A small 30 ft pleasure craft you own is very difficult to steer. In particular the smallest amount of wind or sea makes it almost impossible to keep on course. While the boat is out of the water for the winter, what modification could you make to the hull to improve its maneuvering characteristics?

Add a skeg or deadwood to the bottom of the hull which will increase roll resistance and directional stability (at the expense of draft and responsiveness).
2. Ship has $L_{pp} = 500$ ft, $B = 46$ ft, $T = 20$ ft. Desire good maneuverability, small response time and little overshoot.

a) estimate suitable rudder area for the ship

Rudder area ratio $= \frac{A_{rudder}}{L_{pp} T}$

for good maneuverability, i.e. destroyer, $RAR = 0.025$

let $RAR = 0.025$

$A_{rudder} = (RAR) L_{pp} T = (0.025)(500 \text{ ft})(20 \text{ ft})$

$A_{rudder} = 250 \text{ ft}^2$

b) What constraints are on rudder size?

- distance from hull to baseline
- distance from transom to propeller
9-3 Describe a design improvement that would alter a simple rudder such as that at Figure 9.2a into a semi-balanced rudder. Why is this a better design?

Removing the rudder from the post will make it semi-balanced. This will reduce the torque required to turn the rudder while still allowing the rudder to return to zero on a loss of hydraulic power.
4. Sketch stages of a ship's turn. Why does a ship slow in a turn?

prior to course change

rudder lift

rudder force produces turning moment

Ship slows in a turn due to additional resistance from rudder and hull

as ship turns, flow of water also produces lift
Describe 3 ways in which a ship's slow speed maneuverability can be improved.

- 2 propellers allow a twist to be applied
- Increase rudder size
- Install bow thrusters
- Use rotating thrusters