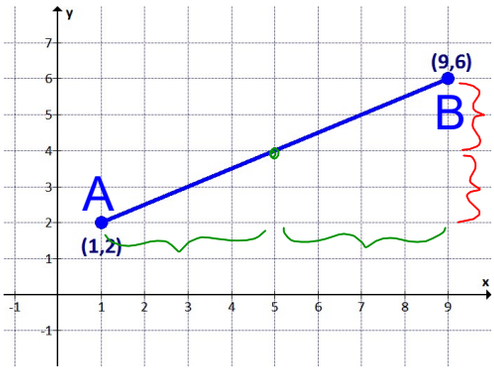
6.2 The Midpoint

Notation: M or M_{AB} is used for midpoint (between points A & B).
Remember m denotes slope.

What are the coordinates of the midpoint of segment AB?



How can you determine the MP algebraically given the coordinates of the two endpoints?

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

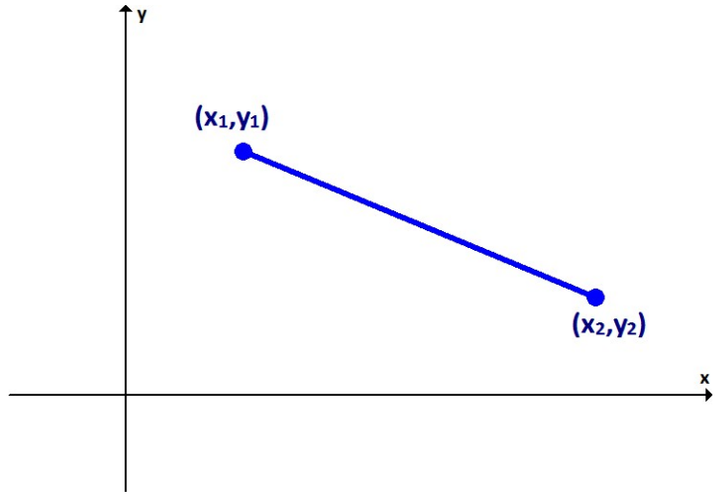
$$= \left(\frac{1+9}{2} , \frac{2+6}{2} \right)$$

$$= (5, 4)$$

.

The coordinates of the midpoint of a line segment are:

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



Ex 2: Find the midpoint of the line segment AB where A(2,-4) and B(-3,5).

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

$$= \left(\frac{2+(-3)}{2}, \frac{-4+5}{2}\right)$$

$$= \left(-\frac{1}{2}, \frac{1}{2}\right)$$

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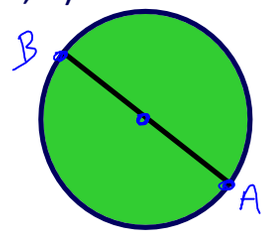
Ex 3: The diameter of a circle has endpoints A(4, -3) and B (-3, 5).
Find the centre of the circle.

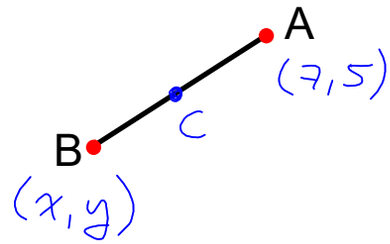


Find the midpoint,

$M_{AB} = \left(\frac{4+(-3)}{2}, \frac{-3+5}{2}\right)$

$= \left(\frac{1}{2}, 1\right)$

Ex 4: C(4, -3) is the midpoint of a line segment with endpoints A(7, 5) and B. Determine the coordinates of B.



$M_{AB} = \left(\frac{x+7}{2}, \frac{y+5}{2}\right)$

$= (4, -3)$

$\frac{x+7}{2} = 4$

$x+7 = 8$

$x = 1$

$\frac{y+5}{2} = -3$

$y+5 = -6$

$y = -11$

$\therefore B(1, -11)$

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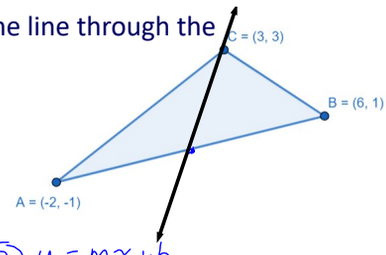
Ex 5: Given ΔABC determine the equation of the line through the midpoint of AB and vertex C.



① Find M_{AB}

② Use M_{AB} & C to find line

① $M_{AB} = \left(\frac{-2+6}{2}, \frac{-1+1}{2}\right)$

$= (2, 0)$

② Slope between (2,0) & (3,3)

$m = \frac{3-0}{3-2}$

$= 3$

③ $y = mx+b$

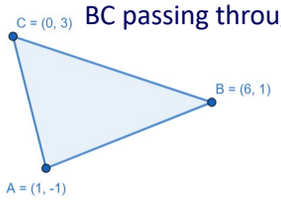
$y = 3x+b$ sub(2,0)

$0 = 3(2)+b$

$b = -6$

$\therefore y = 3x-6$

Ex 6: Given ΔABC determine the equation of the line perpendicular to BC passing through the midpoint of BC.



① Find M_{BC}

② Find slope m_{BC}

③ Find perp. slope

④ Use slope & midpoint to build equation

① $M_{BC} = \left(\frac{0+6}{2}, \frac{3+1}{2}\right)$

$= (3, 2)$

② $m_{BC} = \frac{1-3}{6-0}$

$= -\frac{1}{3}$

③ perp. slope $= 3$

④ use $m = 3$ & $(3, 2)$

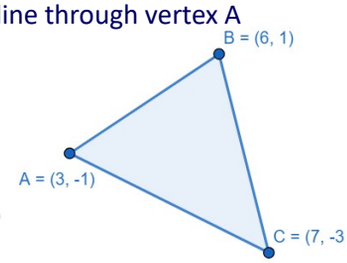
$y = 3x+b$

$2 = 3(3)+b$

$-7 = b$

$\therefore y = 3x-7$

Ex 7: Given ΔABC determine the equation of the line through vertex A and perpendicular to line segment BC.



① Slope of BC

② perp. slope

③ Build equation

① $m = \frac{-3-1}{7-6}$

$= \frac{-4}{1}$

$= -4$

② $m_{\perp} = \frac{1}{4}$

③ $m = \frac{1}{4}$ & $(3, -1)$

$y = \frac{1}{4}x+b$

$-1 = \frac{1}{4}(3)+b$

$-1 = \frac{3}{4}+b$

$-1-\frac{3}{4} = b$

$-\frac{4}{4}-\frac{3}{4} = b$

$-\frac{7}{4} = b$

$\therefore y = \frac{1}{4}x-\frac{7}{4}$

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