Division Point

Goal:

- to understand the concept of a division point

- to determine the coordinates of a division point

- to recognize when a ratio is expressed as part-to-part versus when it is expressed as part-to-whole

A line segment can be divided into pieces:

In this case point C is called a division point.

Point C divides $\overline{AB}$ into two pieces and the lengths of these pieces can be expressed as a ratio.

Here we can see that:

$m\overline{AC}$= 8 units and $m\overline{CB}$= 2 units

the ratio in which C divides AB can be expressed in two ways:

1) part-to part: or 2) part-to-whole

$$\frac{m\overline{AC}}{m\overline{BC}} = \frac{8}{2} = \frac{4}{1} \qquad \frac{m\overline{AC}}{m\overline{AB}} = \frac{8}{10} = \frac{4}{5}$$

4:1 4:5

notice that the order of points matters.

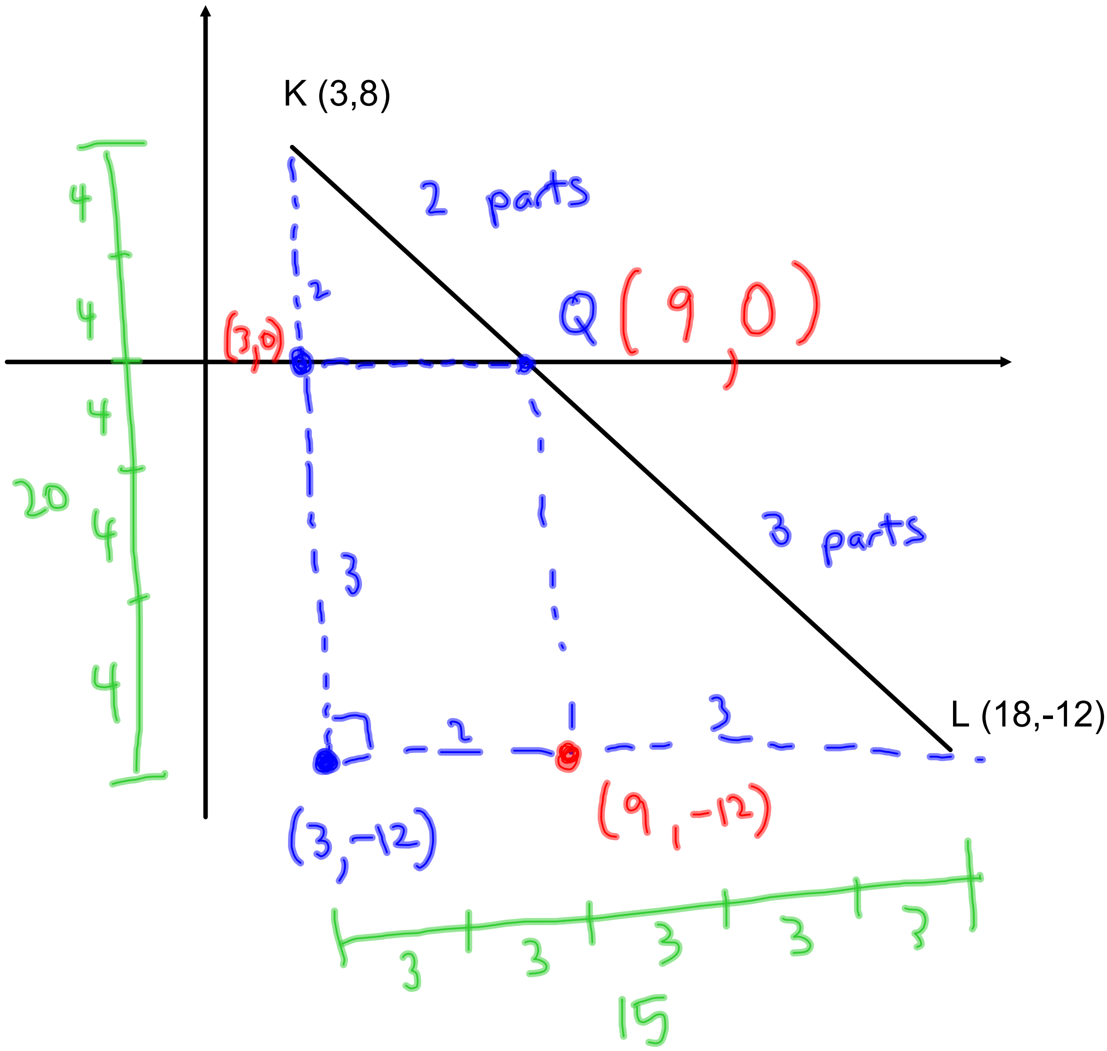
Point C

part-to-part of $\overline{BA}$ 1:4

part-to-whole of $\overline{BA}$ 1:5

If the ratio is known it can be used to find the coordinates of a division point. part-to-part

Ex:Point Q divides line segment KL into a ratio of 2:3. Find the coordinates of point Q given K(3,8) and L(18,-12).



The formula for finding the coordinates
of a division point P (x_p, y_p) is:

$$x_p = x_1 + \frac{a}{a+b}(x_2 - x_1)$$

x_1: is the x-coord. of start point

x_2: is the x-coord. of end point

$\frac{a}{a+b}$: is the part-to-whole ratio

$$y_p = y_1 + \frac{a}{a+b}(y_2 - y_1)$$

Notice the formula requires that the ratio be
expressed part-to-whole.

part-to-part $a:b$

Ex: Line semgent EF has endpoints E(-33,11) and F(-1,-9).
Find the coordinates of the division point Z that:

a) is located 3/4 of the way along $\overline{EF}$. part-to-whole

$$x_z = x_1 + \frac{a}{a+b}(x_2 - x_1) = -33 + \frac{3}{4}(-1 - {}^-33)$$

$$= -33 + \frac{3}{4}(32) = -33 + 24 = -9$$

$$y_z = y_1 + \frac{a}{a+b}(y_2 - y_1) = 11 + \frac{3}{4}(-9 - 11)$$

$$= 11 + \frac{3}{4}(-20) = 11 - 15 = -4$$

$$Z(-9, -4)$$

b) that divides $\overline{FE}$ into a ratio of 1:3.

part-to-part 1:3

part-to-whole: $\frac{1}{1+3} = \frac{1}{4}$

$$x_z = x_1 + \frac{a}{a+b}(x_2 - x_1)$$

$$= -1 + \frac{1}{4}(-33 - {}^-1)$$

$$= -1 + \frac{1}{4}(-32)$$

$$= -1 - 8 = -9$$

$$y_z = y_1 + \frac{a}{a+b}(y_2 - y_1)$$

$$= -9 + \frac{1}{4}(11 - {}^-9)$$

$$= -9 + \frac{1}{4}(20)$$

$$= -9 + 5$$

$$= -4$$

$$Z(-9, -4)$$

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14. A(15, 6)   distance = 17

B(0, y) is located on y-axis

$$17 = \sqrt{(0-15)^2 + (y-6)^2}$$

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

$$17 = \sqrt{(-15)^2 + (y-6)^2}$$

$17^2 = 15^2 + b^2$

$$17 = \sqrt{225 + (y-6)^2}$$

$289 = 225 + b^2$

$64 = b^2$

$$289 = 225 + (y-6)^2$$

$8 = b$

$$289 - 225 = (y-6)^2$$

$b = y-6$

$$64 = (y-6)^2$$

$8 = y-6$

$$\sqrt{64} = y-6$$

$y = 14$

$$8 = y-6$$

$$14 = y$$