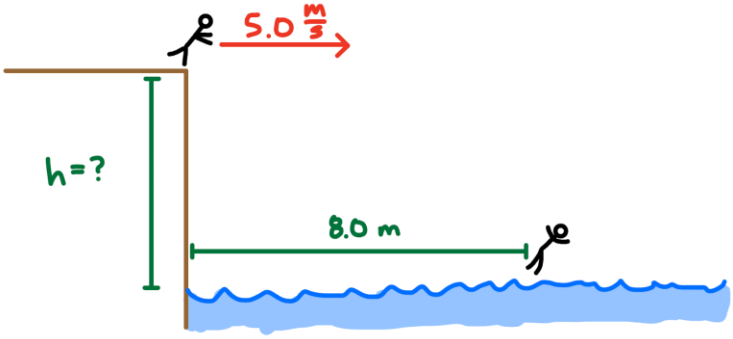
Even More Horizontal Projectiles

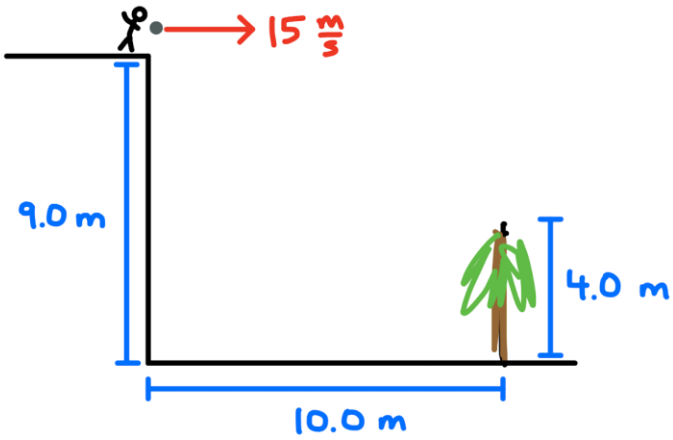
1) A swimmer runs horizontally off the top of a cliff at 5.0 m/s and lands in a lake 8.0 m from the base of the cliff. Ignore air resistance.

a) Determine how long the swimmer is in the air.
b) Determine the vertical displacement of the swimmer during this time.
c) Determine the height of the cliff.
d) Determine the vertical velocity of the swimmer immediately before hitting the water.
e) Determine the magnitude and direction of the swimmer's impact velocity.



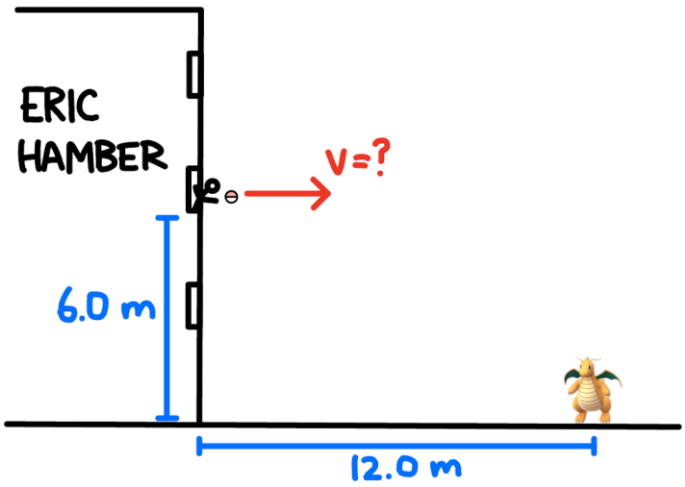
2) A rock is thrown horizontally at 15 m/s from the top of a 9.0 m high building. A 4.0 m tall tree is located 10.0 m from the building. Ignore air resistance.

a) Determine how long the rock is in the air before striking the ground.
b) How far must the rock fall vertically before reaching the height of the top of the tree?
c) Determine how long it takes the rock to fall this distance.
d) Determine how far the rock travels horizontally during this time.
e) Compare this horizontal distance with the location of the tree. Will the rock clear the tree? Explain your reasoning.



3) You are on the second floor of a building, 6.0 m above the ground. You see a Dragonite standing on the ground, 12.0 m horizontally from the building. You want to hit it with a Pokéball thrown horizontally. Ignore air resistance.

a) Determine how long the Pokéball will be in the air before reaching the ground.
b) Determine the horizontal velocity required for the Pokéball to hit Dragonite.
c) Your friend is on the third floor, 9.0 m above the ground, and wants to hit the same Dragonite.
d) Determine how long your friend's Pokéball will be in the air before reaching the ground.
e) Determine the horizontal velocity your friend must throw the Pokéball to hit Dragonite.
f) Compare the two required horizontal velocities. Explain why they are different.



4) A rock is thrown horizontally from the top of a 12 m high building. An 8.0 m tall tree is located 11 m from the base of the building. Ignore air resistance.

a) Sketch the rock's path, labelling the height of the building, height of the tree, and horizontal distance to the tree.
b) Determine how far the rock can fall vertically before reaching the height of the top of the tree.
c) Determine how long it takes the rock to fall this distance.
d) Determine the minimum horizontal velocity required for the rock to clear the tree.
e) Determine how long the rock takes to reach the ground.
f) Determine the final vertical velocity immediately before the rock strikes the ground.
g) Determine the magnitude and direction of the rock's impact velocity, assuming it was launched at the minimum speed calculated in (d).