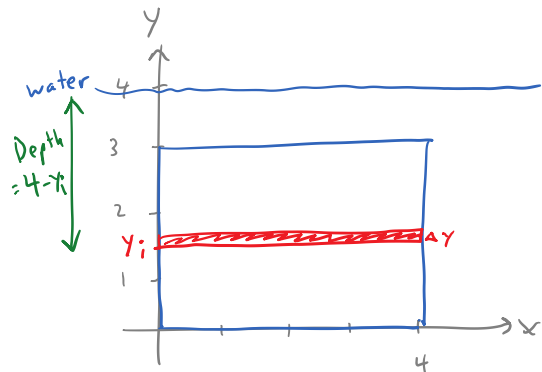
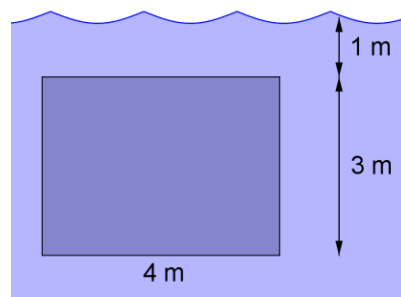


1. A vertical plate is partially submerged in water as shown. Use a Riemann sum to approximate the hydrostatic force against one side of the plate. Then find the exact hydrostatic force against one side of the plate.



$$P_i = \rho g d = (1000 \frac{\text{kg}}{\text{m}^3}) (9.8 \frac{\text{m}}{\text{s}^2}) (4 - y_i \text{ m}) = 9800(4 - y_i) \leftarrow \frac{\text{N}}{\text{m}^2}$$

$$A_i = 4 \Delta y \leftarrow \text{m}^2$$

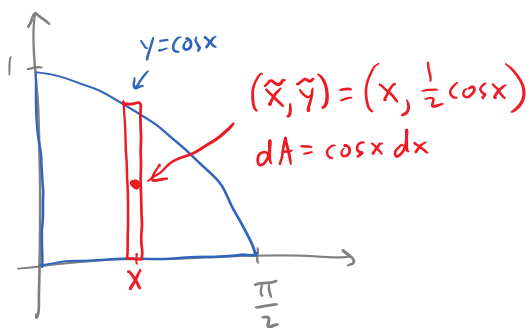
$$F_i = P_i A_i = 39200 (4 - y_i) \Delta y \leftarrow \text{N}$$

$$F = \int_0^3 39200 (4 - y) dy$$

$$= 39200 \left[4y - \frac{y^2}{2} \right]_0^3$$

$$= 39200 \left[4(3) - \frac{3^2}{2} \right] = \boxed{294000 \text{ N}}$$

2. Find the centroid of the region enclosed by $y = \cos x$, $y = 0$, $x = 0$, and $x = \frac{\pi}{2}$.



$$A = \int_0^{\frac{\pi}{2}} \cos x dx = [\sin x]_0^{\frac{\pi}{2}} = 1$$

$$\bar{x} = \frac{1}{A} \int_0^{\frac{\pi}{2}} \underbrace{x}_{\bar{x}} \underbrace{\cos x dx}_{dA}$$

$$= [x \sin x + \cos x]_0^{\frac{\pi}{2}}$$

$$= \frac{\pi}{2} + 0 - (0 + 1)$$

$$= \frac{\pi}{2} - 1$$

Int. by parts

x	+	cos x
1	-	sin x
0	-	-cos x

$$\bar{y} = \frac{1}{A} \int_0^{\frac{\pi}{2}} \underbrace{\left(\frac{1}{2} \cos x\right)}_{\bar{y}} \underbrace{\cos x dx}_{dA}$$

$$= \frac{1}{2} \int_0^{\frac{\pi}{2}} \frac{1 + \cos 2x}{2} dx$$

$$= \left[\frac{1}{4} x + \frac{1}{8} \sin 2x \right]_0^{\frac{\pi}{2}} = \frac{\pi}{8}$$

$$\boxed{\left(\frac{\pi}{2} - 1, \frac{\pi}{8} \right)}$$

Q: What word starts with "e" and has only one letter in it?