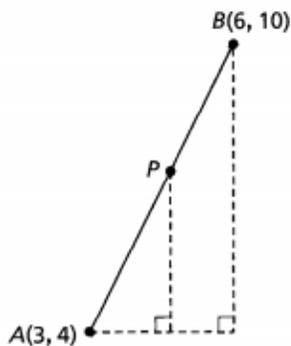*Essential Question:* *How do you find the point on a directed line segment that partitions the segment in a given ratio?*

EXAMPLE:
Find the coordinates of *P* that lies along the directed line segment from *A*(3, 4) and *B*(6, 10)and partitions the segment in the ratio 3:2.

First: Convert the ratio to a percent…

$$P \text{ is } \frac{3}{3+2} = \frac{3}{5} \text{ of the distance from } A \text{ to } B. \quad \frac{3}{5} = 60\%.$$

P is located 60% of the distance from *A* to *B*.

Second: Find the slope of the segment…

$$m = \frac{rise}{run} = \frac{horizontal\ change}{vertical\ change} = \frac{10-4}{6-3} = \frac{6}{3} = 2$$

slopes remain constant along a given line so…

the slope of $\overline{AP}$ must be the same as the slope of $\overline{AB}$.

Third: Find the coordinates of *P*, by adding the percentage of horizontal or vertical change to each coordinate of point *A*…

- For the *x*-coordinate; add 60% of the run.
- For the *y*-coordinate; add 60% of the rise.

  x-coordinate of *P* = 3 + (.60)3 = 4.8
  y-coordinate of P = 4 + (.60)6 = 7.6

Finally: Write in point notation… **Point *P* has coordinates (4.8, 7.6).**

This process **dilates** the segment… $D_{(a,b)k} \rightarrow (a+k(run), b+k(rise))$

1) Use the slope formula to check that the slope of $\overline{AP}$ equals the slope of $\overline{AB}$.

2) Use the distance formula to check that *AP:AB* is equal to 3:2.

PRACTICE:
1) Find the coordinates of the point *P* that lies along the directed segment from *C*(-3, -2) to *D*(6, 1) and partitions the segment in the ratio 2 to 1.

2) Find the coordinates of the point *P* that lies along the directed segment from *R*(-3, -4) to *S*(5, 0) and partitions the segment in the ratio 2 to 3.

3) Find the coordinates of the point *P* that lies along the directed segment from *J*(-2, 5) to *K*(2, -3) and partitions the segment in the ratio 4 to 1.

4) Find the coordinates of the point *P* that lies along the directed segment from *M*(5, -2) to *N*(-5, 3) and partitions the segment in the ratio 1 to 3.

5) The map shows a straight highway between two towns. Highway planners want to build two new rest stops between the towns so that the two rest stops divide the highway into three equal parts. Find the coordinates of the points at which the rest stops should be built.
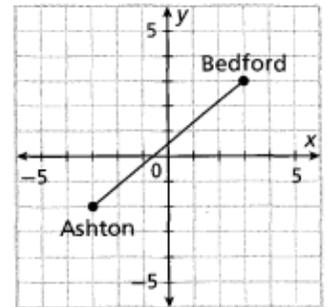
6) $\overleftrightarrow{RS}$ passes through *R*(-3, 1) and *S*(4, 3). Find a point *P* on $\overleftrightarrow{RS}$ such that the ratio of *RP* to *SP* is 5 to 4. Is there more than one possibility? Explain.

Use the map and the information given to solve each problem that follows.
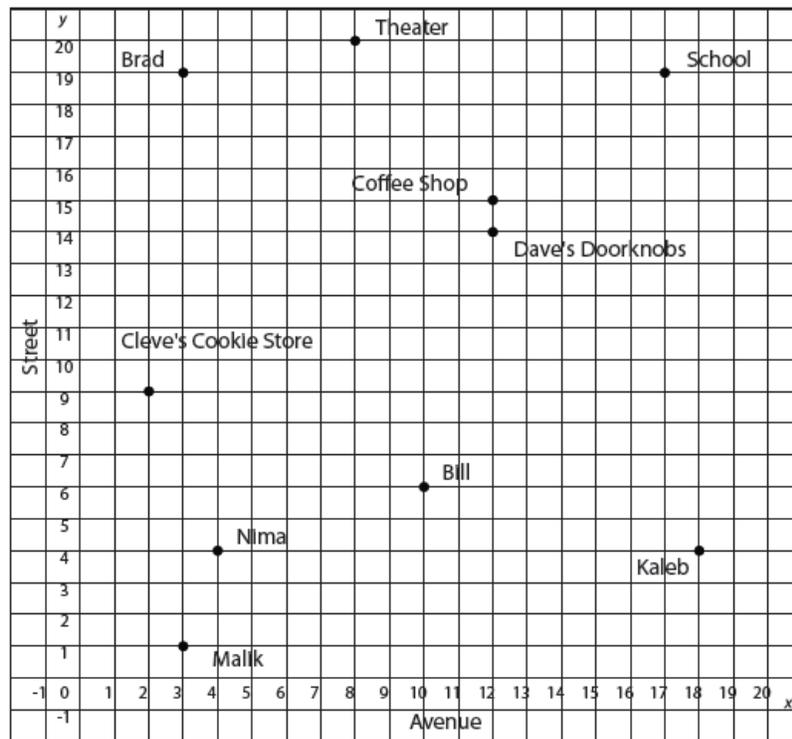
7) Luis works at a theater on 8th Avenue and 20th Street. Kaleb lives at the corner of 18th Avenue and 4th Street. What is a possible location that is midway between them?

8) Nima lives at the corner of 4th Avenue and 4th Street. Bill lives at the corner of 10th Avenue and 6th Street. Their favorite bakery is located midway between them. What is one possible location of the bakery?

9) Cleve's Cookie Store is located at the corner of 2nd Avenue and 9th Street. Dave's Doorknobs is located at the corner of 12th Avenue and 14th Street. Located $\frac{1}{5}$ of the distance from Cleve's Cookie Store to Dave's Doorknobs is the post office. Where is the post office?

10) Malik and Brad both live on 3rd Avenue. Malik lives at the corner of 1st Street, and Brad lives at the corner of 19th Street. $\frac{2}{3}$ the distance from Malik's apartment to Brad's apartment is a market. Where is the market?

11) The main entrance to the high school is located at the corner of 17th Avenue and 19th Street. On his way from school to the bank, Luis stops at the coffee shop located at 12th Avenue and 15th Street. The coffee shop is the midpoint of this trip. What is the location of the bank?