

Unit #2 - Analytic Geometry

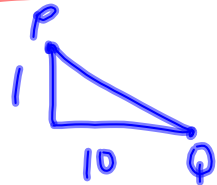
Learning Goal #1 - Find the slope between 2 points

$P(x_1, y_1)$ and $Q(x_2, y_2)$

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

Ex. $(2, 4)$ and $(12, 3)$
 x_1, y_1 x_2, y_2

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{3 - 4}{12 - 2} \\ &= \frac{-1}{10} \end{aligned}$$



Learning Goal #2 - Find the eqn of a line.

Given slope + yint

$$y = mx + b$$

$$m = 4 \quad b = -2$$

$$y = 4x - 2$$

Given slope + a point

$$y = mx + b$$

$$m = 4 \quad P(8, 2)$$

$$y = 4x + b$$

$$2 = 4(8) + b$$

$$2 = 32 + b$$

$$\begin{aligned} 2 - 32 &= b \\ -30 &= b \end{aligned}$$

$$y = 4x - 30$$

Given 2 points

$$y = mx + b$$

$$P(8, 2) \text{ and } Q(4, 6)$$

$$m = \frac{6 - 2}{4 - 8}$$

$$= \frac{4}{-4}$$

$$= -1$$

$$y = mx + b$$

$$y = -1x + b$$

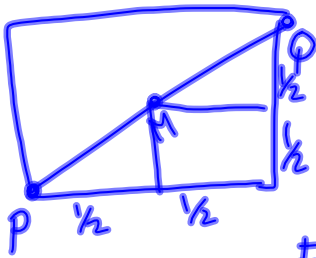
$$6 = -1(4) + b$$

$$6 + 4 = b$$

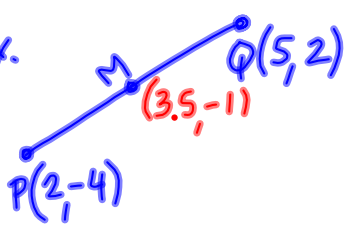
$$10 = b$$

$$y = -1x + 10$$

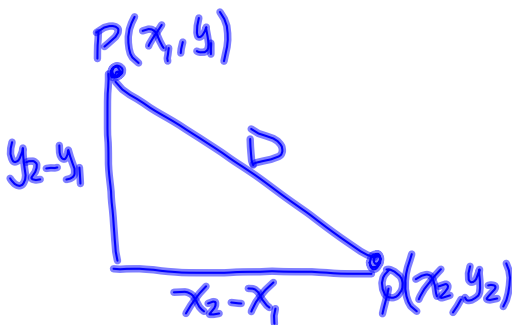
Learning Goal #3 - Finding the midpoint of a line segment.



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

Ex.  $M = \left(\frac{5+2}{2}, \frac{-4+2}{2} \right)$
 $= (3.5, -1)$

Learning Goal #4 - Finding the length of a line segment.



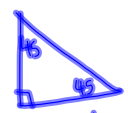
$$D^2 = (y_2 - y_1)^2 + (x_2 - x_1)^2$$
$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Ex. Find the distance between $(-6, 3)$ and $(10, 2)$
 $x_1 \ y_1 \quad \quad \quad x_2 \ y_2$

$$D = \sqrt{(10 - (-6))^2 + (2 - 3)^2}$$
$$= \sqrt{(16)^2 + (-1)^2}$$
$$= \sqrt{256 + 1}$$
$$= \sqrt{257} = 16.03$$

Learning Goal #5 - Classifying Triangles

scalene
 - no sides equal
 - no angles equal
 * can be a right Δ

isosceles
 - 2 angles same
 - 2 sides same

 * can be a right Δ

equilateral
 - all angles 60°
 - all sides the same
 * cannot be a right Δ

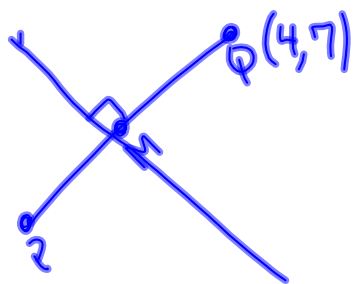
Steps
 1) Find all lengths
 2) Find all slopes

Ex.
 $AB = \sqrt{5}$ $m_{AB} = 2$
 $BC = \sqrt{5}$ $m_{BC} = -\frac{1}{2}$
 $CA = \sqrt{10}$ $m_{CA} = 5$

Negative Reciprocals

$-3, \frac{1}{3}$ $\frac{5}{3}, -\frac{3}{5}$
 $\frac{2}{3}, -\frac{3}{2}$ $-6, \frac{1}{6}$

Learning Goal #6 - Find the eqn of a perp bisector.



$(2,1)$

$$m_{PP} = \frac{7-1}{4-2}$$

$$= \frac{6}{2}$$

$$= 3$$

$$m_{\text{perp}} = -\frac{1}{3}$$

$$y = -\frac{1}{3}x + 5$$

perpendicular bisector
 - line that is perpendicular to the original line and goes through M.

$$M = \left(\frac{4+2}{2}, \frac{7+1}{2} \right)$$

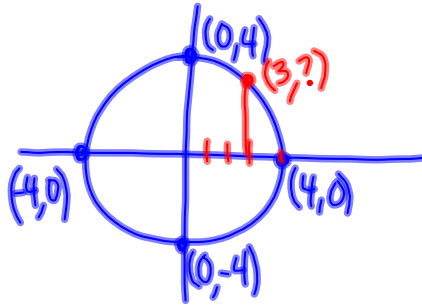
$$= (3, 4)$$

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

$$4 = -\frac{1}{3}(\frac{3}{1}) + b$$

$$4 = -1 + b \quad b = 5$$

Learning Goal #7 - Circles



Equation of a circle:

$$x^2 + y^2 = r^2$$

$$x^2 + y^2 = 4^2$$

$$x^2 + y^2 = 16$$

Sub 3 into eqn for x ,

$$3^2 + y^2 = 16$$

$$9 + y^2 = 16$$

$$y^2 = 7 \quad y = \sqrt{7}$$