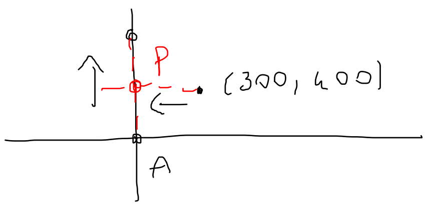
Plane 1 leaves city A at 7 am and flies at a speed of 250 mph in a straight line towards city B, located 1000 miles North of city A.

Plane 2 leaves city C located 300 miles East and 400 miles North of city A at 7:30 am and flies West at a speed v mph.

The planes fly at the same altitude. For which value of v do they collide ?

Choose a coordinate system with origin at city A. $t=0$ corresponds to 7:00 am



The planes' paths intersect at $P(0,400)$

Position of plane 1 at time t is

$f_1(t) = (0,\ 250t)$

Position of plane 2 at time t is

$f_2(t) = \left(300 - v\left(t - \frac{1}{2}\right),\ 400\right)$

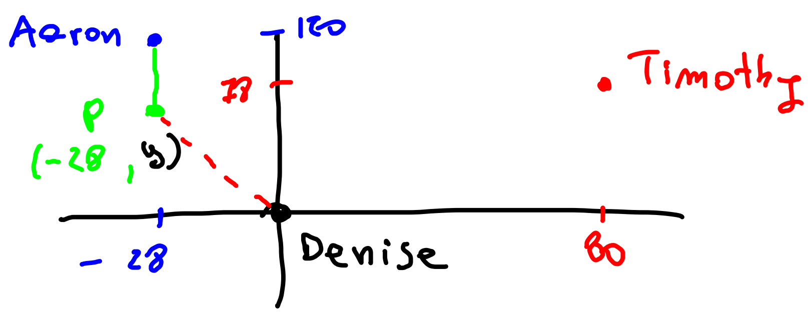
Plane 1 reaches P when $250t = 400$

$t = 1.6$

We want plane 2 to be at P for $t = 1.6$ as well so $300 - v\left(1.6 - \frac{1}{2}\right) = 0$

$v = \dfrac{300}{1.1} \approx 272.73$ mph

Denise stands 28 feet East and 120 feet South of Aaron. Timothy stands 80 feet East and 78 feet North of Denise. Aaron walks due South until he is exactly 100 feet from Denise at P. How far is Aaron from Timothy then?



Choice for origin: where Denise stands (other choices possible)

STEPS TO SOLVE PROBLEM

1) Set up coordinate system. Choose origin. Find out coordinates for Denise: $(0,0)$ (with my choice of origin), Aaron: $(-28, 120)$ (with my choice of origin) Timothy: $(80, 78)$ (with my choice of origin)

2) P has coordinates $(-28, y)$, find y: want

$$100 = \underbrace{\sqrt{(-28-0)^2+(y-0)^2}}_{\text{distance formula}}, \quad 100 = \sqrt{28^2+y^2}, \quad 100^2 = 28^2 + y^2$$

$$y^2 = 100^2 - 28^2$$

$$y = \pm\sqrt{100^2 - 28^2} = \pm 96$$

From the picture we can see y is positive (above x axis) so $y = 96$

3) Calculate the distance between P and Timothy

$$d = \sqrt{(80-(-28))^2 + (78-96)^2} = \sqrt{108^2 + 18^2} \approx 109.49 \text{ Km}$$