

# WORK-ENERGY

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## Skydiver Survives Jump From 25,000 Feet, and Without a Parachute

**Stunt Skydiver Lands Without a Parachute** Luke Aikins was the first person ever to attempt a skydive with neither a parachute nor a wingsuit. He began his dive at an altitude of 25,000 feet.



If you think skydiving is scary, try doing it from twice the usual height and without a parachute. After two minutes of free-fall, you must position yourself **to land on a net less than half the size of a football field, spread out 200 feet above the earth.** On Saturday, Luke Aikins took that challenge. He was the first person ever to attempt a skydive with neither a parachute nor a wingsuit — and, in a feat [broadcast live](#) on Fox, the first ever to complete one. Mr. Aikins began his dive at an altitude of 25,000 feet, just 4,000 feet short of the summit of Mount Everest. Viewers watched him plummet, legs and arms spread, stomach down. Around 18,000 feet, he removed his oxygen mask and passed it to one of the three parachuted assistants diving with him. He aimed for the center of the net, guided by GPS and lights. Seconds before impact, he flipped onto his back and landed safely in the California desert. He lay cocooned in the net for a few moments, hands over his face. Then he clambered out, into the arms of his wife, Monica, with whom he has a 4-year-old son. “We did and cannot thank everyone enough for the support,” Mr. Aikins wrote on Facebook shortly after the jump. “My vision was always proper preparation and that if you train right you can make anything happen. Thank you!!!!” The stunt, planned for two years, almost did not happen. At first, Mr. Aikins, 42, who has skydived 18,000 times since he was 12 years old, felt the idea was a bit much even for him. “Like any normal, sane person, I said: ‘Thank you, but no thank you. I have a wife and a son, and I’ve got a life to live,’” he [told People magazine](#). “Then, two weeks went by and I kept waking up in the middle of the night thinking, ‘If somebody said you had to do this, how could it be done?’”

**INTRODUCTION:** Purpose of this application is to first find the force  $F$  the 200 lb. skydiver experienced from the net while decelerating from 120 mph to zero over 180 ft. (see graphic above). Use work-energy concepts to find  $F$ . The skydiver is traveling at 120 mph (Kinetic energy  $K$ ) when he first hits the net, but also has gravitational potential energy ( $U$ ) there (when he hits net) relative to his stopping point 180 ft. lower. Take origin of coordinate System (0,0) where skydiver first hits net.

**QUESTIONS:** (a) Find  $F$  on skydiver while stopping over 180 ft. Use work-energy concepts., (b) If the skydiver’s body had an area of  $6 \text{ ft.}^2$ , find average pressure ( $P = F/A$  in  $\text{lb./ft.}^2$ ) on his body while falling on his back in net?, (c) Find Pressure on his body while falling to a stop in net in units of  $\text{lb./inch}^2$ ?, (d) Find deceleration a while stopping in the net?, (e) Using Newton’s 2<sup>nd</sup> law find stopping force  $F$  on skydiver? **HINT:** Show the working equation you generated from  $F_{\text{NET}} = m a$  Essentially you are finding  $F$  two ways here. First by work-energy concepts in part (a). Second, by  $F_{\text{NET}} = m a$  in (e).

**HINTS:**  $W = \Delta K + \Delta U$ ,  $K = \frac{1}{2} m v^2$ ,  $U = m g h$ ,  $W$  (work) =  $F x$ , Work or energy lost = Work or energy gained  
 $g = 32 \text{ ft./s.}^2$ ,  $m = \text{mass} = \text{weight}/g$ ,  $F_{\text{NET}} = m a$ ,  $v^2 = v_0^2 + 2 a x$ ,  $144 \text{ inch}^2 = 1 \text{ ft.}^2$ , Pressure =  $F/A$

**ANSWERS:** (a) 737.8 lb., (b) 123  $\text{lb./ft.}^2$ , (c) 0.854  $\text{lb./inch}^2$ , (d) +86.044  $\text{ft./s.}^2$ , **NOTE:** The deceleration vector is UP +, and thus the NET force on skydiver is UP +, (e)  $F = 737.8 \text{ lb.}$ , working equation:  $F - 200 = [200/32](86.044 \text{ ft./s.}^2)$  (- :