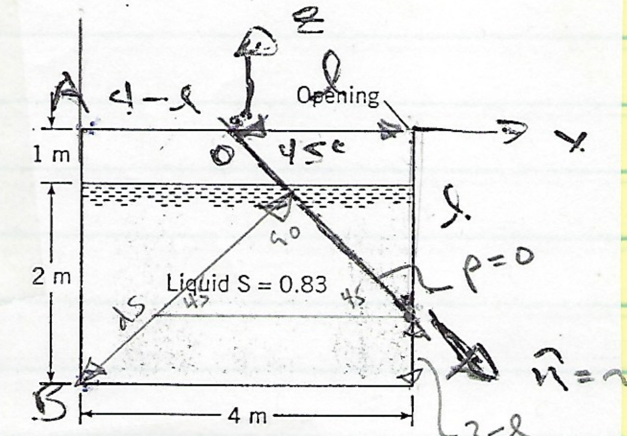
5.24 The tank shown is 4 m long, 3 m high, and 3 m wide, and it is closed except for a small opening at the right end. It contains oil (S = 0.83) to a depth of 2 m in a static situation. If the tank is uniformly accelerated to the right at a rate of 9.81 m/s², what will be the maximum pressure intensity in the tank during acceleration?

$c = \sqrt{2}\,l$



PROBLEM 5.24

$$\nabla p = -\rho(g\hat{k} + \underline{a}) \qquad \underline{a} = a_x\hat{i} = g\hat{i}$$

$$\frac{\partial p}{\partial x} = -\rho a_x = -\rho g \qquad \frac{\partial p}{\partial z} = -\rho g$$

$$\theta = \tan^{-1}\frac{a_x}{g + a_z} = \tan^{-1} 1 \Rightarrow \theta = 45^\circ$$

assume $\forall_{air}$ before and after are equal

$$4 \times 1 \times 3 = \tfrac{1}{2} l^2 \times 3 \Rightarrow l = \sqrt{8} = 2.8$$

$$\frac{p_A - p_o}{x_A - x_o} = -\rho g \qquad p_A - p_o = -\rho g(x_A - x_o)$$

$$p_A = \rho g(4 - l) \qquad x_o = 0$$

$$x_A = -(4-l)$$

$$\frac{p_B - p_A}{z_B - z_A} = -\rho g$$

$$p_B - p_A = -\rho g(z_B - z_A) \qquad z_A = 0$$

$$z_B = -3$$

$$p_B = p_A + 3\rho g \qquad \gamma = \rho g = S_o \gamma_w$$

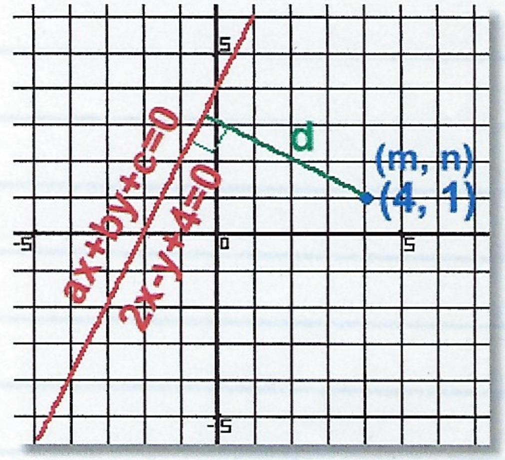
$$= \rho g(4 - l + 3)$$

$$= 34{,}198 \text{ N/m}^2$$

Distance From a Point to a Line

Method 5: Use a One-Step Formula

There is a formula that will give you the distance from a point to a line!



In order to use the formula, we'll need the equation of the line in the form $ax + by + c = 0$
Our original line was $y=2x+4$;
it rearranges to $2x - y + 4 = 0$

The point is (4, 1)

The formula that gives the distance between a point **(m, n)** and a line **ax + by + c = 0** is:

$$d = \frac{|am + bn + c|}{\sqrt{a^2+b^2}}$$

Using a = 2, b = -1, c = 4, and m = 4, n = 1

$$d = \frac{|2\cdot 4 + -1\cdot 1 + 4|}{\sqrt{2^2+1^2}}$$

$$= 4.92$$

Method 5 gives an answer of **4.92** for the distance from point (4, 1) to the line y=2x+4

$z = mx = -x$

$z(0) = 0 \quad z(l) = -l \quad l = \sqrt{8} = 2.83$

$x + z = 0 \quad$ point $(-(4-l), -4) = (-1.17, -3)$

$ax + by + c = 0 \quad (m, n) \quad a = 1 \quad m = -1.2$

$b = 1 \quad n = -3$

$d = \frac{|am + bn + c|}{\sqrt{a^2+b^2}} \quad c = 0$

$= |-1.17 - 3| / \sqrt{1^2+1^2}$

$= 4.2/\sqrt{2}$

≈ 3

$$\frac{dp}{ds} = \rho \left[a_x^2 + (g + a_z)^2 \right]^{1/2}$$

$$= \rho \left[2g^2 \right]^{1/2}$$

$$= \rho \sqrt{2}\, g = \gamma_0 \sqrt{2}$$

$$dp = ds\, \gamma_0 \sqrt{2}$$

$$= 4.2\, \gamma_0$$

$$= 34{,}198 \text{ N/m}^2$$