**Before we begin, are there any questions from last day's work?**

Practice Quiz?
What is a median?
What is a right bisector?

# Today's Learning Goal(s):

By the end of the class, I will be able to:

a) Find the equation of the **altitude** of a triangle.
b) Solve problems involving slope, midpoint and length formulas.

$$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$$

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

$$|AB| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

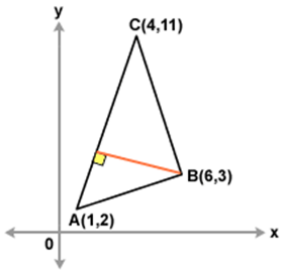
MPM 2DI 2.3 Apply Slope, Midpoint and Length Formulas (Day1) Date: Sept. 30/16

## Altitude of a Triangle

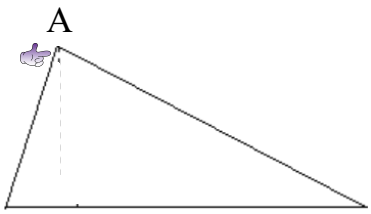
An **altitude** is the height of a geometric shape.

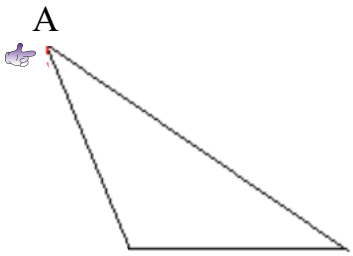
The **altitude** of a triangle is the line that passes through a vertex and is perpendicular to the side (or extension of that side) opposite to that vertex.

***Every triangle has exactly 3 altitudes.***

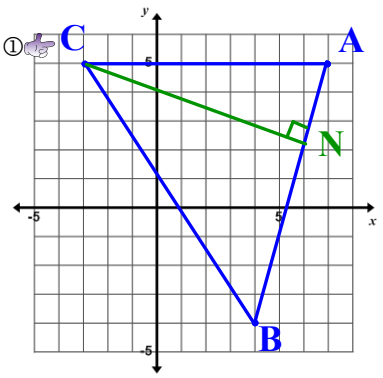



Note: Draw the altitude from A.



Ex. 1 A triangle has vertices A ( 7 , 5), B( 4 ,–4) and C( –3 , 5).
Find an equation for the altitude from C to AB.




② *Let CN represent the altitude from C.*

We need the slope of CN, but don't know the point N.
Since CN is perpendicular to AB, first find the slope of AB.

$m_{AB} = \frac{-4-5}{4-7} = \frac{-9}{-3} = 3$

$m_{CN} = \frac{-1}{m_{AB}} = -\frac{1}{3}$

$y = -\frac{1}{3}x + 4$

Now $y = -\frac{1}{3}x + b$

$(5) = -\frac{1}{3}(-3) + b$

$5 = 1 + b$

$5 - 1 = b$

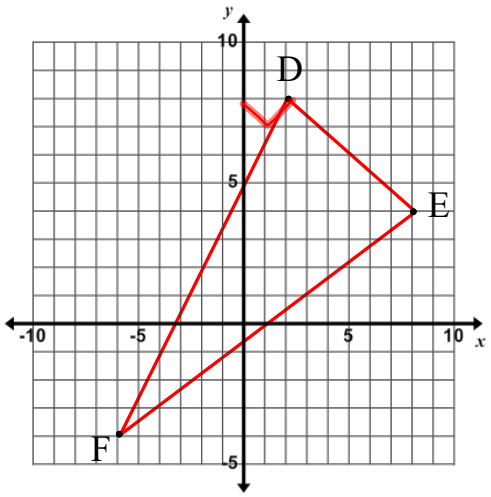
$4 = b$

$\therefore y = -\frac{1}{3}x + 4$ is the equation of the altitude from C.

Ex. 2 A triangle has vertices D ( 2 , 8), E( 8 , 4) and F( –6 , –4).
Determine if ΔDEF is a right triangle.

- *If ΔDEF is a right triangle, then two of the slopes will be negative reciprocals, and have a product of -1.*
- ***We could also calculate the lengths, to see if they satisfy the Pythagorean Theorem. (see p.86 Ex.2 Method 2)***

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




$m_{FE} = \frac{4 - (-4)}{8 - (-6)} = \frac{8}{14} = \frac{4}{7}$

$m_{DE} = \frac{4 - 8}{8 - 2} = \frac{-4}{6} = \frac{-2}{3}$

$m_{DF} = \frac{-4 - 8}{-6 - 2} = \frac{-12}{-8} = \frac{3}{2}$

Today pp. 89-90 #1, 3, 4, 18
*Challenge p.91 #28*

**Study for Monday's Quiz!!**

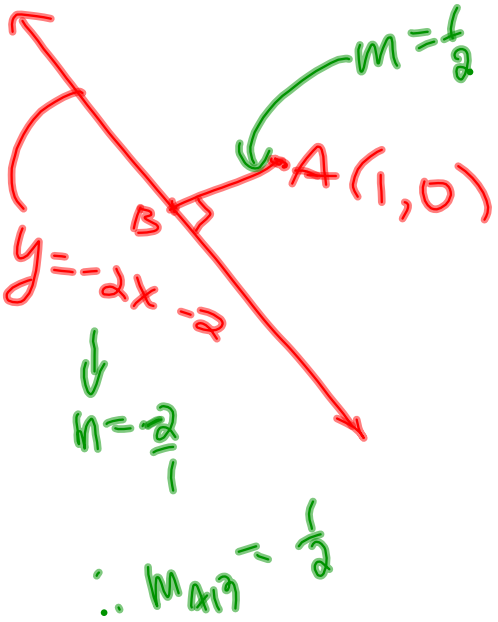
$\because m_{DE} \times m_{DF} = -1$

$\therefore m_{DE} = \frac{-1}{m_{DF}}$

$\frac{-2}{3} \times \frac{3}{2} = -1$

$\therefore DE \perp DF$

$\therefore \Delta DEF$ is a right triangle




$y = mx + b$

$y = \frac{1}{2}x + b$

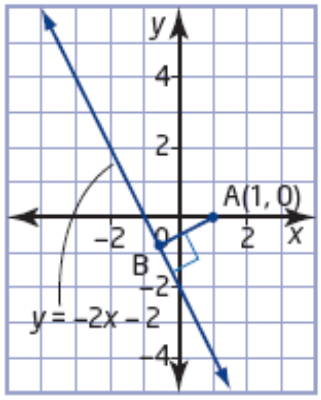
$(0) = \frac{1}{2}(1) + b$

Solutions to follow:

p.89 #1, 3, 4, 5

then tomorrow's #6

**Chapter 2 Section 3** **Question 1** **Page 89**




The slope of the line shown is –2. The slope of line segment AB is $\frac{1}{2}$.

Substitute $m = \frac{1}{2}$ and the coordinates of the known endpoint, (1, 0), to find $b$.

$$y = mx + b$$

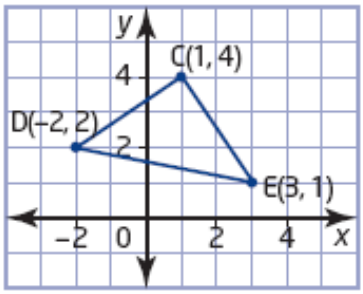
$$0 = \frac{1}{2}(1) + b$$

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

The equation of a line containing the line segment AB is $y = \frac{1}{2}x - \frac{1}{2}$.

**Chapter 2 Section 3** **Question 3** **Page 89**

**a)**




**b)** $m_{CD} = \dfrac{y_2 - y_1}{x_2 - x_1}$

$= \dfrac{4-2}{1-(-2)}$

$= \dfrac{2}{3}$

$m_{CE} = \dfrac{y_2 - y_1}{x_2 - x_1}$

$= \dfrac{1-4}{3-1}$

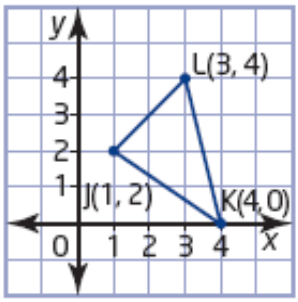
$= \dfrac{-3}{2}$

$= -\dfrac{3}{2}$

The slopes are negative reciprocals. Therefore, $\angle C$ is a right angle.

**Chapter 2 Section 3** **Question 4** **Page 89**

Find the coordinates of the midpoint, M, of side JL.




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

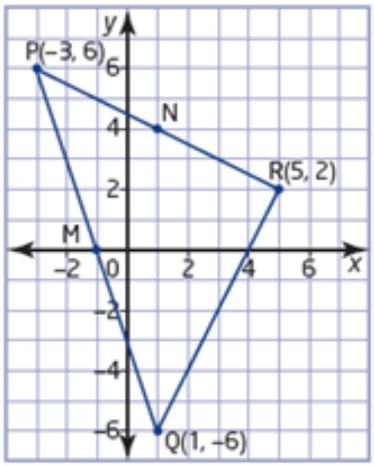
Find the length of the median.

$$d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$
$$=\sqrt{(4-2)^2+(0-3)^2}$$
$$=\sqrt{4+9}$$
$$=\sqrt{13}$$

The length of the median from vertex K is $\sqrt{13}$ .

**Chapter 2 Section 3** **Question 5 Page 89**

**a)** Find the coordinates of M and N.




$$M(x,y)=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$
$$=\left(\frac{-3+1}{2},\frac{6+(-6)}{2}\right)$$
$$=(-1,0)$$

$$N(x,y)=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$
$$=\left(\frac{-3+5}{2},\frac{6+2}{2}\right)$$
$$=(1,4)$$

Find the slopes of MN and QR.

$$m_{MN}=\frac{y_2-y_1}{x_2-x_1}$$
$$=\frac{4-0}{1-(-1)}$$
$$=2$$

$$m_{QR}=\frac{y_2-y_1}{x_2-x_1}$$
$$=\frac{2-(-6)}{5-1}$$
$$=\frac{8}{4}$$
$$=2$$

Since the slopes are the same, MN is parallel to QR.

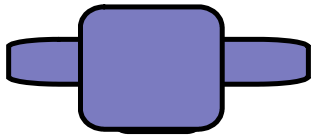
**b)** Find the lengths of MN and QR.

$$MN=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$
$$=\sqrt{(1-(-1))^2+(4-0)^2}$$
$$=\sqrt{4+16}$$
$$=\sqrt{20}$$
$$=2\sqrt{5}$$

$$QR=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$
$$=\sqrt{(5-1)^2+(2-(-6))^2}$$
$$=\sqrt{16+64}$$
$$=\sqrt{80}$$
$$=4\sqrt{5}$$

The length of MN is half the length of QR.

**p.89 #6**



You could:

Determine the equation of the perpendicular bisector, and see if the point T satisfies the equation.

a) Determine the midpoint of UV: (0, 2)

b) Determine the slope of UV: m= -1

c) Determine the equation through M, perpendicular to UV:

use m= 1, $y=1x+2$

d) Do a L.S./R.S. check to see if T is on the bisector:

L.S.=y R.S.=$1x+2$

=(-1) =1(2) + 2

=4

***Understanding the properties of the perpendicular bisector is less work.***

**Chapter 2 Section 3** **Question 6** **Page 89**

Find the lengths of TU and TV.

$TU = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$= \sqrt{(3-2)^2+(5-(-1))^2}$

$= \sqrt{1+36}$

$= \sqrt{37}$

$TV = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$= \sqrt{(-3-2)^2+(-1-(-1))^2}$

$= \sqrt{25+0}$

$= 5$

The lengths are not the same. T does not lie on the right bisector of line segment UV.