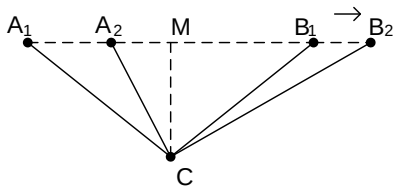
Consider two ships which are joined by a cable attached to each ship at the water line. Suppose the two ships are 200 metres apart, with the cablestretched tight and attached to a pulley which is anchored halfway between the ships at a depth of 45 metres. If one ship moves away from the other at 3 km/h,how quickly is the other ship moving after one min

Solution:



Suppose that in the beginning of the ships were at the points A_1 and B_1. The pulley is at the point C. So cable length is:

$l = A_1C + B_1C$

$MC = 45\,m$

$A_1M = B_1M = \frac{200}{2} = 100\,m$

ΔA_1MC and ΔB_1MC:

$A_1C = B_1C = \sqrt{A_1M^2 + MC^2} = \sqrt{100^2 + 45^2}\,m = 109.66\,m$

$l = 2\sqrt{100^2 + 45^2}\,m = 219.32\,m$

The ships are at the points A_2 and B_2 after one minute

$B_1B_2 = v_1t$

$v_1 = 3km/h = \frac{3000}{60} = 50\ m/min\,,\ t = 1\ min$

$B_1B_2 = 50\ m$

ΔB_2MC:

$B_2M = B_1M + B_1B_2 = 100 + 50 = 150\ m$

$B_2C = \sqrt{B_2M^2 + MC^2} = \sqrt{150^2 + 45^2}\,m = 156.60\,m$

So $A_2C = l - B_2C = 219.32 - 156.60 = 62.72\ m$

ΔA_2MC

$A_2M = \sqrt{A_2C^2 + MC^2} = \sqrt{62.72^2 - 45^2} = 43.69\,m$

$A_1A_2 = A_1M - A_2M = 100 - 43.69 = 56.31\,m$

$v_1 = \frac{A_1A_2}{t} = \frac{56.31}{1} = 56.31\,m/min$