

The Citrus Clinic
PO Box 2358
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Calculus Student
Montgomery College
Rockville, MD 20850

Dear Calculus Student,

Grapefruits can only fall so fast. It's sad, but it's true.

When I was in Calculus, they taught me that the speed of a falling object was just gravity times time, but they lied. I know, because I've dropped a lot of grapefruit in my day, and they've never gone quite as fast as my teachers promised me they would. Next time, I'll use a helicopter instead of a tall building, and try to get up to speed from higher up.

I suppose I should back up a bit. You probably want to know why I'd want to drop grapefruit anyway. I mean, I guess that's a normal question for someone to ask, given that most people don't go around dropping grapefruits for a living. Dave Barry might be an exception I guess, but he's more of a watermelon or Volkswagen kind of a guy. Grapefruits are less spectacular, but they're easier to carry around without arousing suspicion. Plus, they're cheaper than typewriters. They're biodegradable, too.

I started dropping grapefruit as a way of relieving stress during college. You know the feeling: midterms come around, everyone is wired on caffeine, your roommate has that psycho-killer look in his eye. I got the idea that smashing things would be cathartic. Just take something and crunch it to pieces. I discovered early on that my roommate's ceramics project was a bad idea (psycho-killer and all that). Fruit seemed to be less controversial.

The weight room at the gym was a wonderful place to get rid of all those pent up tensions, at least until the trainer caught me smashing bananas in the Universal weight machine. He didn't seem to appreciate the aesthetics of the situation, if you know what I mean. The roof of the chemistry building seemed to be a much better locale for letting my creativity run wild: in the true experimental spirit, I released various fruits. Kumquats smashed well; cherries and plums were hard to see by the time they splattered; apples and lemons held together just a little too much to be satisfactory. Twinkies just bounce. But an old, warm grapefruit did the trick. What a great smash it made! The feeling I got was all I needed to drive away those midterm demons. You had to be there.

To make a long story short, others got involved. I started a stress clinic with grapefruit therapy. It's been more successful than you'd think, really. I've started advertising with glossy brochures, and that's where I get into trouble.

I have an office in a very tall building. My clients drop their grapefruits from there, and since it takes the grapefruits 3.3 seconds to fall, I claim that they end up going "more than 100 feet per second!". (Am I right? If velocity is acceleration times time, then 3.3 times 32 is 105.6 feet per second). I've timed the grapefruit often, and so have my clients. It's good therapy.

Last week my ex-roommate (the psycho-killer of decimated ceramic sculpture fame) found a copy of my brochure and sent me a nasty letter. He says,

Merton you jerk! It's not $v = gt$, it's

$$v = A \frac{e^{at} - 1}{e^{at} + 1}$$

Any physicist worth his beans knows that the terminal speed of a baseball has been measured to be a measly 138 feet/sec. Admittedly, grapefruits are bigger and denser: 10 cm compared to 7.2 cm, and 0.86 g/cm^3 versus 0.72 g/cm^3 . Since terminal velocity scales like the square root of the ratio of the diameters for equally dense round objects (duh!), and putting this extra mass into the equation, this increases the top speed of a grapefruit to 176 ft/sec. So there's no way your grapefruit could be going 100 ft/sec after just 3.3 seconds. If you keep lying through your teeth about your grapefruits, I'm going to sue your big fat [you get the idea] for false advertising!

Well, now I'm stuck. I should never have taken the old mallet to the ceramic, that's for sure. And I should have taken more math. What in the heck is a ? or A ? It's not gravity, and it's not initial velocity. I read in my calculus book that the equation that I used to get 105.6 "assumes no acceleration due to air resistance, which physicists claim is proportional to the square of velocity". Great. Now they tell me. That's just great.

Can you help me? I have no idea if my psycho roomie is right about that e junk. Is he? I have no idea how long it'll take a grapefruit to fall as fast as 100 feet per second. Man, I'm about to lose my business, and all because grapefruits can only fall so fast. It's sad, but it's true. I need your response by Friday October 30th.

Yours sincerely,

Joe Merton

p.s. As long as you're at it, could you tell me how long a grapefruit would take to pass 150 feet per second? I might just try out this helicopter idea after all.