

Special Lines in Triangles

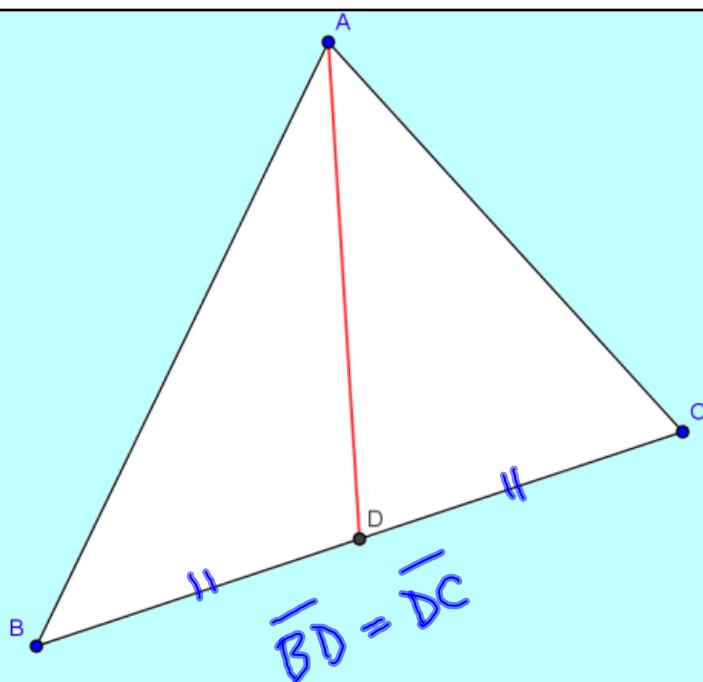
Assigned Work:

Triangle ABC has vertices A(3, 4), B(-5, 2) and C(1, -4).
Find the equation for the altitude from A to BC.

- p.79 #12
- p.80 #13c,14
- p.102 #4
- p.110 #13b

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Median: A line that joins a vertex of a triangle to the midpoint of the opposite side.

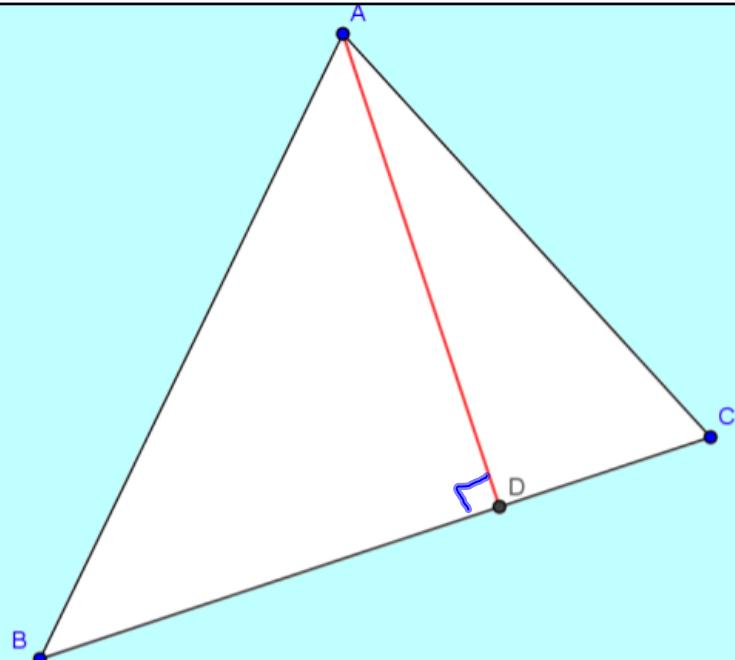


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Altitude: A line frc to the opposite sid is perpendicular tc opposite side.

$$m_{BC}$$

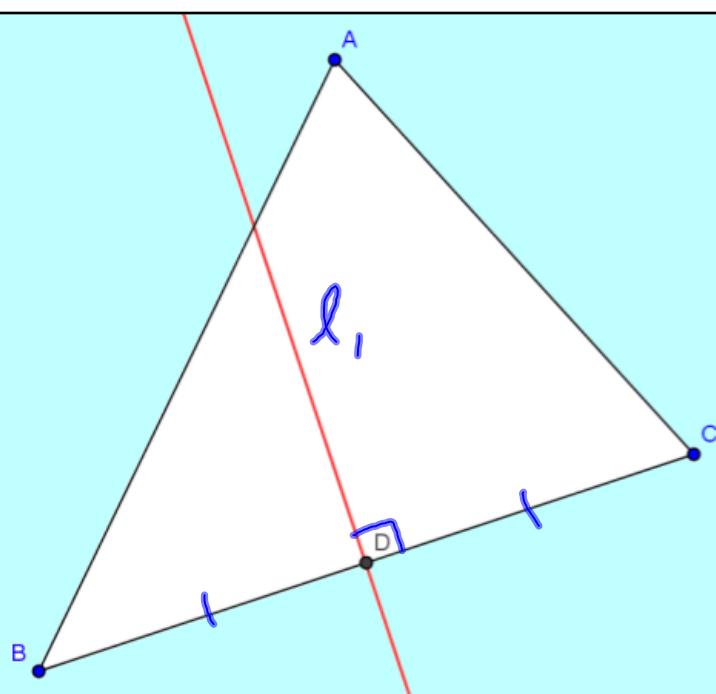
$$m_{AD} = -\frac{1}{m_{BC}}$$



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Perpendicular Bisect
A perpendicular line through the midpoint of a line segment.

$$m_{l_1} = -\frac{1}{m_{BC}}$$



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Special Lines in Triangles

Mar. 4/2011

Refer to yesterday's hand-out for the characteristics of the special lines.

Ex.: 1) Triangle STU has vertices at S(-2, -3), T(9, 4) and U(11, -4).

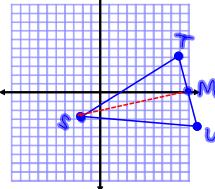
- a. Find the equation of the median from S.

① MP of TU

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

$$M_{TU} = \left(\frac{9+11}{2}, \frac{4+(-4)}{2} \right)$$

$$M_{TU} = (10, 0)$$



② slope of median (SM)

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_{SM} = \frac{0 - (-3)}{10 - (-2)}$$

$$= \frac{3}{12}$$

$$m_{SM} = \frac{1}{4}$$

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

$$\left. \begin{array}{l} \text{③ } y\text{-int of median} \\ \text{Sub a point into } y = \frac{1}{4}x + b \\ \text{sub } M(10, 0) \\ 0 = \frac{1}{4}(10) + b \\ 0 = 2.5 + b \\ b = -2.5 \end{array} \right\}$$

$$\frac{1}{4}(10)$$

$$= \frac{10}{4}$$

$$= \frac{5}{2}$$

$$\therefore \text{the median is } y = \frac{1}{4}x - \frac{5}{2}$$

$$\text{or } y = 0.25x - 2.5$$

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Ex.1 continues...

Triangle STU has vertices at S(-2, -3), T(9, 4) and U(11, -4).

- b. Find the equation of the altitude from U.

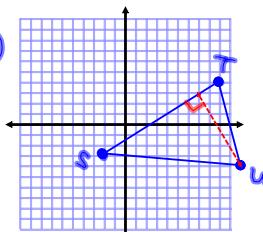
① slope of opposite side (ST)

$$m_{ST} = \frac{4 - (-3)}{9 - (-2)}$$

$$= \frac{7}{11}$$

② Slope perpendicular to ST

$$m_{\perp} = -\frac{11}{7} \quad y = -\frac{11}{7}x + b$$



③ Sub U(11, -4) to find b

$$-4 = -\frac{11}{7}(4) + b$$

$$-4 = -\frac{44}{7} + b$$

$$-4 + \frac{44}{7} = b$$

$$-\frac{28}{7} + \frac{44}{7} = b$$

$$b = \frac{16}{7}$$

\therefore the equation of the altitude is

$$y = -\frac{11}{7}x + \frac{16}{7}$$

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Ex.1 continues...

Triangle STU has vertices at S(-2, -3), T(9, 4) and U(11, -4).

- c. Find the equation of the perpendicular bisector of side TU.

① midpoint of TU

$$M_{TU} = \left(\frac{9+11}{2}, \frac{4+(-4)}{2} \right)$$

$$= (10, 0)$$

② slope of TU

$$m_{TU} = \frac{-4-4}{11-9}$$

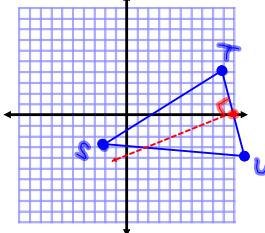
$$= \frac{-8}{2}$$

$$= -4$$

$$\textcircled{3} \quad m_{\perp} = -\frac{1}{(-4)}$$

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

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

④ sub $M(10, 0)$

$$0 = \frac{1}{4}(10) + b$$

$$0 = \frac{10}{4} + b$$

$$b = -\frac{5}{2}$$

\therefore perpendicular
bisector is

$$y = \frac{1}{4}x - \frac{5}{2}$$

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Assigned Work:

Triangle ABC has vertices A(3, 4), B(-5, 2) and C(1, -4).
Find the equation for the altitude from A to BC.

p.79 #12

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P 80 #14
 obvious choice is the MP between towns
 $x_m = \frac{3+13}{2} = \frac{16}{2} = 8$
 $y_m = \frac{10+4}{2} = 7$ $M = (8, 7)$

In general, any point on the perpendicular bisector would work

$m_{AB} = \frac{4-10}{13-3} = \frac{-6}{10} = -\frac{3}{5}$ $m_{\perp} = \frac{5}{3}$

$y = m_{\perp}x + b$
 $y = \frac{5}{3}x + b$

Sub (8, 7)
 $7 = \frac{5}{3}(8) + b$
 $7 = \frac{40}{3} + b$
 $7 - \frac{40}{3} = b$ $\therefore y = \frac{5}{3}x - \frac{19}{3}$
 $\frac{21}{3} - \frac{40}{3} = b$
 $-\frac{19}{3} = b$

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P. 110
 #13(b)

$M_{AB} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right) = \left(\frac{-4+3}{2}, \frac{3-4}{2} \right) = \left(-\frac{1}{2}, -\frac{1}{2} \right)$

$m_{AB} = \frac{-4-3}{3-(-4)} = \frac{-7}{7} = -1$

$m_{\perp} = 1$ $y = m_{\perp}x + b$
 $y = x + b$
 $-\frac{1}{2} = -\frac{1}{2} + b$
 $b = 0$
 $y = x$

Verify (0, 0)
 $LS = y = 0$ $RS = x = 0$ $\therefore (0, 0)$ is a point on the perpendicular bisector.

$LS = 0$ $RS = 0$
 $LS = RS \checkmark$

$x^2 + y^2 = 25$
 $LS = x^2 + y^2 =$
 $RS = 25$

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