Have your homework out and ready to check. Test on Thursday!

Classwork - Distance Formula

1) Graph the following points. Label the points.

Point U $(-3,-3)$ **Point F** $(0,\ 5)$ **Point O** $(6,-3)$

A) If you connect the points, what type of polygon do they form? *Be as specific as possible.*

Acute Triangle

B) Find the length of each side of the polygon. Round to the nearest tenth when needed.

$\overline{UF}$ = 8.5 units $\overline{FO}$ = 10 units $\overline{UO}$ = 9 units

$8^2+8^2=c^2$

$64=c^2$

$\sqrt{64}=\sqrt{c^2}$

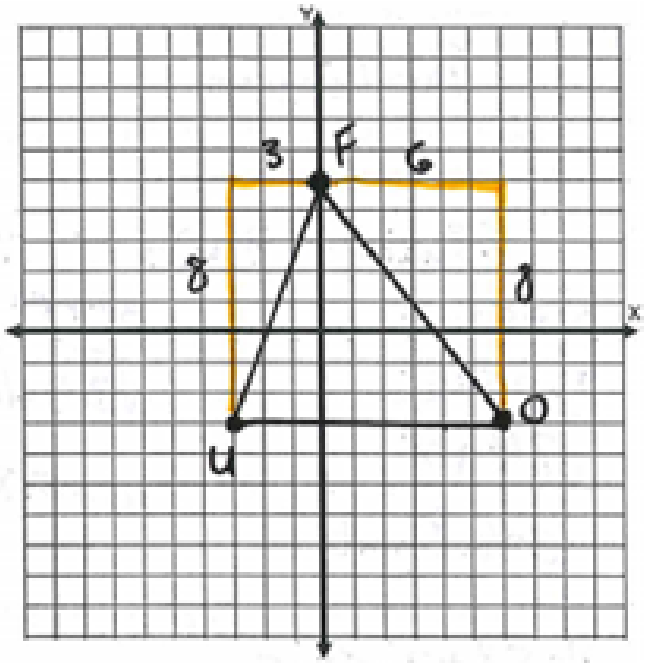
$8=c$

$6^2+8^2=c^2$

$36+64=c^2$

$\sqrt{100}=\sqrt{c^2}$

$10=c$



C) Find the perimeter of polygon that the points formed.

$P = 8.5+10+9$

$P = 27.5$ units

D) Find the area of the polygon.

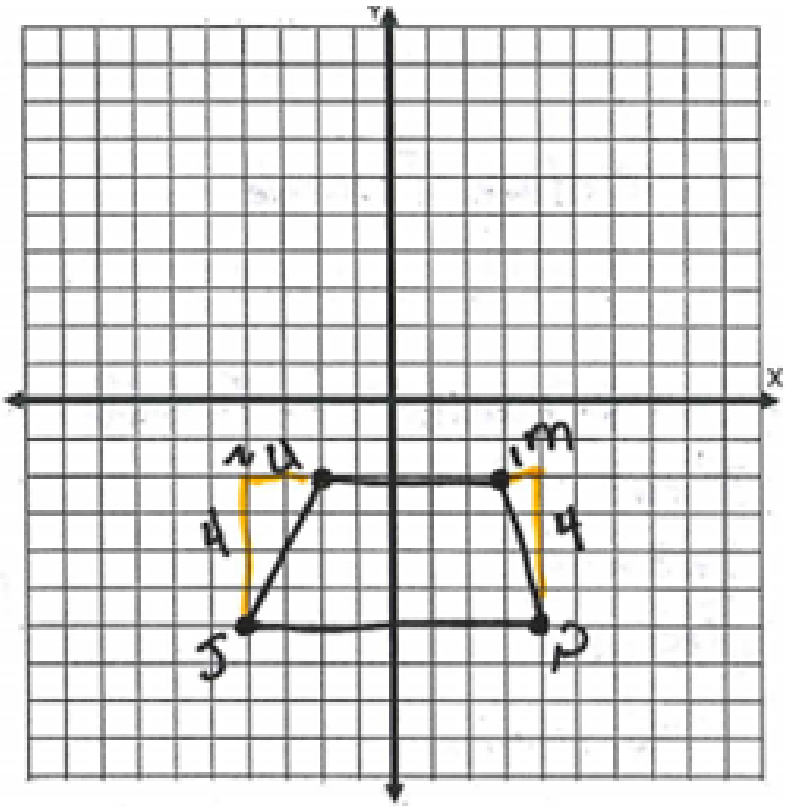
$A = \frac{1}{2}(9)(8)$

$A = 36$ units^2

2) Graph the following points. Label the points

Point J $(-4,-6)$ **Point U** $(-2,-2)$

Point M $(3,-2)$ **Point P** $(4,-6)$



A) If you connect the points, what type of polygon do they form? *Be as specific as possible.*

Trapezoid

B) Find the length of each side of the polygon. Round to the nearest tenth when needed.

$\overline{JU}$ = 4.5 units $\overline{UM}$ = 5 units $\overline{MP}$ = 4.1 units $\overline{JP}$ = 8 units

$2^2+4^2=c^2$

$4+16=c^2$

$\sqrt{20}=\sqrt{c^2}$

$c=4.5$ units

$1^2+4^2=c^2$

$1+16=c^2$

$\sqrt{17}=\sqrt{c^2}$

$c=4.1$ units

C) Find the perimeter of polygon that the points formed.

$P=4.5+5+4.1+8$

$P=21.6$ units

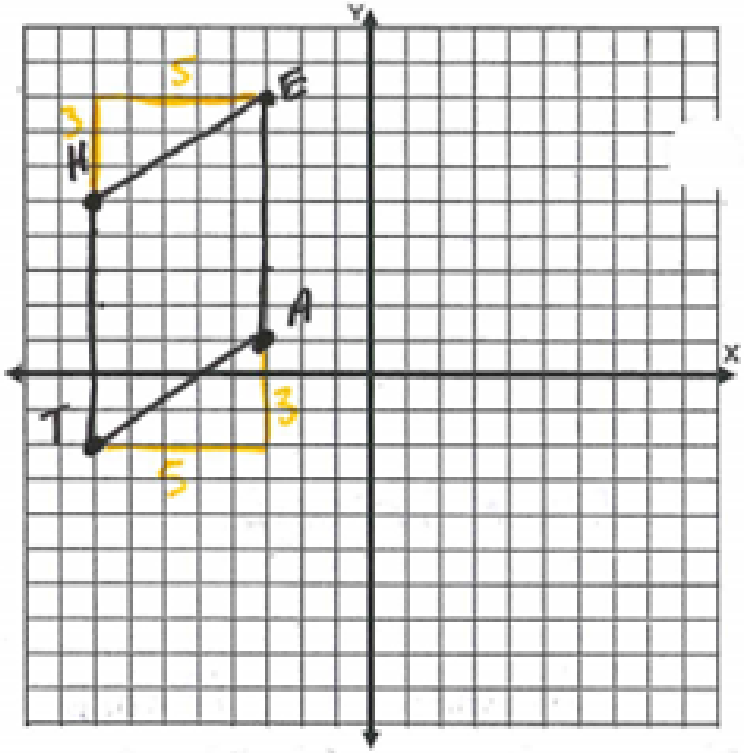
D) Find the area of the polygon.

$A=\frac{1}{2}(8+5)\cdot 4$ $A=26$ units^2

3) Graph the following points. Label the points

Point H $(-8,\ 5)$ **Point E** $(-3,\ 8)$

Point A $(-3,\ 1)$ **Point T** $(-8, -2)$



A) If you connect the points, what type of polygon do they form?
Be as specific as possible.

Parallelogram

B) Find the length of each side of the polygon. Round to the nearest tenth when needed.

$\overline{HE}$ = 5.8 units $\overline{EA}$ = 7 units $\overline{AT}$ = 5.8 units $\overline{HT}$ = 7 units

$3^2+5^2=c^2$

$9+25=c^2$

$\sqrt{34}=\sqrt{c^2}$

$c=5.8$ units

$3^2+5^2=c^2$

$\sqrt{34}=\sqrt{c^2}$

$c=5.8$ units

C) Find the perimeter of polygon that the points formed.

$P=5.8+7+5.8+7$

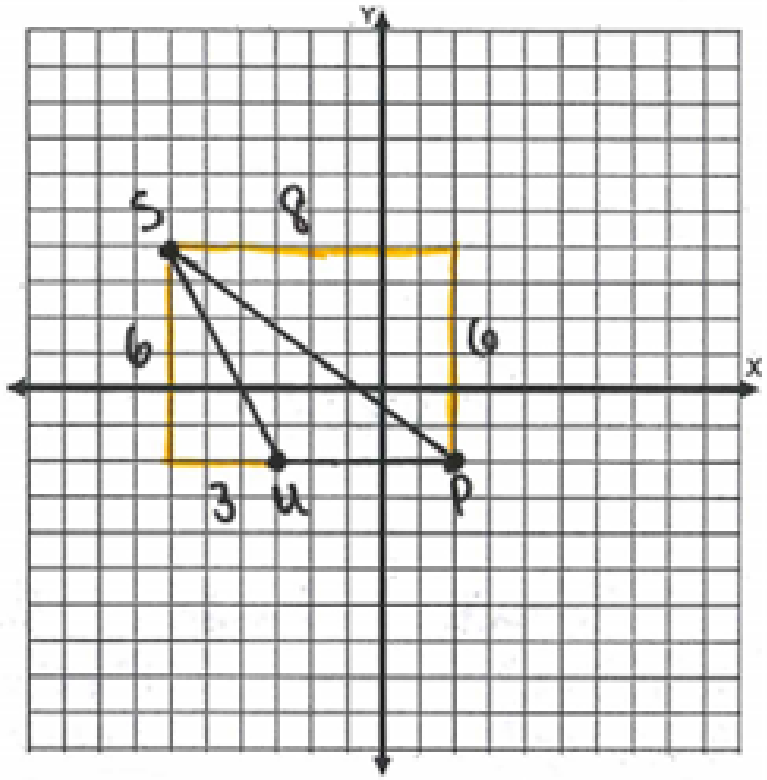
$P=25.6$ units

D) Find the area of the polygon.

$A=7\cdot5=35$ units^2

4) Graph the following points. Label the points.

Point S $(-6, 4)$ **Point U** $(-3, -2)$ **Point P** $(2, -2)$



A) If you connect the points, what type of polygon do they form? *Be as specific as possible.*

Obtuse Triangle

B) Find the length of each side of the polygon. Round to the nearest tenth when needed.

$\overline{SU}$ = 6.7 units $\overline{UP}$ = 5 units $\overline{SP}$ = 10 units

$3^2+6^2=c^2$

$9+36=c^2$

$\sqrt{45}=\sqrt{c^2}$

$c=6.7$ units

$8^2+6^2=c^2$

$64+36=c^2$

$\sqrt{100}=\sqrt{c^2}$

$10=c$

C) Find the perimeter of polygon that the points formed.

$P=6.7+5+10$

$P=21.7$ units

D) Find the area of the polygon.

$A=\frac{1}{2}(6)(5)$

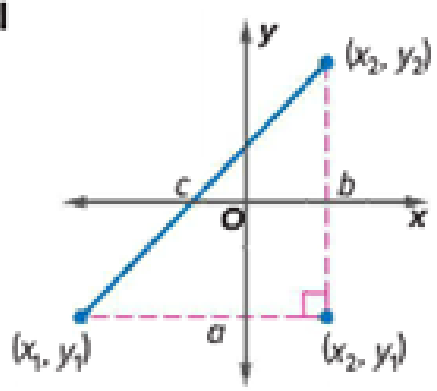
$A=15$ units^2

Distance Formula

Symbols The distance d between two points with coordinates (x_1, y_1) and (x_2, y_2) is given by the formula

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

Model



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You can also use the **Distance Formula** to find the distance between two points on the coordinate plane. You can use the model from the Key Concept box to see how the Distance Formula is based on the Pythagorean Theorem as shown below.

$c^2 = a^2 + b^2$ Pythagorean Theorem

$c^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$ Substitute. The length of side a is $(x_2 - x_1)$, and the length of side b is $(y_2 - y_1)$.

$c = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ Definition of square root

Example

2. **On the map, each unit represents 45 miles. West Point, New York, is located at (1.5, 2) and Annapolis, Maryland, is located at (−1.5, −1.5). What is the approximate distance between West Point and Annapolis?**

Method 1

Use the Pythagorean Theorem

Let c represent the distance between West Point and Annapolis. Then $a = 3$ and $b = 3.5$.

$$a^2 + b^2 = c^2$$

$$3^2 + 3.5^2 = c^2$$

$$21.25 = c^2$$

$$\pm\sqrt{21.25} = \sqrt{c^2}$$

$$\pm 4.6 \approx c$$

Method 2

Use the Distance Formula

Let $(x_1, y_1) = (1.5, 2)$ and $(x_2, y_2) = (-1.5, -1.5)$.

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

$$c = \sqrt{(-1.5 - 1.5)^2 + (-1.5 - 2)^2}$$

$$c = \sqrt{(-3)^2 + (-3.5)^2}$$

$$c = \sqrt{9 + 12.25}$$

$$c = \sqrt{21.25}$$

$$c \approx \pm 4.6$$

Since each map unit equals 45 miles, the distance between the cities is 4.6 • 45 or about 207 miles.

Got It? **Do this problem to find out.**

b. Cromwell Field is located at (2.5, 3.5) and Dedeaux Field at (1.5, 4.5) on a map. If each map unit is 0.1 mile, about how far apart are the fields?

$(\overset{x_1}{2.5}, \overset{y_1}{3.5})$

$(\overset{x_2}{1.5}, \overset{y_2}{4.5})$

$d = \sqrt{(1.5-2.5)^2 + (4.5-3.5)^2}$

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

$= \sqrt{1+1}$

$= \sqrt{2}$ $\quad d = 1.4$ units

Actual Distance

$(0.1)(1.4) = 0.14$ miles

Example

3. **Use the Distance Formula to find the distance between $X(5, -4)$ and $Y(-3, -2)$. Round to the nearest tenth if necessary.**

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

$$XY = \sqrt{(-3 - 5)^2 + [-2 - (-4)]^2}$$ $(x_1, y_1) = (5, -4)$, $(x_2, y_2) = (-3, -2)$

$$XY = \sqrt{(-8)^2 + 2^2}$$ Simplify.

$$XY = \sqrt{64 + 4}$$ Evaluate $(-8)^2$ and 2^2.

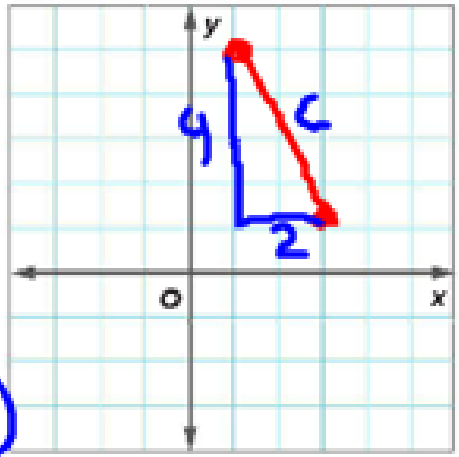
$$XY = \sqrt{68}$$ Add 64 and 4.

$$XY \approx \pm 8.2$$ Simplify.

So, the distance between points X and Y is about 8.2 units.

Guided Practice

1. Graph the ordered pairs (1, 5) and (3, 1). Then find the distance between the points. Round to the nearest tenth if necessary. (Example 1)



$4^2+2^2=c^2$

$16+4=c^2$

$\sqrt{20}=\sqrt{c^2}$

4.5 units = c

2. On a park map, the ranger station is located at (2.5, 3.5) and the nature center is located at (0.5, 4). Each unit in the map is equal to 0.5 mile. What is the approximate distance between the ranger station and the nature center? (Examples 2 and 3)

$d=\sqrt{(0.5-2.5)^2+(4-3.5)^2}$

$d=\sqrt{(-2)^2+(0.5)^2}$

$=\sqrt{4+0.25}$

$d=\sqrt{4.25}$

$d=2.1$ units

Act. D.: $2.1(0.5)=1.05$ mi

4. A ferry sets sail from an island located at (4, 12) on a map. Its destination is Ferry Landing *B* at (6, 2). How far will the ferry travel if each unit on the grid is 0.5 mile? (Example 2)

$d = \sqrt{(6-4)^2 + (2-12)^2}$

$= \sqrt{(2)^2 + (-10)^2}$

$= \sqrt{4 + 100}$

$d = \sqrt{104}$

$d = 10.2$ units

Act Dis $= 10.2(0.5) = 5.1$ miles

Use the Distance Formula to find the distance between each pair of points. Round to the nearest tenth if necessary. (Example 3)

5. $C(-5, -3), D(-4, -2)$

6. $Y(3.5, 1), Z(-4, 2.5)$

7. $K\left(8\frac{1}{2}, 12\right), L\left(-6\frac{3}{4}, 7\frac{1}{2}\right)$