AMDG

NAME
Ms. Kresovic
Adv Geo –
Wednesday 6 March 2013

9.5: The Distance Formula

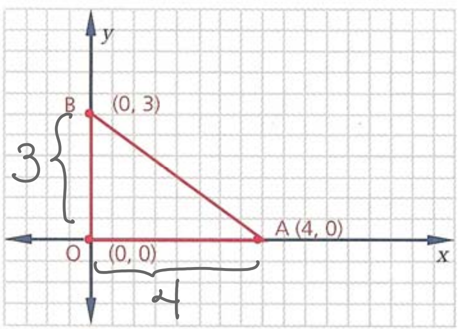
Objective

After studying this section, you will be able to

- Use the distance formula to compute lengths of segments in the coordinate plane

Prior Knowledge:

Pythagorean Theorem



I

$3^2+4^2=AB^2$

$9+16=AB^2$

$25=AB^2$

$5=AB$

II

$\sqrt{\Delta y^2+\Delta x^2}$

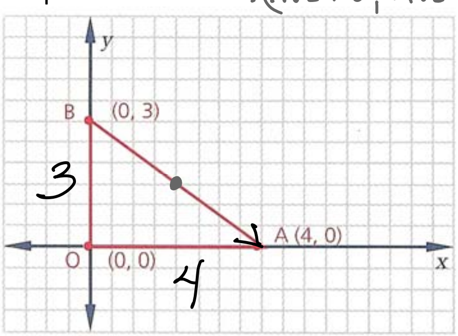
$\sqrt{(3-0)^2+(4-0)^2}$

$\sqrt{9+16}$

$\sqrt{25}$

$\boxed{5=AB}$

Midpoint formula → (AVE X's, AVE Y's)

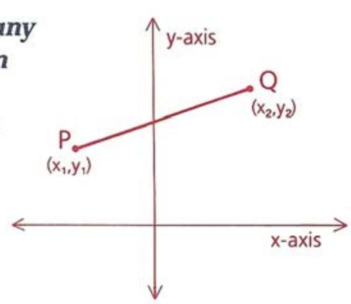


$$\left(\frac{0+4}{2}, \frac{3+0}{2}\right) = \boxed{\left(2, \frac{3}{2}\right)}$$

Slope: $\frac{\Delta y}{\Delta x} = \frac{3-0}{0-4} = \boxed{\frac{3}{-4}}$

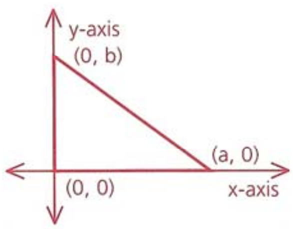
Theorem 71 ***If $P = (x_1, y_1)$ and $Q = (x_2, y_2)$ are any two points, then the distance between them can be found with the formula***

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \text{ or}$$
$$PQ = \sqrt{(\Delta x)^2 + (\Delta y)^2}$$

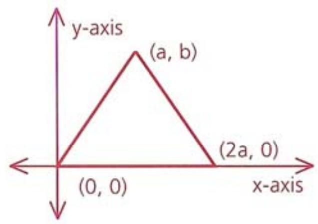


When doing coordinate proofs (sometimes called analytic proofs), you may select any convenient position in the coordinate plane for the figure *as long as complete generality is preserved*. Here are some convenient locations for a right triangle, an isosceles triangle, and a parallelogram.

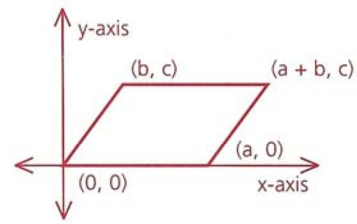
Right Triangle



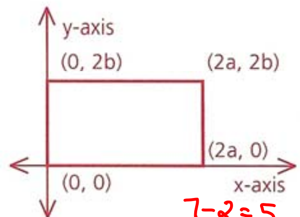
Isosceles Triangle

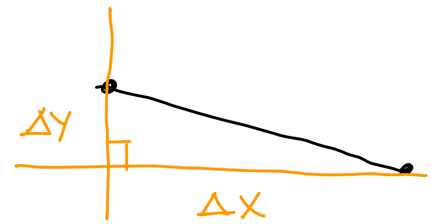


Parallelogram

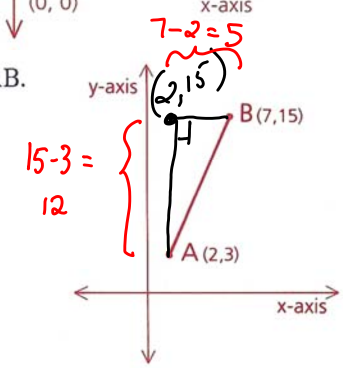


When midpoints are involved in a problem, it is helpful to use coordinates that make computations easier. For example, you could locate a rectangle as shown at the right.





Problem 1 *If A = (2, 3) and B = (7, 15), find AB.*



$\sqrt{(7-2)^2+(15-3)^2}$

$\sqrt{5^2+12^2}$

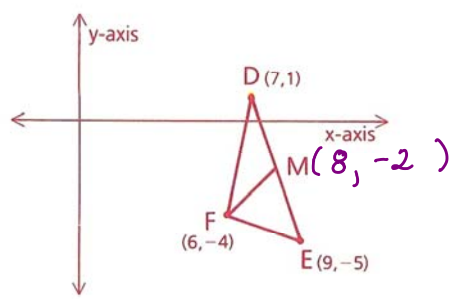
$\sqrt{25+144}$

$\sqrt{169}$

13

Problem 2 *If D = (7, 1), E = (9, −5), and F = (6, −4), find the length of the median from F to $\overline{DE}$.*

↳ mdpt



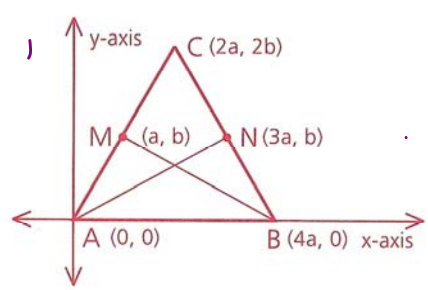
$FM=\sqrt{(8-6)^2+(-2--4)^2}$

$=\sqrt{4+4}$

$=\sqrt{8}$

$FM=2\sqrt{2}$

Problem 3 *Prove: The medians to the legs of an isosceles triangle are congruent.*



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9.5: The Distance Formula

1 Find the distance between each pair of points.

a (4, 0) and (6, 0)

b (2, 3) and (2, −1)

c (4, 1) and (7, 5)

d (−2, −4) and (−8, 4)

e The origin and (2, 5)

f (2, 1) and (6, 3)

1a $\sqrt{(4-6)^2+(0-0)^2}$

$\sqrt{(-2)^2+0^2}$

$\sqrt{4}$

2

2 Find the perimeter of △ABC if A = (2, 6), B = (5, 10), and C = (0, 13).

* **3** Show that the triangle with vertices at (8, 4), (3, 5), and (4, 10) is a right triangle by using

a The distance formula **b** Slopes

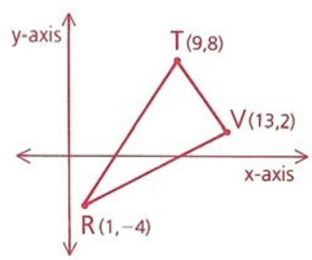
4 Use the distance formula to show that $\triangle DOG$ is equilateral if $D = (6, 0)$, $O = (0, 0)$, and $G = (3, 3\sqrt{3})$.

5 Find the area of the circle that passes through $(9, -4)$ and whose center is $(-3, 5)$.

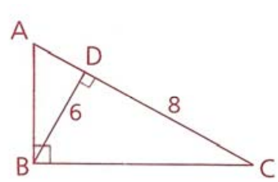
6 Given: $\triangle RTV$ as shown

Find: **a** The length of the median from T

b The length of the segment joining the midpoints of $\overline{RT}$ and $\overline{TV}$



7 Find AD and BC.



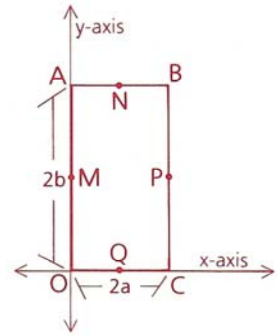
8 Given: Rectangle ABCO

a Find the coordinates of A, B, C, and O.

b Find the coordinates of M, N, P, and Q, the midpoints of the sides.

c Find the slopes of $\overline{MN}$, $\overline{QP}$, $\overline{MQ}$, and $\overline{NP}$. What can we conclude about MNPQ?

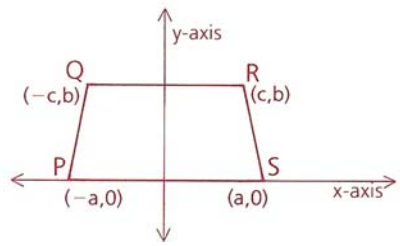
d Find the lengths of $\overline{MN}$, $\overline{QP}$, $\overline{MQ}$, and $\overline{NP}$. What can we now conclude about MNPQ?



9 Given: Trapezoid PQRS

a Find PQ and SR and verify that PQRS is an isosceles trapezoid.

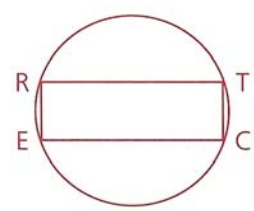
b Prove that the diagonals $\overline{PR}$ and $\overline{QS}$ are congruent.



11 In rectangle RECT, RE = 5 and EC = 12.

a Find the circumference of the circle.

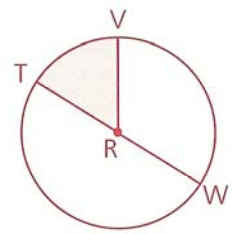
b Find the area of the circle to the nearest tenth.



13 Given: $\odot R$, $m\widehat{VW} = 120$,
$RW = 9$

Find: **a** The area of sector TRV to the nearest tenth

b The difference, to the nearest tenth, between the length of $\overline{TW}$ and the length of $\widehat{VW}$



15 Find, to the nearest tenth, the perimeter of a quadrilateral with vertices $A = (2, 1)$, $B = (7, 3)$, $C = (12, 1)$, and $D = (7, -4)$, and give the figure's most descriptive name.

20 The point $(5, y)$ is equidistant from $(1, 4)$ and $(10, -3)$. Find y.

22 A model rocket shot up to a point 20 m above the ground, hitting a smokestack, and then dropped straight down to a point 11 m from its launch site. Find, to the nearest meter, the total distance traveled from launch to touchdown.