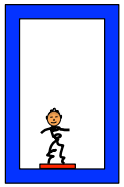
Problem 6.23



Again, a standard N.S.L. problem, but in this case one where you simply have to accumulate equations, then be clever and solve. It doesn't matter whether the elevator is picking up speed by accelerating upward in the +y direction or slowing down by accelerating downward in the –y direction, the f.b.d. for the forces acting on the man will be the same. It is shown below to the right. The N.S.L. equation will also have the same look with the exception that the acceleration term in one case will be positive while in the other case negative. With that in mind, and noting that the normal force will be equal to the scale's reading, we can write:

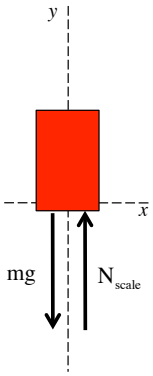
--for the upward, speed increasing acceleration, we can write:

$$\sum F_y:$$

$$N - mg = +ma_y$$

$$\Rightarrow \quad ma_y = N - mg$$

$$= (591\ \text{N}) - mg$$



--for the downward, slowing acceleration:

$$\sum F_y:$$

$$N - mg = -ma_y$$

$$\Rightarrow \quad mg = N + ma_y$$

$$= (391\ \text{N}) + [(591\ \text{N}) - mg]$$

$$\Rightarrow \quad 2mg = 982\ \text{N}$$

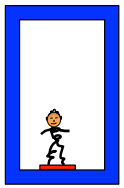
$$\Rightarrow \quad mg(\text{equal to the weight}) = 491\ \text{N}$$

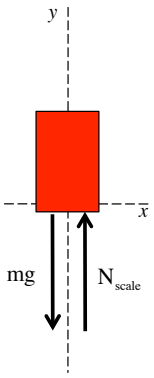
b.) The person's mass?

$$mg = 491\ \text{N}$$

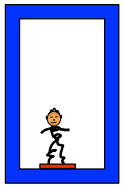
$$\Rightarrow \quad m = \frac{491\ \text{N}}{9.80\ \text{m/s}^2}$$

$$= 50.1\ \text{kg}$$





c.) The acceleration of the elevator?



$$ma_y = (591\ \text{N}) - mg$$

$$\Rightarrow \quad a_y = \frac{(591\ \text{N}) - mg}{m}$$

$$= \frac{(591\ \text{N}) - (50.1\ \text{kg})(9.80\ \text{m/s}^2)}{(50.1\ \text{kg})}$$

$$= 2.00\ \text{m/s}^2$$