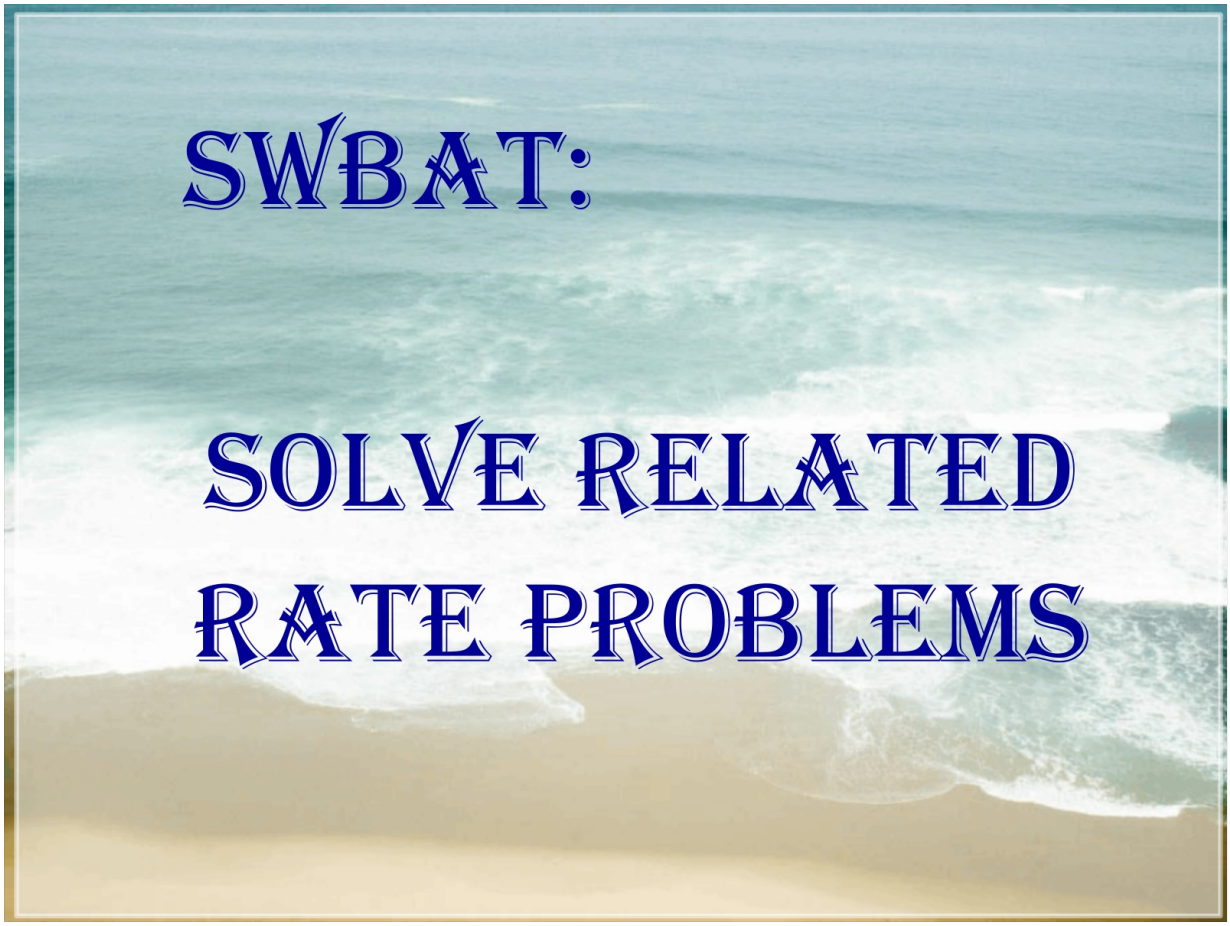
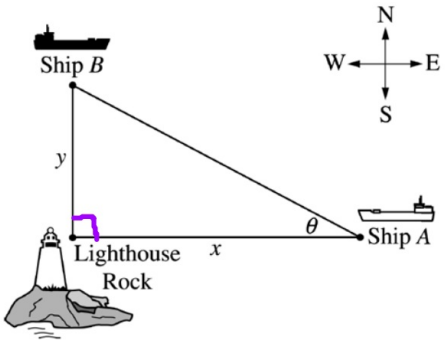


(1) State what you know and what you are looking for *
(2) take the differential of each term
(3) divide by dt
(4) substitute values you have
(5) solve

* sometimes you may have to solve for a variable on first



$x=4$ $y=3$ $h=5$

$\frac{dx}{dt}=-15$ $\frac{dy}{dt}=10$ $\frac{dh}{dt}=?$

6. Ship A is traveling due west toward Lighthouse Rock at a speed of 15 kilometers per hour (km/hr). Ship B is traveling due north away from Lighthouse Rock at a speed of 10 km/hr. Let x be the distance between Ship A and Lighthouse Rock at time t, and let y be the distance between Ship B and Lighthouse Rock at time t, as shown in the figure above.

(a) Find the distance, in kilometers, between Ship A and Ship B when $x = 4$ km and $y = 3$ km.

$x^2+y^2=h^2 \rightarrow 3^2+4^2=h^2$ $\quad h=5$ km

(b) Find the rate of change, in km/hr, of the distance between the two ships when $x = 4$ km and $y = 3$ km.

$x^2+y^2=h^2$

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

$2(4)(-15)+2(3)(10)=2(5)\frac{dh}{dt}$

$\frac{2(4)(-15)+2(3)(10)}{2(5)}=\frac{dh}{dt}=-6\ \text{km/hr}$

(c) Let θ be the angle shown in the figure. Find the rate of change of θ, in radians per hour, when $x = 4$ km and $y = 3$ km.

$\frac{d\theta}{dt}=?$ $\quad \tan\theta=\frac{y}{x}$

$\tan\theta=\frac{3}{4}$

$\theta=\tan^{-1}\left(\frac{3}{4}\right)$

$\sec^2\theta\frac{d\theta}{dt}=\frac{x\left(\frac{dy}{dt}\right)-y\left(\frac{dx}{dt}\right)}{x^2}$

$\sec^2\left(\tan^{-1}\left(\frac{3}{4}\right)\right)\frac{d\theta}{dt}=\frac{4(10)-3(-15)}{4^2}$

$\frac{d\theta}{dt}=\frac{85}{16}\cos^2\left(\tan^{-1}\left(\frac{3}{4}\right)\right)$