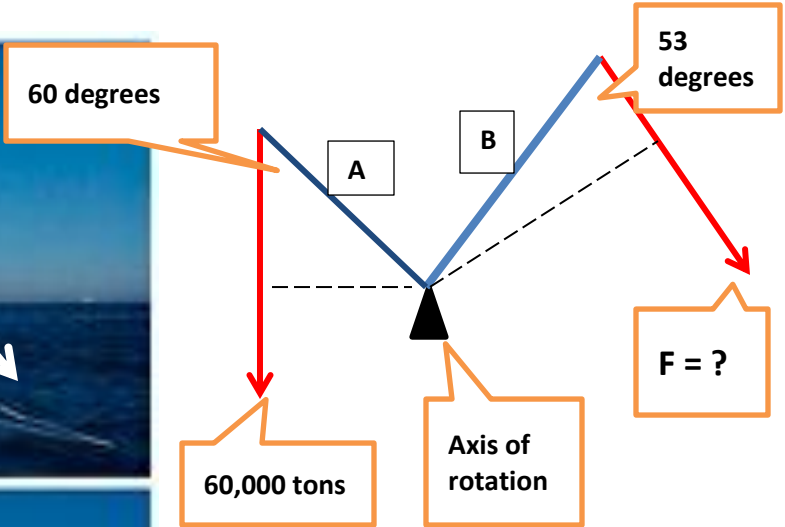
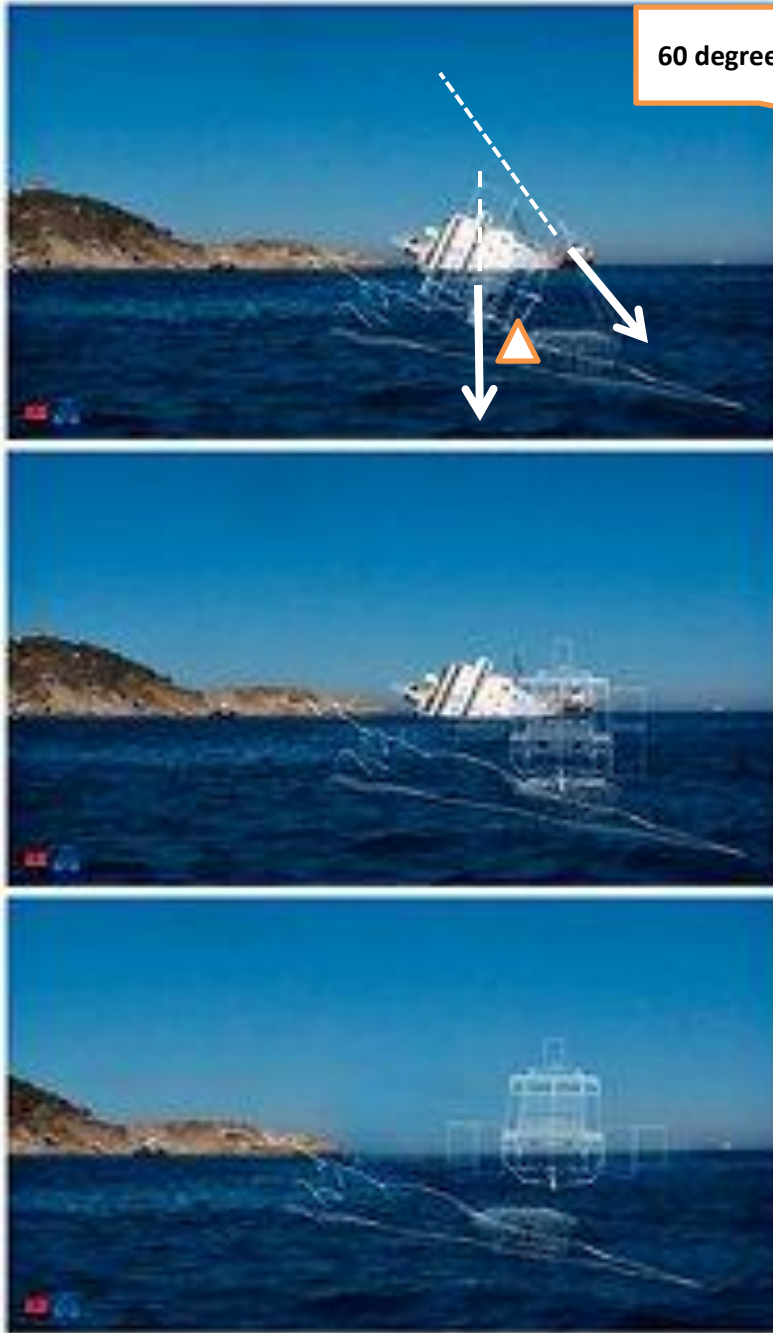


ROTATIONAL EQUILIBRIUM

Unit 15 Dr John P. Cise, Professor of Physics, Austin Community College, 1212 Rio Grande St., Austin Tx 78701 jpcise@austincc.edu & NYTimes May 19,2012 by Gaia Pianigiani

Luxury Liner's Removal to Begin Off Italian Coast

ROME — One of the most expensive and challenging salvage operations ever planned, the removal of the luxury liner Costa Concordia from granite rocks off the Tuscan coast, where it ran aground in January, will begin next week, the companies in charge announced Friday.



INTRODUCTION: A(100 ft) is distance from center of mass of 60,000 ton ship to axis of rotation as Shown. B(150 ft.) is distance from axis of rotation to where cable F is attached. The angles between forces and distances A & B are as shown. The dashed lines are the perpendicular distances from axis to line of action of forces A & B.

QUESTIONS: (a) Find lever arm of 60,000 lb ship weight(force) from axis of rotation? (b) Find lever arm of cable force(F) from axis of rotation? (c) Find minimum force F needed to bring ship to upright position as in last graphic at left?

HINTS: LEVER ARM = perpendicular distance from axis of rotation to line of action of force. To be in rotational equilibrium the sum of the torques must = 0

ANSWERS: (a) 86.6 ft., (b) 120 ft., (c) 43,300 tons

The companies, [Titan Salvage](#), which is based in Florida, and [Micoperi](#), an Italian underwater construction and offshore contractor, plan to lift the half-submerged vessel with pullers mounted on a platform and a subsea platform to roll it on, using water-filled caissons to stabilize it, and finally tow it to a yet unidentified Italian port. There, it will be demolished.