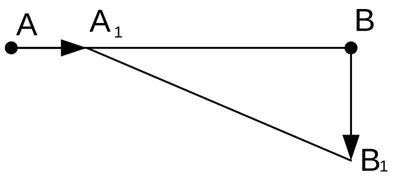
At noon, ship A is 100km west of ship B. Ship A is sailing east at 30km/h and ship B is sailing north at 40km/h. How fast is the distance between the ships changing at 4pm?

Solution:



Let at noon ship A was at the point A and ship B was at the point B. After t hours Ship A is at the point A_1 and ship B at the point B_1

So after t hours the distance between the ships will be:

$$S = A_1B_1 = \sqrt{BA_1{}^2 + BB_1{}^2}$$

$$BA_1 = AB - AA_1$$

$AB = 100\ km$ –given

$$AA_1 = v_A \cdot t$$

$v_A = 30\ km/h$ - given

So $BA_1 = 100 - 30t$

$$BB_1 = v_B \cdot t$$

$v_B = 40\ km/h$ - given

$$BB_1 = 40 \cdot t$$

So $S = \sqrt{(100-30t)^2 + (40t)^2}$

The rate of change the distance is:

$$V = \frac{dS}{dt} = \frac{-60t + 80t}{2\sqrt{(100-30t)^2 + (40t)^2}} = \frac{10t}{\sqrt{(100-30t)^2 + (40t)^2}}$$

When $t = 4$

$$V = \frac{10 \cdot 4}{\sqrt{(100 - 30 \cdot 4)^2 + (40 \cdot 4)^2}} = 0.25\ km/h$$