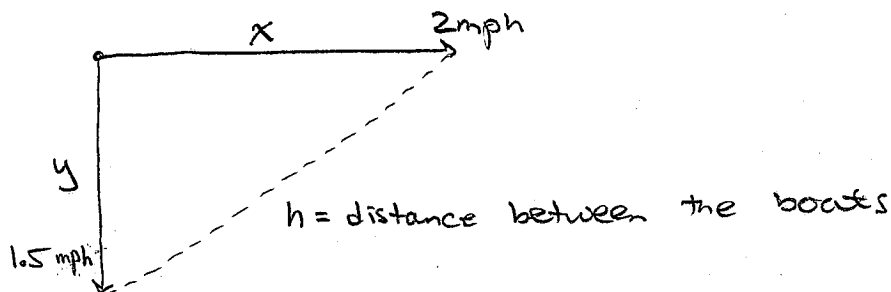


1. Two boats start moving at the same point. One moves due south at 1.5 mph and the other moves due east at 2 mph. At what rate is the distance between the boats increasing two hours later? (Hint: You should draw a picture and clearly label your variables before you do anything else. Don't use any letters without stating what exactly they stand for. You should also simplify your answer as much as possible, and include the units of your answer.)



x = distance the faster boat has moved.

y = " " " slower " " "

at $t=0$, $y=0$ and $x=0$

$$\frac{dy}{dt} = 1.5 \Rightarrow y = 1.5t$$

So at $t=2$, $y = (1.5)(2) = 3$, $x = 2(2) = 4$

$$\frac{dx}{dt} = 2 \Rightarrow x = 2t$$

$$h = \sqrt{x^2 + y^2} = \sqrt{3^2 + 4^2} = 5$$

$$x^2 + y^2 = h^2 \Rightarrow 2x \frac{dx}{dt} + 2y \frac{dy}{dt} = 2h \frac{dh}{dt}$$

So at $t=2$: $2(4)(2) + 2(3)(1.5) = 2(5) \frac{dh}{dt}$

$$16 + 9 = 10 \cdot \frac{dh}{dt}$$

$$25 = 10 \frac{dh}{dt}$$

So at $t=2$, $\frac{dh}{dt} = 2.5$ mph

Note: Defining your variables doesn't just mean saying x goes with the faster boat, it also means saying

x is the distance of the faster boat, as opposed to the rate or time. Not being clear about that causes many common mistakes.