

Mathematics 10D

2.1 – Midpoint of a Line Segment

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A **line segment** is a line that connects two points. A **midpoint**, then, is the point that represents the middle of that line segment.

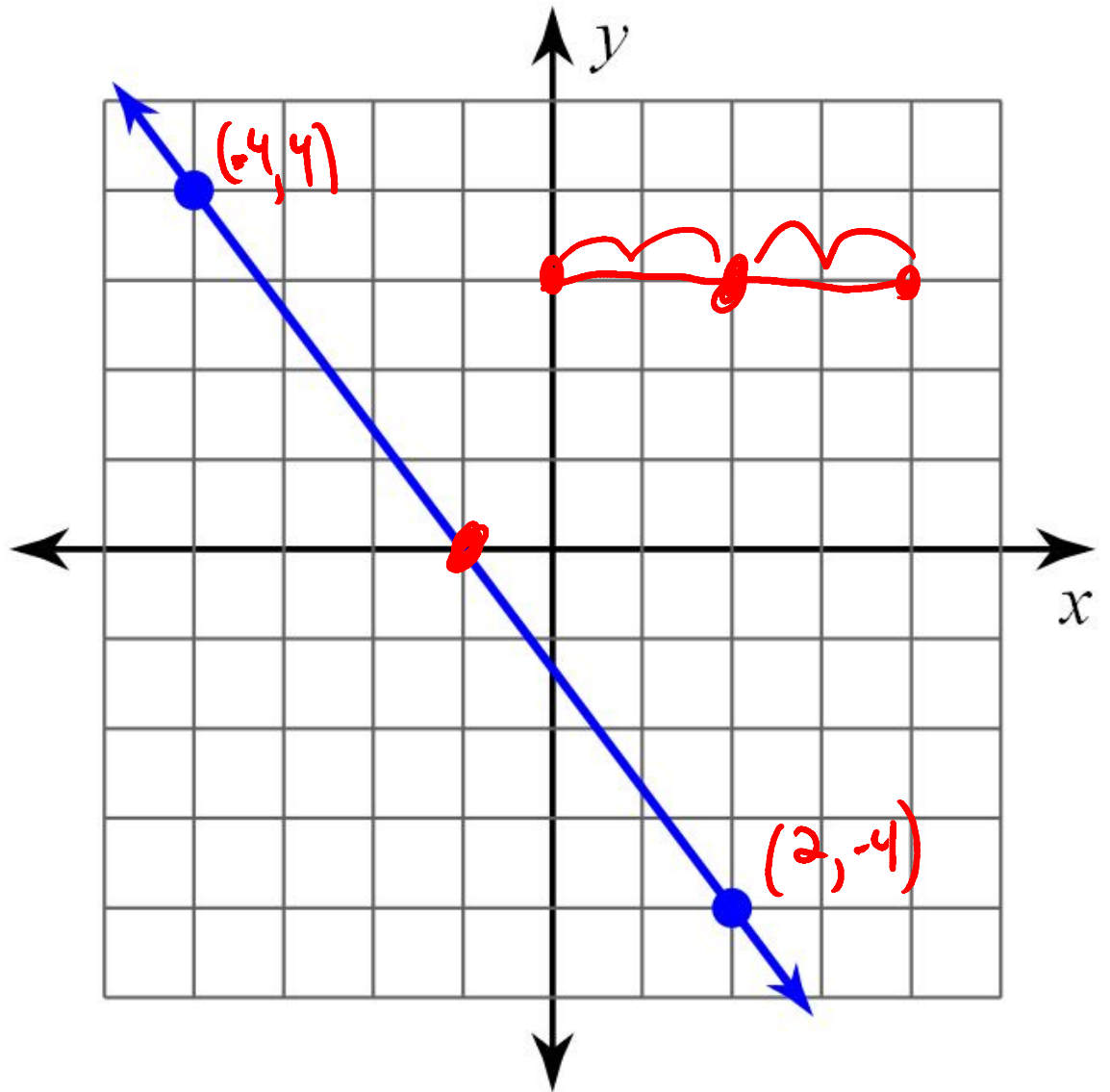
Question: If you scored a 70% on a test and then an 82% on the next test, what is the average of those tests?

$$\frac{70 + 82}{2} = \frac{152}{2} = 76$$

Find the midpoint of the line segment below:

$$x = \frac{-4 + 2}{2} = \frac{-2}{2} = -1$$

$$y = \frac{4 + -4}{2} = \frac{0}{2} = 0$$



The coordinate of the midpoint is:

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

big M

two point

m, little m is slope

Find the midpoint of the points:

$$A(6, -9), B(-2, -4)$$

$$M_{AB} \left(\frac{6 + (-2)}{2}, \frac{-9 + (-4)}{2} \right)$$

$$M_{AB} \left(\frac{4}{2}, \frac{-13}{2} \right)$$

$$M_{AB} (2, -6.5)$$

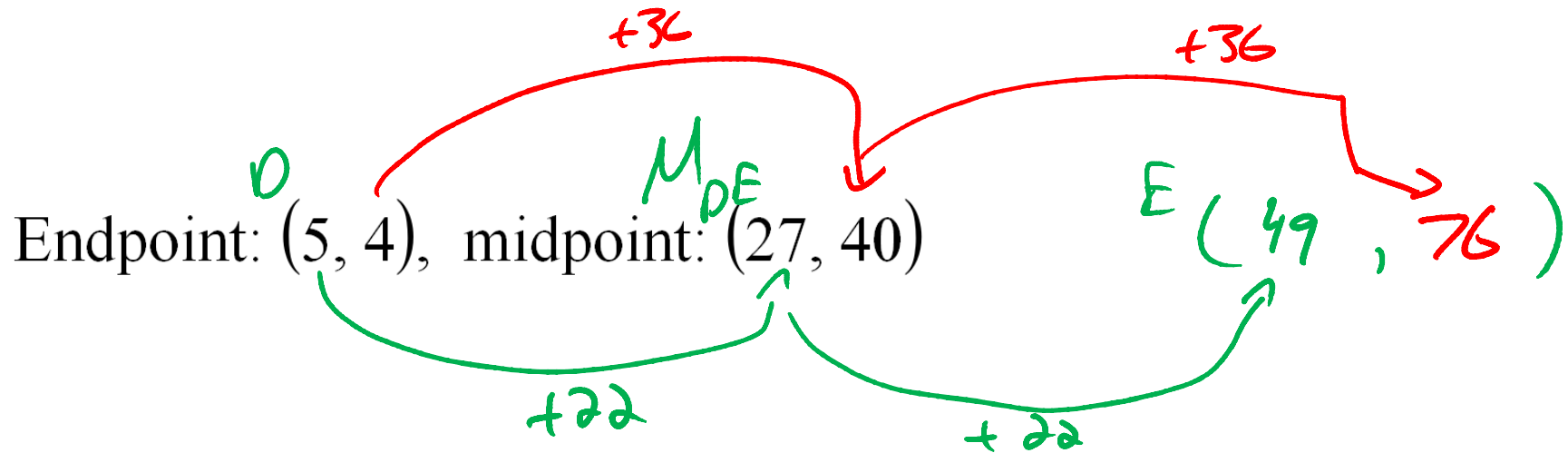
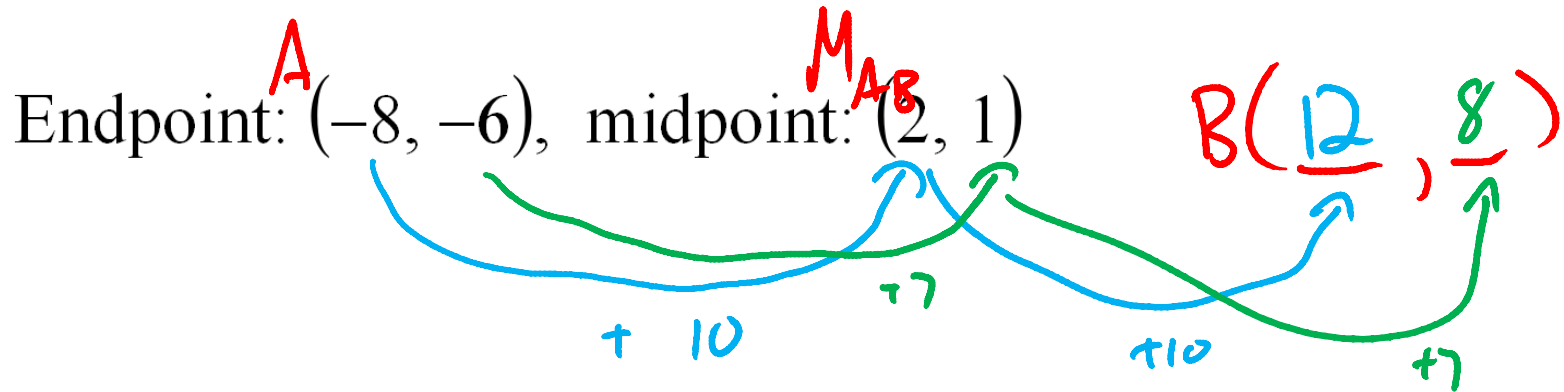
$$D(-655, 848), E(117, 976)$$

$$M_{DE} \left(\frac{-655 + 117}{2}, \frac{848 + 976}{2} \right)$$

$$M_{DE} \left(\frac{-538}{2}, \frac{1824}{2} \right)$$

$$M_{DE} (-269, 912)$$

Given one endpoint and the midpoint, find the second endpoint.



The Big Question: A triangle has vertices at A(-3,1), B(3,5) and C(7,-3). Determine the equation of the median from vertex A.

$$y = mx + b$$

A median is a line segment that joins a vertex of a triangle to the midpoint of the opposite side.

① Find $M_{BC} \Rightarrow D$

② find slope, m_{AD}

③ find $y = mx + b$

① $M_{BC} \left(\frac{3+7}{2}, \frac{5+(-3)}{2} \right) = M_{BC} (5, 1) D$

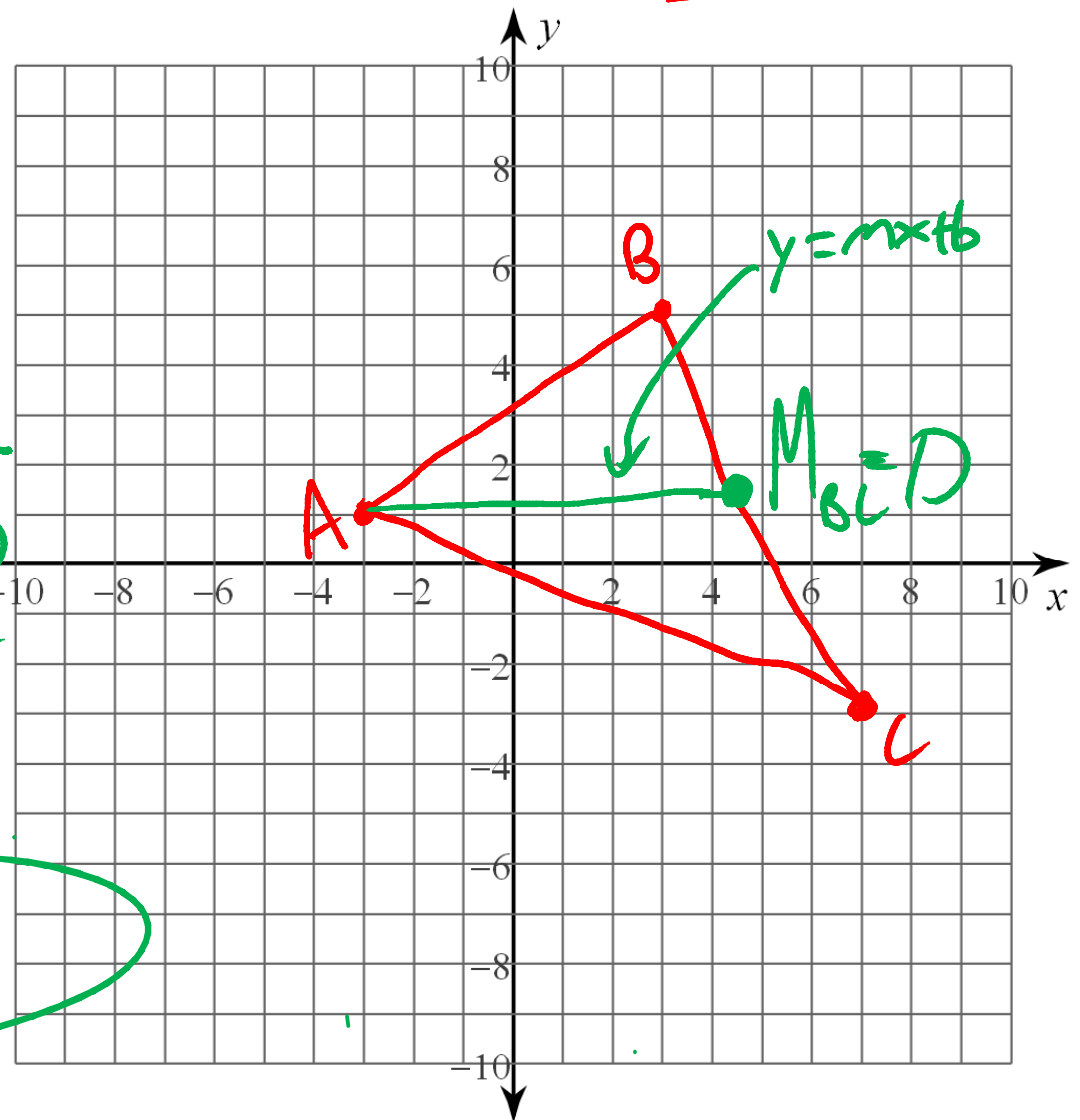
② $m_{AD} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 1}{5 - (-3)} = \frac{0}{8} = 0$

③ $y = mx + b$

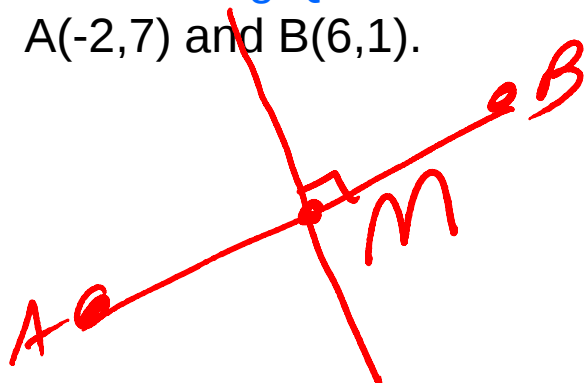
$1 = 0(-3) + b$

$1 = b$

$\therefore y = 1$



Another Big Question: Find the equation of the perpendicular bisector of the points A(-2,7) and B(6,1).



$$\begin{aligned} \text{slope} = m &= \frac{a}{b} \quad \left\{ \begin{array}{l} \hookrightarrow \text{cut in half} \\ \hookrightarrow \text{midpoint} \end{array} \right. \\ \text{perp. slope} = m_{\perp} &= \frac{-b}{a} \end{aligned}$$

① Find midpoint.

$$M_{AB} \left(\frac{-2+6}{2}, \frac{7+1}{2} \right)$$

$$M_{AB} (2, 4)$$

② Find slope of AB

$$m = \frac{1-7}{6-2} = \frac{-6}{4} = -\frac{3}{2}$$

$$m_{\perp} = \frac{2}{3}$$

③ Find the equation:

$$y = m_{\perp}x + b$$

$$4 = \left(\frac{2}{3}\right)(2) + b$$

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

$$\frac{12}{3} - \frac{4}{3} = b$$

$$\frac{8}{3} = b$$

$$\therefore y = \frac{2}{3}x + \frac{8}{3}$$