L2 – Median, Right Bisector, Altitude Unit 2
MPM2D
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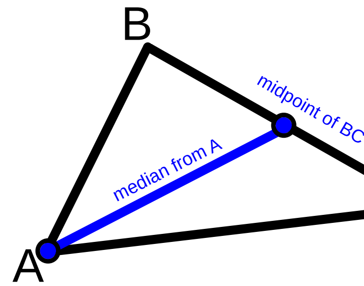
Median of a Triangle:

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

To find the equation of the median from a vertex:

1) Find the midpoint of the opposite side
2) Find the slope of the line connecting the vertex to the midpoint of the opposite side
3) Calculate the y-intercept of the line
4) Write the equation of the line.

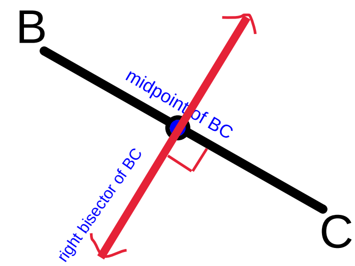


Right Bisector

The line that passes through the midpoint of a line segment and intersects it at a $90°$ *angle.*

To find the equation of the right bisector of line BC:

1) Find the midpoint of BC
2) Find the slope of BC.
3) Find the slope of a line perpendicular to BC
4) Use the slope perpendicular to BC and the midpoint of BC to calculate the y-intercept of the right bisector
5) Write the equation of the right bisector

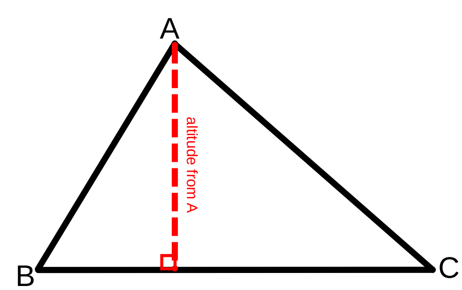


Altitude

An altitude of a triangle is a line segment from a vertex of a triangle to the opposite side, that is perpendicular to that side.

To find the equation of an altitude from a vertex:

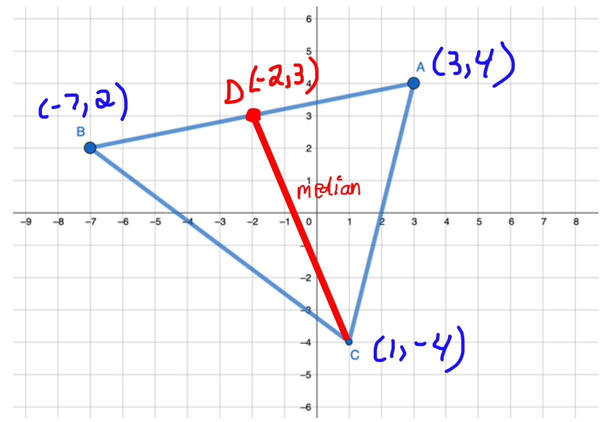
1) Find the slope of the side opposite from the vertex
2) Find the slope of the altitude which is perpendicular to the slope of the side opposite from the vertex
3) Use the altitude's slope and the point from the vertex to calculate the y-intercept of the altitude
4) Write the equation of the altitude



Example 1: ΔABC has vertices $A(3,4)$, $B(-7,2)$, and $C(1,-4)$. Determine…

a) an equation for the median from vertex C

$\text{midpoint}_{AB} = D = \left(\frac{-7+3}{2}, \frac{2+4}{2}\right) = (-2,3)$



$\text{slope}_{DC} = \dfrac{-4-3 \;(\Delta y)}{1-(-2) \;(\Delta x)} = \dfrac{-7}{3}$

y-int_{DC}:

$y = mx+b$

$3 = \left(-\frac{7}{3}\right)(-2)+b$

$3 = \frac{14}{3}+b$

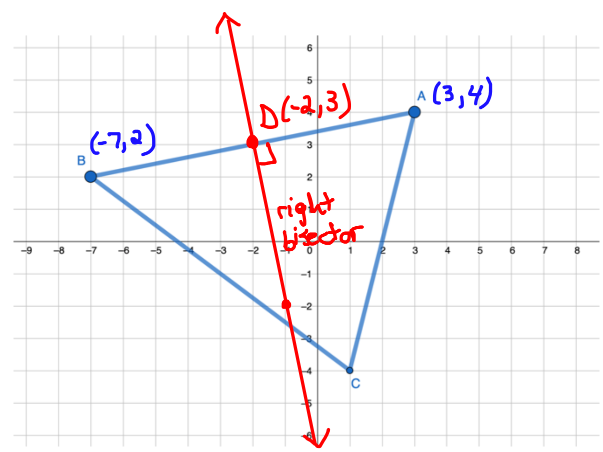
$b = \frac{9}{3} - \frac{14}{3}$

$b = -5/3$

$\boxed{\text{Eq}^n \text{ of median: } \quad y = \frac{-7}{3}x - \frac{5}{3}}$

b) an equation for the right bisector of AB

$\text{midpoint}_{AB} = D = (-2,3)$



$\text{slope}_{BA} = \dfrac{4-2 \;(\Delta y)}{3-(-7) \;(\Delta x)} = \dfrac{2}{10} = \dfrac{1}{5}$

slope perpendicular to $BA = -5$

y-int of right bisector:

$y = mx+b$

$3 = (-5)(2)+b$

$3 = -10+b$

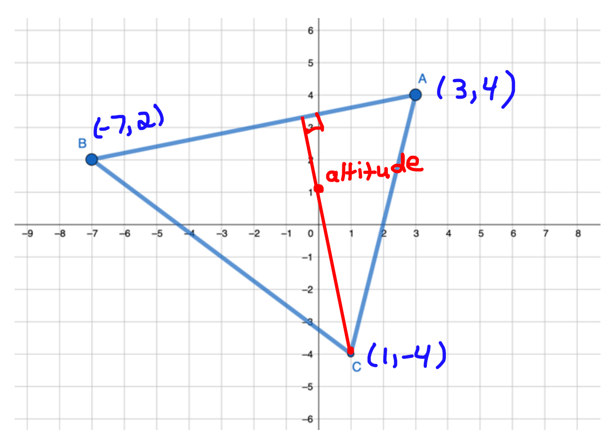
$b = 13$

$\boxed{\text{Eq}^n \text{ of right bisector: } \quad y = -5x+13}$

c) an equation for the altitude from vertex C

$\text{slope}_{BA} = \frac{1}{5}$

slope perpendicular to $BA = -5$



y-int of altitude:

$y = mx+b$

$-4 = -5(1)+b$

$-4 = -5+b$

$b = 1$

Eq^n of altitude:

$y = -5x+1$

Example 2: ΔDEF has vertices $D(-1,5)$, $E(-2,-1)$, and $F(5,2)$. Determine…

a) an equation for the median from vertex E

$\text{midpoint}_{DF} = G = \left(\frac{-1+5}{2}, \frac{5+2}{2}\right) = \left(2, \frac{7}{2}\right)$

$\text{slope}_{EG} = \frac{\frac{7}{2} - (-1)}{2(-2)} = \frac{\frac{7}{2} + \frac{2}{2}}{4} = \frac{\frac{9}{2}}{4} = \frac{9}{8}$

y-int median:

$y = mx + b$

$-1 = \frac{9}{8}(-2) + b$

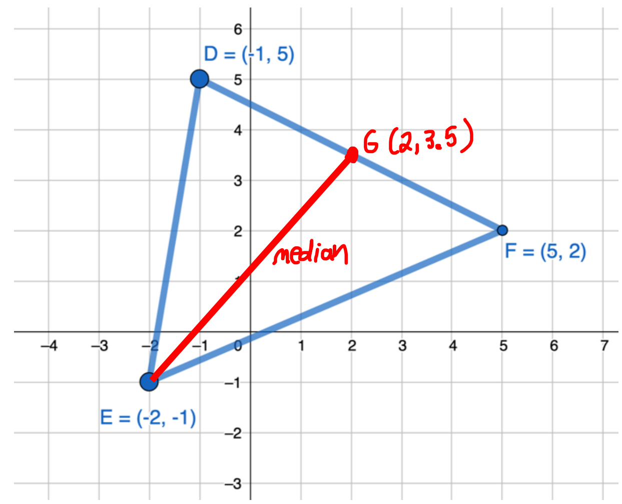
$-1 = \frac{-9}{4} + b$

$b = \frac{-4}{4} + \frac{9}{4}$

$b = \frac{5}{4}$

Eq^n of median:

$\boxed{y = \frac{9}{8}x + \frac{5}{4}}$



b) an equation for the right bisector of DF

$\text{midpoint}_{DF} = G = \left(2, \frac{7}{2}\right)$

$\text{slope}_{DF} = \frac{2-5}{5-(-1)} = \frac{-3}{6} = \frac{-1}{2}$

slope perpendicular to DF = 2

y-int of right bisector:

$y = mx + b$

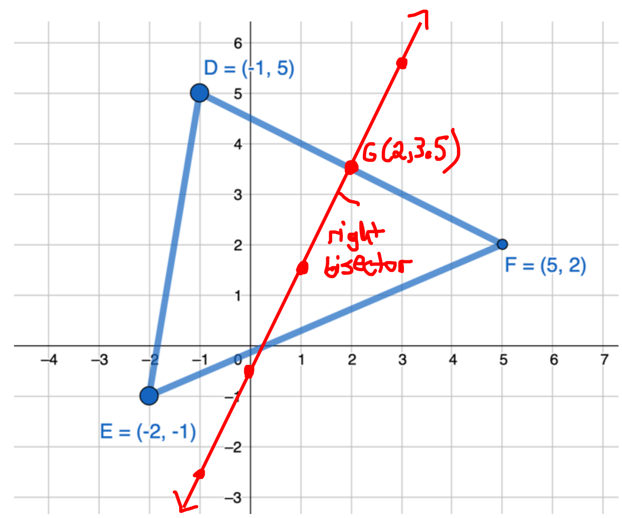
$\frac{7}{2} = 2(2) + b$

$\frac{7}{2} - \frac{8}{2} = b$

$b = \frac{-1}{2}$

Eq^n of right bisector:

$y = 2x - \frac{1}{2}$



c) an equation for the altitude from vertex E

$\text{slope}_{DF} = \frac{-1}{2}$

slope perpendicular to DF = 2

y-int of altitude:

$y = mx + b$

$-1 = 2(-2) + b$

$-1 = -4 + b$

$b = 3$

Eq^n of altitude:

$\boxed{y = 2x + 3}$