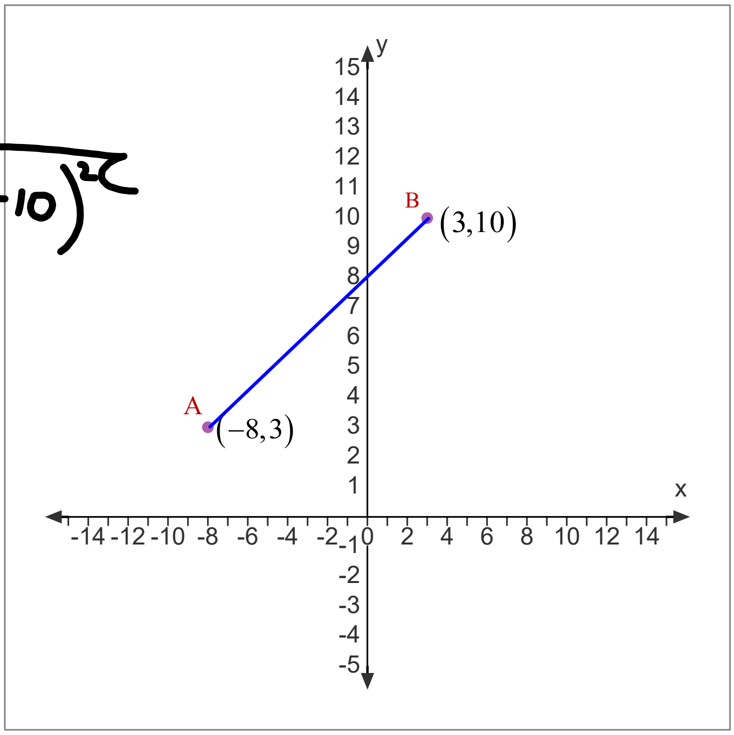
$= \sqrt{(14)^2 + (^-2)^2}$

$= \sqrt{196 + 4}$

$= \sqrt{200}$

$= 14.14$ units

Example: Calculate $m\overline{AB}$.



Note: $m\overline{AB} = d(A,B)$

$d(A,B) = \sqrt{(-8-3)^2 + (3-10)^2}$

$= \sqrt{(-11)^2 + (-7)^2}$

$= \sqrt{121 + 49}$

$= \sqrt{170}$

$= 13.08$

Example: Calculate $m\overline{FL}$, given $F(6,4)$ and $L(3,-6)$.

$$d(F,L) = \sqrt{(6-3)^2 + (4 - -6)^2}$$

$$= \sqrt{3^2 + 10^2}$$

$$= \sqrt{9 + 100}$$

$$= \sqrt{109}$$

$$= 10.4$$

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perimeter of ΔABC.

$S_1 = \overline{AB} \Rightarrow m\overline{AB}$

$d(A,B) = \sqrt{(2 - -1)^2 + (3-1)^2}$

$= \sqrt{3^2 + 2^2}$

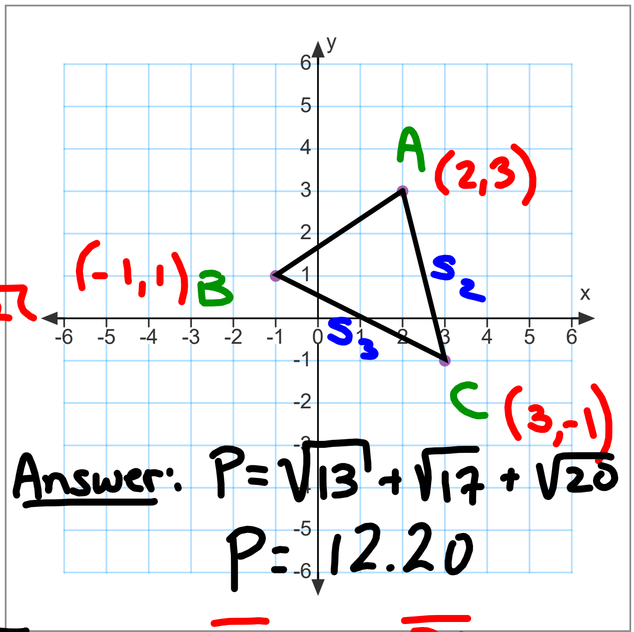
$= \sqrt{13}$

$S_2 = \overline{AC} \Rightarrow m\overline{AC}$

$d(A,C) = \sqrt{(3-2)^2 + (-1-3)^2}$

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

$= \sqrt{17}$



Answer: $P = \sqrt{13} + \sqrt{17} + \sqrt{20}$

$P = 12.20$

$S_3 = \overline{BC} = m\overline{BC}$

$d(B,C) = \sqrt{(3 - -1)^2 + (-1-1)^2}$

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

$= \sqrt{20}$

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6. $A(-4,1)$ $B(1,6)$ $C(1,1)$

$\underline{\triangle ABC}$ show that $\triangle ABC$ is a $\underline{\text{right}}$ $\underline{\text{isosceles}}$ triangle

① $d(A,B)$

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

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

$= \sqrt{25+25}$

$= \sqrt{50}$

$= \sqrt{25 \cdot 2}$

$= \sqrt{25} \cdot \sqrt{2} = 5\sqrt{2}$

② $d(B,C)$

$y_2 - y_1$

$6 - 1$

5

③ $d(A,C)$

$x_2 - x_1$

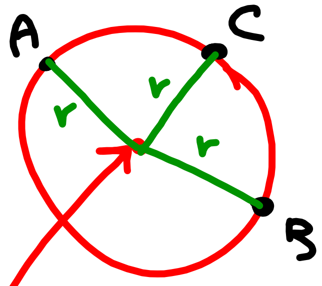
$1 - (-4) = 5$

* $m\overline{BC} = m\overline{AC} = 5 \Rightarrow \triangle ABC$ is isosceles

* $\left.\begin{aligned} 5^2 + 5^2 &= (\sqrt{50})^2 \\ 25 + 25 &= 50 \\ 50 &= 50 \end{aligned}\right\}$ $\triangle ABC$ is right

7. $A(-2,2)$ $B(5,-5)$ $C(4,2)$

<u>show</u> that all these points are on the circle



centre
$w(1,-2)$

$$d(A,w) = \sqrt{(-2-1)^2+(2--2)^2} = \sqrt{(-3)^2+(4)^2}$$
$$= \sqrt{9+16}$$
$$= \sqrt{25}$$
$$= 5$$

$d(B,w) =$

$d(C,w) =$