NEWTON'S 2ND LAW : $F_{NET} = m\ a$

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& New York Times , January 24, 2017 by Jessica Schwartz. Dedicated to a great athletic ballet person: Kim Hollister

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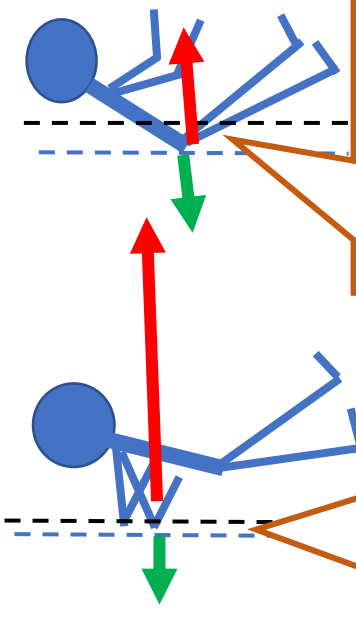
The Right Way to Fall



Rare is the individual who hasn't tripped over a pet or **uneven pavement, tumbled off a bike**, slipped on ice or maybe wiped out skiing or skating.Some get injured, while others go unhurt — often claiming it's because they knew how to fall. According to paratroopers, stunt professionals, physical therapists and martial arts instructors, there is indeed a "right way" to fall — and it can save you a lot of grief if you know how to do it. The other thing to avoid, she said, is "foosh," an acronym **for "falling onto outstretched hands." If you do that, all the force of impact will be concentrated there, raising the risk of breaking your wrist.** Instead, if you feel yourself falling, experts said you should bend your elbows and knees and try to **take the hit on the fleshiest parts of your body, like the side of your thigh, buttocks and shoulder. "Aim for the meat, not bone,"** The procedure is strikingly similar to how martial arts practitioners learn to take a fall when they are, say, thrown over someone's shoulder or have their legs knocked out from under them. "I would say the principles we follow are: Accept that you're falling and go with it, round your body, **and don't stiffen and distribute the energy so you take the fall in the widest area possible,"** While martial arts falls often have a gymnastic aspect, with rather elegant and snappy kinds of somersaults, it's still all about **spreading out the force of impact.** "There may be an aesthetic component, but what it does is save the body," said Mr. Schreiner. **"If you don't take the fall in any single place, you'll still walk out sore, but you'll walk out of there."**

INTRODUCTION: **Purpose of this application is to verify stopping over a larger distance produces smaller stopping forces. Also, increasing stopping area reduces pressure of forces. Some variables are given in graphic in upper right.**

QUESTIONS: **(a) Find speed after falling 3 ft. ?, (b) Find deceleration (a_1) while stopping in 3 inches on butt?(see graphic above right), (c) Find deceleration(a_2) while stopping in ½ inch on elbows?(see graphic), (d) Set up the application of newton's 2nd law working equation for the person stopping? Note: set up proper NET force acting on person while stopping.,(e) Find stopping force in each case : F_{ELBO} , F_{BUTT} ?, (f) Find pressure (P = F/A) on stopping surface in each case(Butt vs elbows) ? Find P in lb./in.²**

HINTS: **$v^2 = v_o^2 + 2\ a\ x$, weight = m g , g = 32 ft./s.² , 1 ft. = 12 inches , ft.² = 144 inch²**

ANSWERS: **(a) v = - 13.86 ft./s., (b) a_1 = + 384 ft./s.² , (c) a_2 = + 2304 ft./s.² , (d) F – mg = m a , (e) F_{BUTT} = 2080 lb. , F_{ELBO} = 11,680 lb. (f) P_{BUTT} = ~ 13.4 lb./in.² , P_{ELBOES} = ~ 5,840 lb./in.² NOTE: Stopping in a big distance over a large area is much safer. jc**