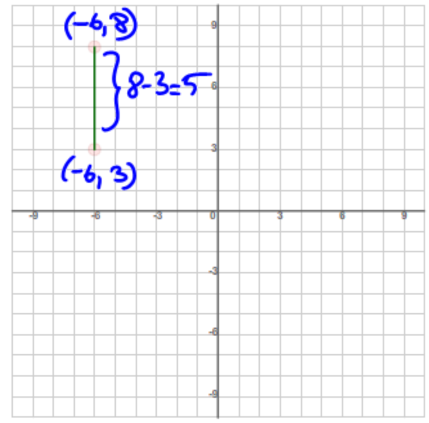
**10 Academic** **Date:**

**Day 3: Length of a Line Segment** **Unit 2&3: Analytic Geometry**

# Task 1: The Distance Formula

## Vertical Line Segments



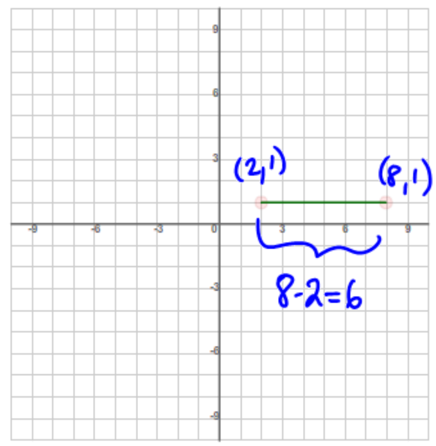

How long is the line segment on the graph?

$\boxed{5}$ units

How can the length be determined using a mathematical calculation instead of counting the number of squares?

Answer: 8-3=5

## Horizontal Line Segments



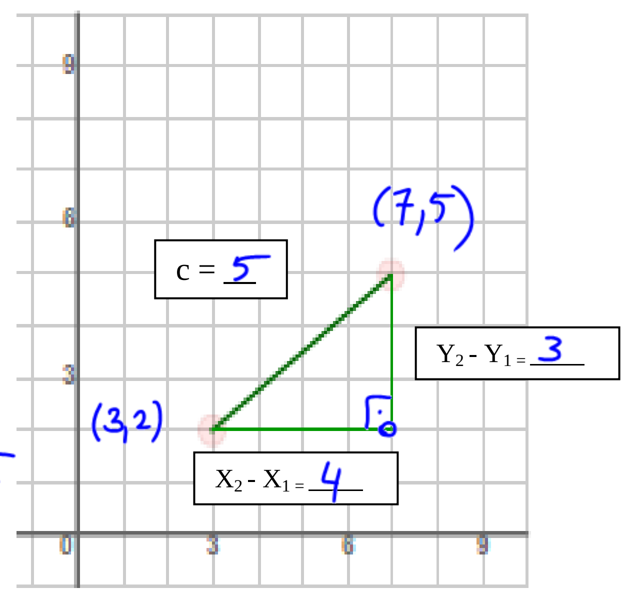

How long is the line segment on the graph?

$\boxed{6}$ units

How can the length be determined using a mathematical calculation instead of counting the number of squares?

Answer: 8-2

## Diagonal Line Segments




This line segment is more difficult to determine the length as the number of squares cannot be counted as they are on a diagonal.

First, calculate the vertical line segment

$y_2 - y_1 = 5-2 = 3$

Second, calculate the horizontal line segment

$x_2 - x_1 = 7-3=4$

Then, calculate the hypotenuse of the right triangle

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

$= 4^2+3^2 \longrightarrow c^2 = \sqrt{(7-3)^2 + (5-2)^2}$

$= 16+9$

$c^2 = 25$

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

$c = 5$

**Length of a Line Segment Formula:**

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

Ex. Using the formula, find the length of the line segment D (-3, 5) and E (4,-6).

$x_1$ $y_1$ $x_2$ $y_2$

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

$= \sqrt{(4-(-3))^2+(-6-5)^2}$

$= \sqrt{(7)^2+(-11)^2}$

$= \sqrt{49+121}$

$d = \sqrt{170}$

$d \doteq 13$

∴ The length is app. 13

Task 2: Practice Complete the 5 practice examples in Discovering Distances.

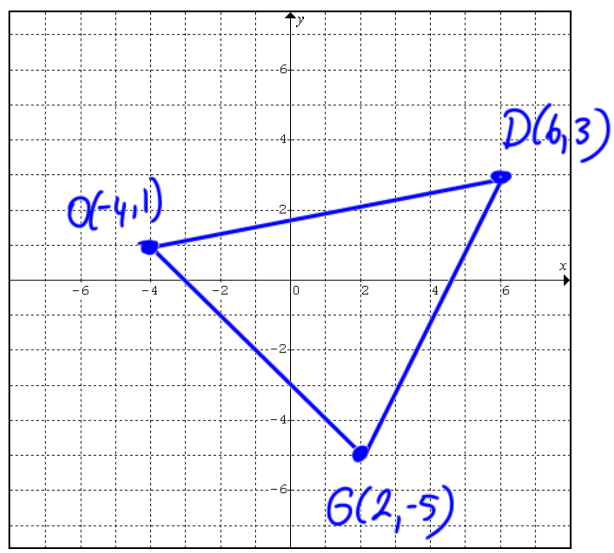
## Task 3: Applications

*What types of triangles are there?*

SCALENE = *all sides unequal* ISOSCELES = *2 equal sides*

EQUILATERAL = *3 equal sides* RIGHT-ANGLE TRIANGLE = *follows the Pythagorean Theorem: $a^2 + b^2 = c^2$, where c is the hypotenuse (the longest side)*

1. A triangle has these vertices: D(6, 3), O(-4, 1), G(2, -5).
   a. Graph this triangle.
   b. Determine the length of each side using the formula. Leave your answers with the square root.




DO = $\sqrt{(6-(-4))^2+(3-1)^2}$

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

$= \sqrt{104}$

$= 2\sqrt{26}$

$\overline{DO} = 2\sqrt{26}$

OG = $\sqrt{(-4-2)^2+(1-(-5))^2}$

$= \sqrt{36+36}$

$= \sqrt{72}$

$\overline{OG} = 6\sqrt{2}$

DG = $\sqrt{(3-(-5))^2+(6-2)^2}$

$= \sqrt{64+16}$

$= \sqrt{80} = 4\sqrt{5}$

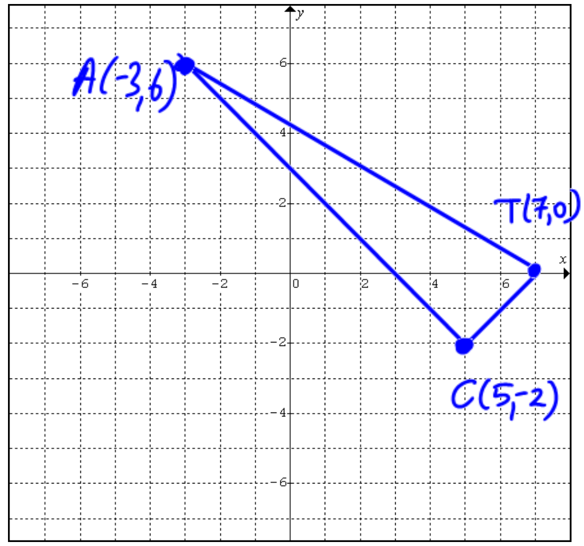
$\overline{DG} = 4\sqrt{5}$

$\overline{DO} \neq \overline{OG} \neq \overline{DG}$

Therefore, ΔDOG is SCALENE (*scalene, isosceles, or equilateral?*)

2. A triangle has these vertices: C(5, -2), A(-3, ~~4~~ 6), T(7, 0).

a. Graph this triangle.




b. Use the formula to determine the length of each side. Leave your answers with the square root.

$CA = \sqrt{(-3-5)^2+(6-(-2))^2}$
$= \sqrt{64+64}$
$= \sqrt{128}$ $\overline{CA} = 8\sqrt{2}$

$AT = \sqrt{(-3-7)^2+(6-0)^2}$
$= \sqrt{100+36}$ $\overline{AT} = 2\sqrt{34}$
$= \sqrt{136}$

$CT = \sqrt{(5-7)^2+(-2-0)^2}$ $\overline{CT} = 2\sqrt{2}$
$= \sqrt{4+4}$
$= \sqrt{8}$
$= 2\sqrt{2}$

c. Therefore, ΔCAT is SCALENE (*scalene, isosceles, or equilateral?*)

d. Use the three lengths and the Pythagorean Theorem to determine if ΔCAT is right angled.

$AT^2 \overset{?}{=} CA^2 + CT^2$

| LS | RS |
|---|---|
| $(\sqrt{136})^2$ | $(\sqrt{128})^2 + (\sqrt{8})^2$ |
| 136 | 128 + 8 |

136 = 136

LS = RS, it's right angled

e. Determine the slope of each side!

$CA = \frac{-2-6}{5-(-3)}$ $= \frac{-8}{8}$ $= -1$

$AT = \frac{0-6}{7-(-3)}$ $= \frac{-6}{10}$ $= -3/5$

$CT = \frac{-2-0}{5-7}$ $= \frac{-2}{-2}$ $= 1$

f. How can you use the slopes to determine whether ΔCAT is right angled?

if $m_{CA} \times m_{CT} = -1$, then ΔCAT is right angled.

COMPLETE: p.77 #2ac, 4, 5a, 6, 8, 10, 15abcd, 20