Problem 2 (20 points)
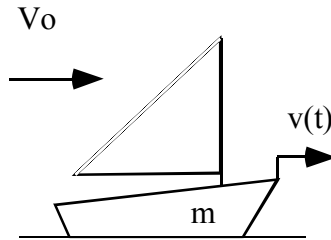
A sailing ship of mass, m , is initially at rest, i.e. $v(0) = 0$. At time $t = 0$, a strong wind arises of magnitude

$V_o = 10m/s$

Assume that the force of the wind on the sails in the direction of travel is given by

$F_w(t) = B_w [V_o - v(t)]$

Assume that the viscous drag of the water on the ship is given by

$F_b(t) = B_d v(t)$

a) Formulate a differential equation that describes the ship's velocity, $v(t)$.

b) Solve the differential equation from a) and write an expression for the ship's velocity, $v(t)$.

c) Sketch the response, $v(t)$.

d) Write an expression for the steady-state velocity, v_{ss} , in terms of system parameters.