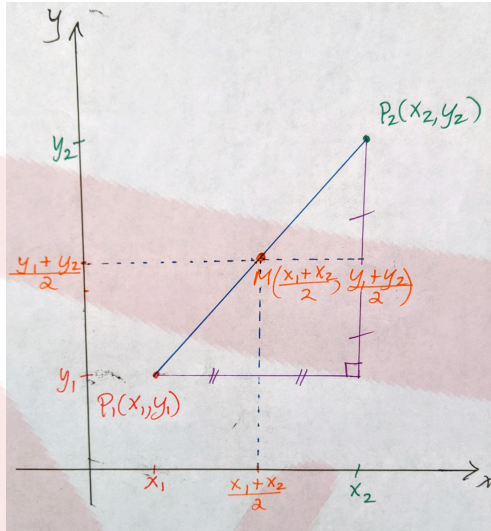Midpoint of a Line

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Midpoint of a Line

How do you calculate the midpoint of a line segment? First we need two points on the line. Let's say $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$ are the two endpoints of the line sements.

Fron the graph above we see that the midpoint of the line segment is

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

Let's consider the two points, $P_1(2, -3)$ and $P_2(-4, 6)$. The midpoint of P_2 and P_1 is given by,

$$
\begin{aligned}
M &= \left(\frac{-4 - 2}{2}, \frac{6 - (-3)}{2} \right) \\
&= \left(-\frac{6}{2}, \frac{9}{2} \right) \\
&= (-3, 4.5)
\end{aligned}
$$

So, the midpoint of P_1 and P_2 is, $(-3, 4.5)$.

Let's consider two points in $\mathbb{R}^3$, $P = (1, -1, 2)$ and $Q = (-20, 1)$. Find the midpiotn of PQ.

Solutions: We need to use the midpoint formula,

$$M = (x, y, z) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2} \right)$$

Using the midpoint formula we have,

$$
\begin{aligned}
M &= \left(\frac{1-2}{2}, \frac{-1+0}{2}, \frac{1+2}{2}\right) \\
&= \left(\frac{1}{2}, -\frac{1}{2}, \frac{3}{2}\right)
\end{aligned}
$$

So the midpoint of PQ is $M = (\frac{1}{2}, -\frac{1}{2}, \frac{3}{2})$.

Exercises

Find the midpoint of the points P and Q below.

a) $P(3,2), Q(0,2)$

f) $P(-2,0), Q(1,3)$

b) $P(4,1), Q(-1,0)$

g) $P(4,0), Q(-1,2)$

c) $P(-1,2), Q(2,0)$

h) $P(-1,-2), Q(4,3)$

d) $P(3,-2), Q(2,2)$

i) $P(-3,-4), Q(2,0)$

e) $P(-5,3), Q(0,1)$

j) $P(0,-4), Q(3,0)$