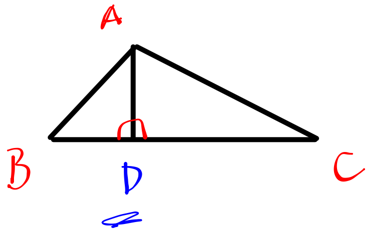
Unit 8: 3 very important and ~~different~~ omg different lines in a triangle.

- altitude/height: the line that goes through a vertex and hits the opposite side at a $90°$ angle.

ex



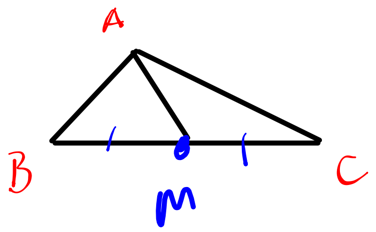
$y = ax + b$

$l_{AD} \perp l_{BC}$

(negative reciprocal slopes)

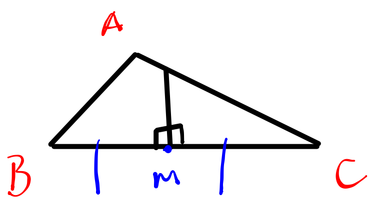
- median: in a triangle, it's that line that goes through a vertex and through the midpoint of the opposite side.

ex

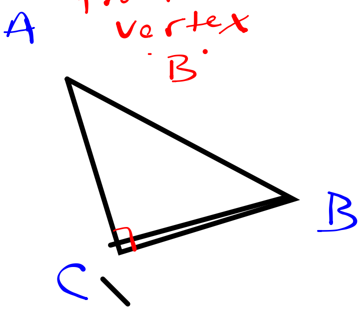


$d_{BM} = d_{MC}$

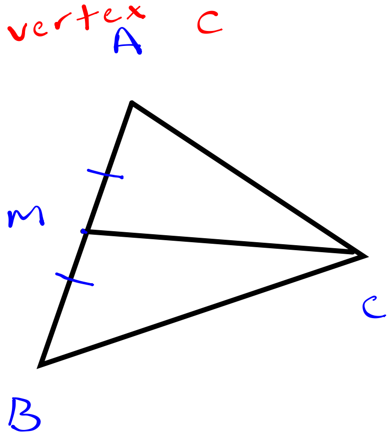
- Perpendicular Bisector: in a triangle, it's the line that goes through the midpoint of a side perpendicularly!

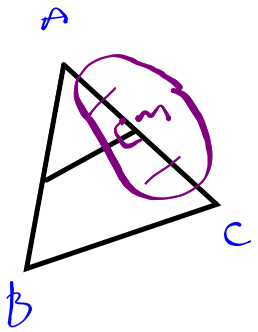


Altitude drawn from vertex B



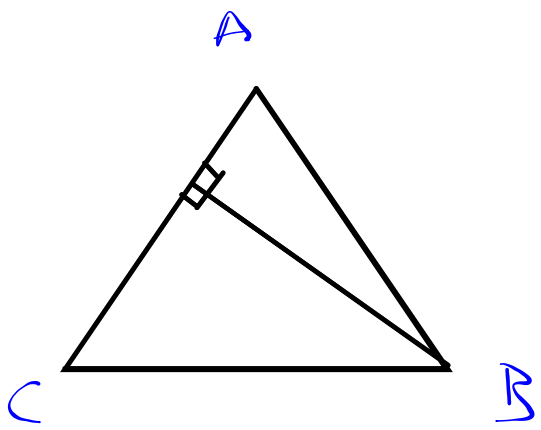
median from vertex C

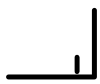




Perpendicular Bisector of side AC

Altitude
drawn
from
vertex
B

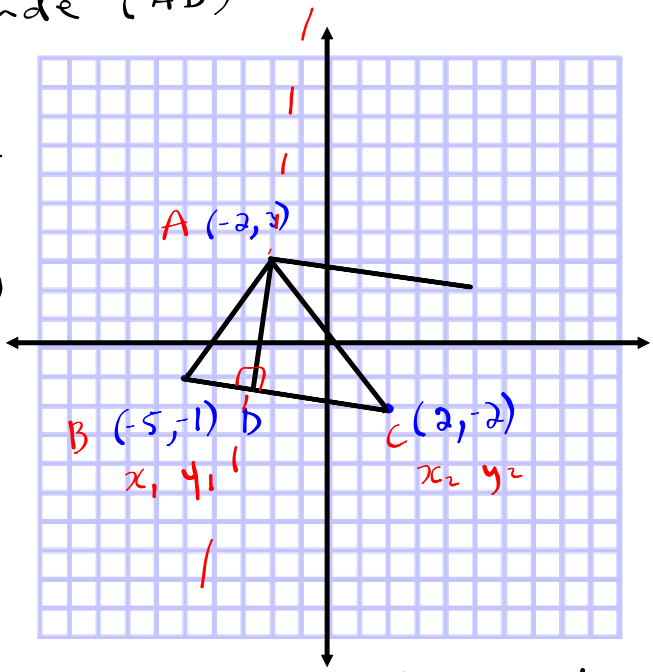




How to calculate the equation of an altitude ($\overline{AD}$)

$y = mx + b$

Step ①: To find the slope of $\overline{AD}$, first find the slope of $\overline{BC}$ (cuz they're ⊥)



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

$m_{BC} = \frac{-2-(-1)}{2-(-5)}$

$m_{BC} = \frac{-2+1}{2+5}$

$m_{BC} = \frac{-1}{7}$

Step 2: Take the negative reciprocal of m_{BC}. That's m_{AD}.

flip it/change sign

$m_{AD} = 7$

Step 3: Sub in slope, and to find the y-int (b), temporally sub in a point on the line.

$y = 7x + b$

sub (-2, 3)

$3 = 7(-2) + b$

$3 \; {+14} = -14 \; {+14} + b$

$17 = b$

$b = 17$

$b =$

$$\boxed{y = 7x + 17}$$

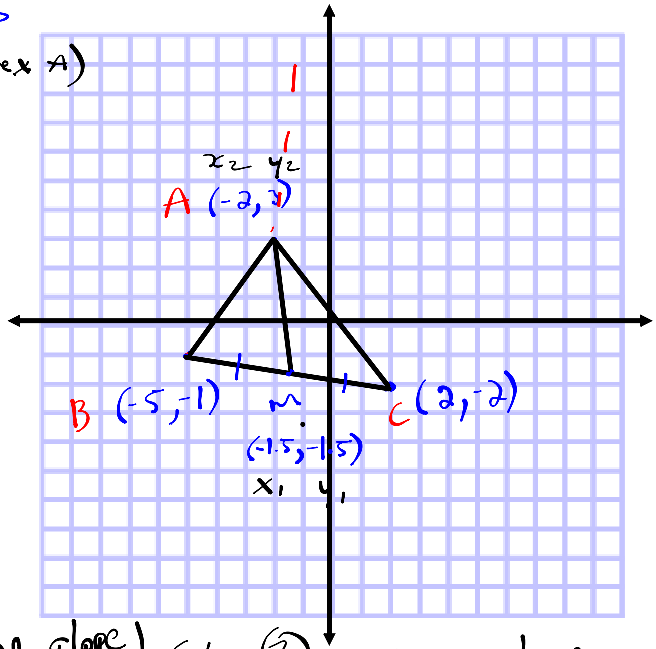
Steps to find the equation $y = mx + b$ of the median (from vertex A)

Step ①: To find the slope of AM, first find the coordinates of M by using the midpoint formula

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

$$M = \left(\frac{-5+2}{2}, \frac{-1+(-2)}{2}\right)$$

$$M = (-1.5, -1.5)$$



Step ②: Find m_{AM} using the slope formula

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

$$= \frac{(3 - (-1.5))}{(-2 - (-1.5))}$$

$$m_{AM} = -9$$

Step ③ Sub in slope, and to find y-int, temp. sub in a point on the line, and solve for b.

$$y = -9x + b$$

$$(-2, 3)$$

$$3 = -9(-2) + b$$

$$3 = 18 + b$$

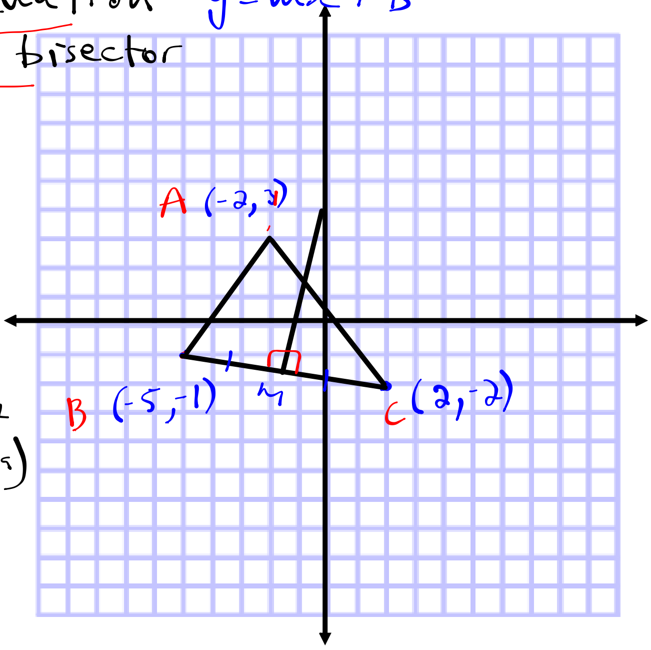
$$-18 \quad -18$$

$$b = -15$$

$$\boxed{y = -9x - 15}$$

Steps to find the equation of the perpendicular bisector of side BC

$y = mx + b$



Step ① To find the slope, first find the slope of m_C, by first finding the coordinates of M (midpoint formula)

$M(-1.5, -1.5)$

$m_{MC} = -\frac{1}{7}$

Step ② : To find to slope of the ⊥ bisector take the negative reciprocal of m_{MC}!

$m = 7$

Step ③ : Sub into slope, sub in a point on the line.

$y = 7x + b$

$(-1.5, -1.5)$

$-1.5 = 7(-1.5) + b$

$-1.5 \overset{+10.5}{=} -\cancel{10.5} \overset{+10.5}{} + b$

$b = 9$

$$\boxed{y = 7x + 9}$$

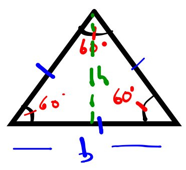
Unit 7: Polygons - their features (properties), areas, and perimeters

Triangle:

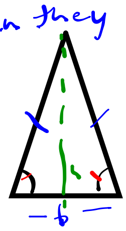
congruent sides mean they have the same length

$A = \frac{b \times h}{2}$

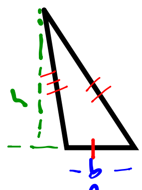
180°



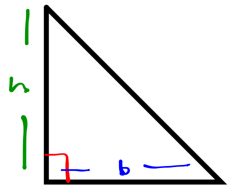
equalatiral



isosceles

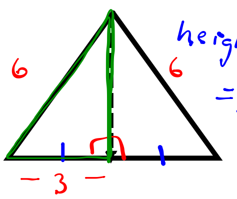


Scalene

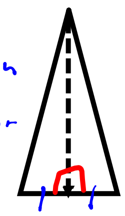


right triangle

* you could use Pythagoreans theorem to find height



height = median = ⊥ bisector

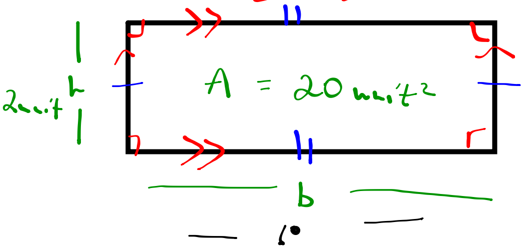


$$c^2 = a^2 + b^2$$
$$6^2 = 3^2 + b^2$$
$$36 - 9 = 9 - 9 + b^2$$
$$\sqrt{27} = \sqrt{b^2}$$
$$b = 5.2$$

Rectangle

$A = b \times h$

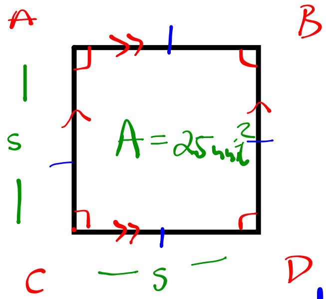
$\frac{20}{2} = \frac{b \cdot \cancel{2}}{\cancel{2}}$ $b = 10$



$A = b \times h$

$A = l \times w$

Square



$A = s^2$

$\sqrt{25} = \sqrt{s^2}$

$s = 5$ units

All sides congruent.

$A = b \times h$

$A = s^2$

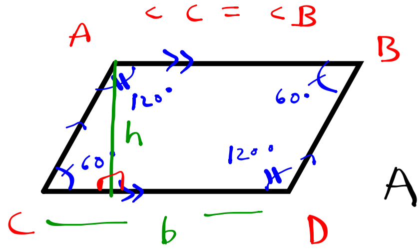
Parallelogram

(slanted rectangle)

360°

$\angle A = \angle D$

$\angle C = \angle B$



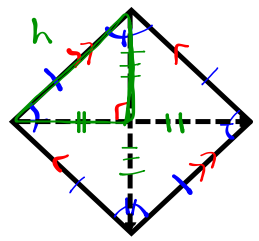
$A = b \times h$

$\angle A + \angle C = 180°$

$\angle A + 60° = 180°$

Rhombus

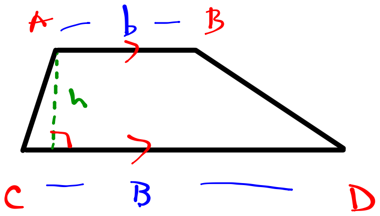
(slanted square)



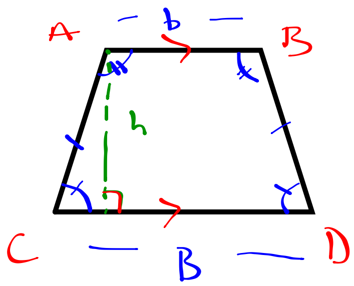
$A = \frac{D \cdot d}{2}$

The diagonals of a rhombus bisect each other perpendicularly

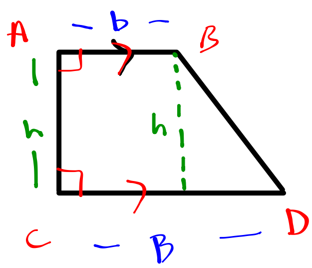
Trapezoid :



Isosceles Trapezoid

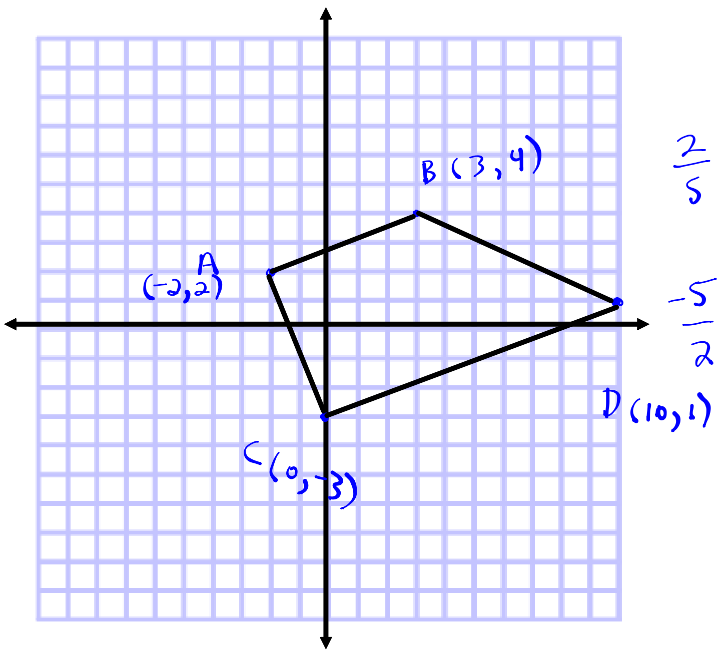


Right Trapezoid



$$A = \frac{(B+b)\cdot h}{2}$$

ABCD is a right trapezoid. Find its area.

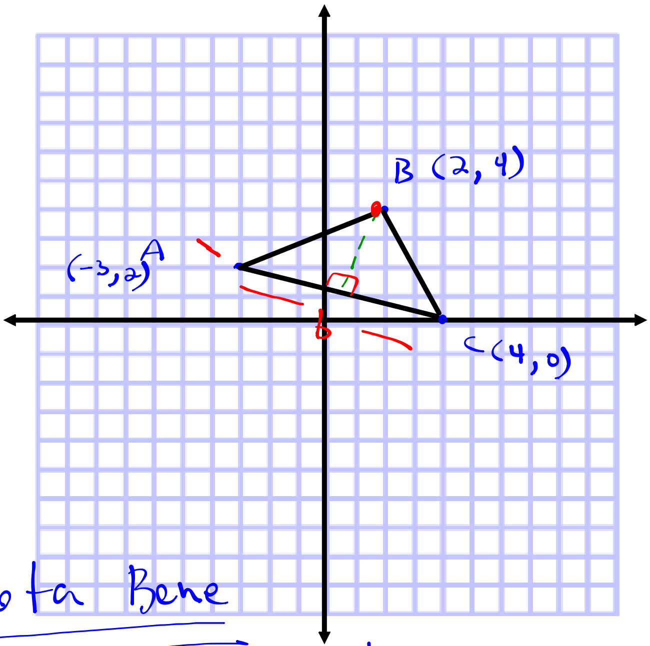


Find the area of $\triangle ABC$.

$A = \frac{b \times h}{2}$ $\frac{2}{5}$ $\frac{-4}{2}$

Base

$d_{AC} =$



equation of base

$y = mx + b$

$m_{AC} = \frac{-2}{7}$

$y = \frac{-2}{7}x + b$

sub (4, 0)

$0 = \frac{-2}{7}(4) + b$

$0 \overset{1.14}{=} -1.14 \overset{+1.14}{+} b$

$b = 1.14$

Nota Bene

More often than not, the height does not bisect the base. Therefore, your only tool left to find it's length is the new distance formula.

i.e. distance between a point and a line (base)

To find the height

$y = \underset{a}{-\frac{2}{7}}x + \underset{b}{1.14}$ $B(\underset{x_1}{2}, \underset{y_1}{4})$

$d_h = \frac{|ax_1 - y_1 + b|}{\sqrt{a^2+1}}$