PROJECTILE MOTION

Unit 9 Dr. John P. Cise , Professor of Physics, Austin Com. College, 1212 Rio Grande St. , Austin Tx., 78701 , jpcise@austincc.edu & New York Times, July 29, 2016 by Phil Davison

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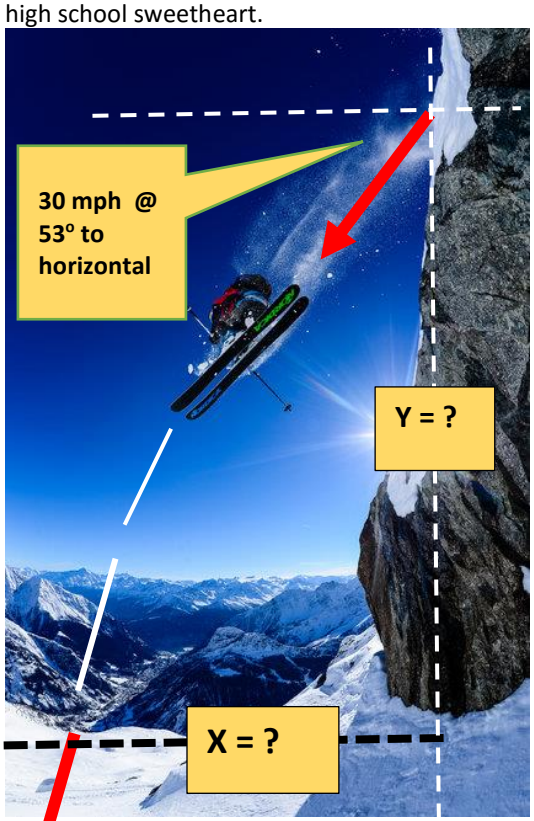
Matilda Rapaport, an Extreme Skier, Is Dead at 30

Matilda Rapaport skied peaks that could be reached only by helicopter and appeared in thrilling ski films.

INTRODUCTION: Using projectile concepts (V_H = constant, V_V like any free fall, $t_H = t_V$) this application goals is to find four unknowns in the graphic in lower left. Her initial velocity off cliff at 53° below horizontal is 30 mph (44 ft./s.)

QUESTIONS: (a) Find initial horizontal and vertical components of velocity as she leaps off cliff ?, Use units of ft./s. (b) If she is in the air for 1.263125 s. prior to landing in the snow, find Y & X?, (c) Find the horizontal velocity after 1.263125 s.? (d) Find vertical velocity after 1.263125 s.? (e) Find resultant velocity V after 1.263125 s. & angle below horizontal?

Two years ago, Matilda Rapaport, a Swedish extreme skier, survived an avalanche in Haines, Alaska. "I was dragged all the way down the mountain, partially buried and couldn't get myself out,'' she said later. "That was a very scary experience. But I don't want memories of being scared of avalanches." Rapaport continued to ski on peaks that could be reached only by helicopter and aspired to be next year's Freeride World Tour ski champion. But another avalanche, this time in the Chilean Andes, claimed her life this month. She was 30. She died on July 18 in a hospital in Santiago, four days after she was buried in snow. The cause was brain damage from oxygen deprivation, said her husband of only three months, Mattias Hargin, a Swedish Alpine World Cup skier and her high school sweetheart.



Matilda Rapaport dropping off a cliff in Courmayeur, Italy

HINTS: $X = V\,t$, $V = V_o + a\,t$, $V^2 = V_o^2 + 2\,a\,X$, $Y = V_o\,t + \frac{1}{2}\,g\,t^2$
$g = 32$ ft./s.^{2} , sin Θ = opp./hyp. , cos Θ = adj./hyp. , tan. Θ = opp./adj.

When solving projectile problems, it is best to break your solution into horizontal section and a vertical section. The reason is to keep constant velocity horizontal from the vertical acceleration in the vertical direction.

ANSWERS: (a) $V_{OH} = 26.4$ ft,/s. , $V_{OV} = -35.2$ ft,/s.,
(b) Y = 70 ft., X = 33.35 ft.
(c) 26.4 ft./s.
(d) – 75.12 ft./s.
(e) V = 80.094 ft./s. @ 70.755° below horizontal.

EXTRA EXTRA : If your familiar with conservation of energy concepts you also can find V after falling the computed Y = 70 ft. using conservation of energy concepts: $W = \Delta K + \Delta U$, or work & energy lost = work & energy gained. Energy is never lost, it is just changed from one form to another. As she comes off the top of the cliff she has both kinetic (K) and gravitational potential energy(U). After falling 70 ft. all the energy she had at cliff edge is converted into kinetic energy.

QUESTION: Find V after falling 70 ft. with an initial speed of 30 mph(44 ft./s.) using energy concepts?

HINTS: $K = \frac{1}{2}\,m\,V^2$, $U = m\,g\,h$, $g = 32$ ft./s.^{2}

ANSWERS: V = 80.1 ft./s.