June 17, 2007

We have:

Figure 1: Some Silly Clown

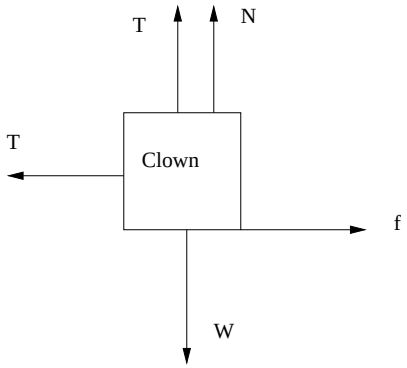

Figure 2: FBD

Newton's 2nd law in x–direction:

$$T - f = ma_x \tag{1}$$

Newton's 2nd law in y–direction:

$$T + N - mg = ma_y \tag{2}$$

We want the clown to *just* start moving, so let $\mathbf{a} = 0$:

$$\begin{aligned} T - f &= 0 \\ T + N - mg &= 0 \end{aligned} \tag{3}$$

If the clown is going to start moving, then the static friction, f, must be taking its max value, or $f = \mu N$. Thus:

$$\begin{aligned} T &= f \\ T &= -N + mg \end{aligned}$$

$$\begin{aligned} f &= -N + mg \\ \mu N &= -N + mg \\ N(1+\mu) &= mg \\ N &= \frac{mg}{1+\mu} \end{aligned} \tag{4}$$

So, we must have:

$$\begin{aligned} T &= f \\ T &= \mu N \end{aligned}$$

$$T = \left(\frac{\mu}{1+\mu}\right) mg \tag{5}$$

Hopefully this helps! The key steps:

- Draw FBD
- Right down Newton's 2nd Law in x and y
- Use the fact that we are *just* lifting the clown
  - $\mathbf{a}$=0
  - $f = \mu N$
- Solve one equation and plug into the other (i.e. plug in $T = f$)
- Solve for N
- Use N to get T

Cheers,
Chris