

2.113

2.113 An open rectangular tank 1 m wide and 2 m long contains gasoline to a depth of 1 m. If the height of the tank sides is 1.5 m, what is the maximum horizontal acceleration (along the long axis of the tank) that can develop before the gasoline would begin to spill?

To prevent spilling,

$$\frac{dz}{dy} \leq -\frac{1.5\text{ m} - 1.0\text{ m}}{1\text{ m}} = -0.50$$

(see figure).

Since,

$$\frac{dz}{dy} = -\frac{a_y}{g + a_z} \quad (\text{Eq. 2.28})$$

or, with $a_z = 0$,

$$a_y = -\left(\frac{dz}{dy}\right)g$$

so that

$$(a_y)_{\max} = -(-0.50)\left(9.81 \frac{\text{m}}{\text{s}^2}\right) = \underline{\underline{4.91 \frac{\text{m}}{\text{s}^2}}}$$

(Note: Acceleration could be either to the right or the left.)

