Engineering Assignment: Hydrostatic Force on a Dam

Student Learning Outcomes

1.3.5	Use the Fundamental Theorem of Calculus, Part 2, to evaluate definite integrals
2.5.5	Find the hydrostatic force against a submerged vertical plate

Assignment Overview

Manmade dams create artificial lakes called reservoirs. When the reservoir behind the dam is full, the dam withstands a great deal of force. However, water levels in the lake vary considerably as a result of droughts and varying water demands. We can use definite integrals to calculate the force exerted on the dam when the reservoir is full and we examine how changing water levels affect that force.

Exercise 1: Using Figure 1, consider a dam wall that is 28 meters wide and slanted at an angle of 22° relative to the vertical. The water depth is 8 meters.

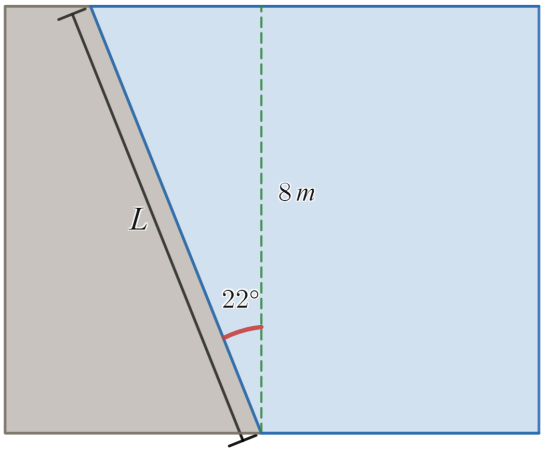

Figure 1 Source: Screenshot from Desmos

a. Find the length of the slanted portion of the dam, L. Round to the nearest thousandth.

b. Find the depth function.
Hint: Use trigonometry to find the depth of a slice.

c. Find the force (in Newtons) exerted on the slanted face of the dam by water pressure under these conditions. The weight-density of water is $9800\ \frac{N}{m^3}$. Round to the nearest thousandth.

Exercise 2: adafsd

a. Given the same conditions as above except with the dam wall being completely vertical, predict whether the force exerted on the face of the dam by water pressure increases or decreases. Explain your reasoning.

b. Find the force (in Newtons) exerted on the face of the dam by water pressure given the dam wall is completely vertical.

Exercise 3:

At what angle does the force exerted on the slanted dam wall reach 10,000,000 Newtons? Round to the nearest thousandth.