Midpoint and Distance Formulas

A party with x and y...

The Midpoint Formula:

Here it is with an example...

\[
\left( \frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right) = \text{(x,y) midpoint}
\]

Step 1. Write out the points and label them.

A \((5, -6)\)  \ B\((-3, 6)\)

\[
x_1, y_1 \quad x_2, y_2
\]

Step 2. Plug 'em in. Be careful!

\[
\left( \frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right) = \left( \frac{5+(-3)}{2}, \frac{-6+6}{2} \right)
\]

What you are actually doing is finding the halfway point of the x coordinates and the y coordinates by taking an average of both.

This is another type of problem. It looks tricky, but it just uses the midpoint formula backwards.

C is the midpoint of AB. If A is at \((3, -2)\) and C is at \((4, 3)\), find the coordinates of B.

Step 1. Write out the points and label them.

A \((5, -6)\)  \ B\((x_2, y_2)\)  \ C\((4, 3)\)

\[
x_1, y_1 \quad x_2, y_2
\]

Step 2. Plug it in and solve...

\[
\frac{x_1+x_2}{2} = x_m \quad \frac{y_1+y_2}{2} = y_m
\]

\[
\frac{5+(-3)}{2} = 4 \quad \frac{-6+6}{2} = 3
\]

The Distance Formula: The Distance Formula is just the Pythagorean theorem solved for the hypotenuse. It is \(D=\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}\). It looks weird, but all the \(x_2-x_1\) bit is the length of one leg and \(y_2-y_1\) is the length of the other leg. The square root is over the whole thing because otherwise you would be solving for \(D^2\) which is not very helpful.

Ex. Find the distance between \((4, 9)\) and \((-3, 7)\).

Step 1. Write out and label the points.

A \((5, 7)\)  \ B\((-6, -5)\)

\[
x_1, y_1 \quad x_2, y_2
\]

\[
D=\sqrt{(5+6)^2 + (7+5)^2} \quad D=\sqrt{121+144} \quad D=\sqrt{265} \quad D\approx 16.78
\]

It's party time!
Find the midpoint between each pair of points.

1. (4,8) and (-6,3)

2. (5,-7) and (8,-12)

3. (-3,-9) and (-4,6)

4. (-7,8) and (-11,-13)

5. (-13,4) and (0,9)

6. (10,-4) and (15,3)

7. (12,15) and (14,-7)

8. (19,-12) and (-19,-21)

Bubble all the correct answers from above. Don’t bubble incorrect answers.
9. M is the midpoint of $\overline{AB}$. If A is at (5,7) and M is at (-3,-4), find the coordinates of B.

10. Q is the midpoint of $\overline{RS}$. If R is at (-7,-4) and Q is at (8,-6), find the coordinates of S.

11. M is the midpoint of $\overline{LN}$. If L is at (8,-9) and M is at (8,7), find the coordinates of N.

12. G is the midpoint of $\overline{HI}$. If H is at (1,0) and G is at (-4,-6), find the coordinates of F.

13. K is the midpoint of $\overline{JL}$. If J is at (-12,5) and K is at (11,-10), find the coordinates of L.

14. Y is the midpoint of $\overline{XZ}$. If X is at (-8,13) and Y is at (-5,-15), find the coordinates of Z.

Bubble all the correct answers from above. Don’t bubble incorrect answers.

○ (-7,11) ○ (13,-10) ○ (36,-20) ○ (8,23) ○ (-9,-12) ○ (-2,-43) ○ (-43,18) ○ (34,-25) ○ (-11,-15) ○ (23,-8)

© 2010  www.letspracticegeometry.com
Find the distance between each pair of points.
15. (3,9) and (-2,-7)
16. (-8,4) and (5,-4)

17. (7,9) and (-6,7)
18. (3,-9) and (8,2)

19. (13,7) and (-10,-4)
20. (-5,-13) and (-6,-12)

21. (15,-16) and (10,-5)
22. (-2,64) and (-28,61)

Bubble all the correct answers from above. Don’t bubble incorrect answers.

© 2010  www.letspracticegeometry.com