Look at $\frac{\text{rise}}{\text{run}}$ as $\frac{\text{the change in the y's}}{\text{the change in the x's}}$

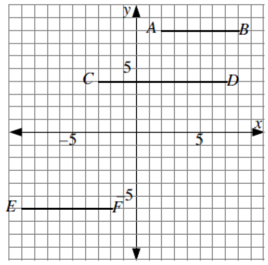
$= \frac{3-(-1)}{4-(-2)} = \frac{4}{6} = \frac{2}{3}$

Unit 5: Linear Equations

5.1 Line Segments on the Cartesian Plane

Length of a Horizontal Line Segment

Consider the line segments shown on the grid.



a) Find the length of each line segment by counting.

- length of AB is 6 units.
- length of CD is 10 units.
- length of EF is 7 units.

b) Determine the coordinates of the endpoints of each line segment.

- AB → $A(2, 8)$ $B(8, 8)$
- CD → $C(-3, 4)$ $D(7, 4)$
- EF → $E(-9, -6)$ $F(-2, -6)$

c) Complete the following.

- The difference in the x-coordinates, $x_B - x_A$, is $8-2=6$.
- The difference in the x-coordinates, $x_D - x_C$, is $7--3=10$.
- The difference in the x-coordinates, $x_F - x_E$, is $-2--9=7$.

$|-6| \rightarrow 6$
$|-10| \rightarrow 10$
$|-7| \rightarrow 7$

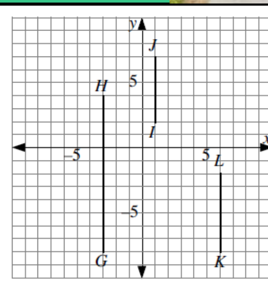
d) How can the coordinates of the end points of a horizontal line segment be used to find the length of the line segment?

Subtract the two x-values

Look at $\frac{\text{rise}}{\text{run}}$ as $\frac{\text{the change in the y's}}{\text{the change in the x's}}$

$= \frac{3-(-1)}{4-(-2)} = \frac{4}{6} = \frac{2}{3}$

Consider the line segments shown on the grid.



a) Find the lengths of each line segment by counting.

- length of GH is 12 units.
- length of IJ is 5 units.
- length of KL is 6 units.

b) Determine the coordinates of the endpoints of each line segment.

- GH → $G(-3, -8)$ $H(-3, 4)$
- IJ → $I(1, 2)$ $J(1, 7)$
- KL → $K(6, -8)$ $L(6, -2)$

c) Complete the following.

- The difference in the y-coordinates, $y_H - y_G$, is $4--8=12$.
- The difference in the y-coordinates, $y_J - y_I$, is $7-2=5$.
- The difference in the y-coordinates, $y_L - y_K$, is $-2--8=6$.

d) How can the coordinates of the end points of a vertical line segment be used to find the length of the line segment?

Subtract the y-values

Look at $\frac{\text{rise}}{\text{run}}$ as

$$\frac{\text{the change in the y's}}{\text{the change in the x's}}$$

$$= \frac{3-(-1)}{4-(-2)} = \frac{4}{6} = \frac{2}{3}$$

Ex.1) Line segment AB has endpoints A(2, 8) to B(-5, 8). Determine the length of AB.

horizontal : subtract x-values

$$x_A - x_B = 2 - {}^-5 = \boxed{7 \text{ units}}$$

Ex. 2) Determine the length of the line segment from P(a-2, b) to Q(a+4, b)

$$x_Q - x_P = (a+4) + (-a+2)$$
$$= \cancel{a} + 4 + \cancel{-a} + 2$$
$$= \boxed{6}$$

Look at $\frac{\text{rise}}{\text{run}}$ as

$$\frac{\text{the change in the y's}}{\text{the change in the x's}}$$

$$= \frac{3-(-1)}{4-(-2)} = \frac{4}{6} = \frac{2}{3}$$

Ex. 3) Line segment RS has endpoints R(1, -4) to S(1, 9). Determine the length of RS.

$$y_S - y_R = 9 - {}^-4 = \boxed{13 \text{ units}}$$

Ex. 4) Determine the length of the line segment from P(a, b) to Q(a, b+10).

$$\cancel{b} + 10 - \cancel{b}$$
$$\boxed{10 \text{ units}}$$

Look at $\frac{\text{rise}}{\text{run}}$ as

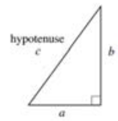
$\frac{\text{the change in the y's}}{\text{the change in the x's}}$

$= \frac{3-(-1)}{4-(-2)} = \frac{4}{6} = \frac{2}{3}$

Pythagorean Theorem Review

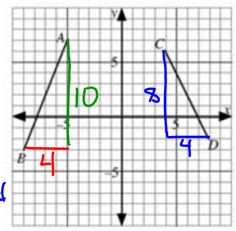
In a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the other two sides.

i.e. $a^2 + b^2 = c^2$



Use the Pythagorean theorem to determine the length of the line segments shown on the grid.

Answer as an exact value and as a decimal to the nearest tenth.



$4^2 + 10^2 = AB^2$

$\sqrt{16 + 100} = AB$

$\sqrt{116} = AB$

$\boxed{AB = 10.8}$

Mixed Radical

$\sqrt{116}$

$= \sqrt{4 \times 29}$

$= \sqrt{4} \times \sqrt{29}$

$AB = \boxed{2\sqrt{29}}$

$CD = \sqrt{8^2 + 4^2}$

$CD = \sqrt{64 + 16}$

$CD = \sqrt{80}$

$= \sqrt{16 \times 5}$

$= \sqrt{16} \times \sqrt{5}$

$CD = \boxed{4\sqrt{5}}$

$\boxed{CD = 8.9}$