MATH 1710 Tutorial 4

1. A triangular plate with sides of lengths 3, 4 and 5 metres is submerged vertically in oil with density 950 kilograms per cubic metre. The side of length 3 metres is vertical, and the side of length 4 is horizontal and lies below the rest of the plate. If the uppermost vertex of the triangle is 1 metre below the surface of the oil, find the force due to oil pressure on each side of the plate.

2. A thin square plate whose sides are length L is lowered by one corned vertically into a reservoir of water until the top corner of the suspended plate lies at the surface of the water. Find the total force due to water pressure acting on one side of the plate.

3. Find the centre of mass of a plate with constant mass per unit area ρ if its edges are defined by the curves

$$y = x^3, \qquad x = \sqrt{2 - y}, \quad x = 0.$$

4. Find the centroid of the area bounded by the curves

$$x = \sqrt{y + 2}, \quad y = x, \quad y = 0.$$

5. A plate with constant mass per unit area ρ has edges defined by the curves

$$x = y^5, \quad y = x^5, \quad \text{where } x \geq 0.$$

Find its first moment about the line $x = -1$.

Answers: **1.** 1.68×10^5 N **2.** $9810 L^3 / \sqrt{2}$ N **3.** $(33/85, 572/595)$
4. $\left(5/(10 - 4\sqrt{2}), (8\sqrt{2} - 4)/(25 - 10\sqrt{2}) \right)$ **5.** $226\rho/231$