

A Pocketful of Projectile Puzzles

For all of these puzzles, ignore effects of air drag. Use the projectile motion solution pages to answer the following 8 puzzles. Let $g = 9.80 \text{ m/s}^2$. Each group is solved using similar methods.

1.1) A lion leaps horizontally from a rocky crag 2.5 m high toward a sleeping gnu 4.0 meters away. {What's a gnu? Oh, not-a much. What's a-gnu with you?} With what speed must the lion leap to g-grab the gnu?

1.2) You are the special effects director for a film, in which a car shoots off horizontally from a cliff, falls to the ground below, and bursts into flames. {What a good idea! That hardly *ever* happens in the movies!} If the cliff is 45 m high, how fast must the car leave the top of the cliff to land where your camera is focused, 24 m from the base of the cliff?

1.3) Did you hear about the guy who decided to spend his life throwing rocks at sea gulls? He vowed to leave no tern unstoned! Anyway, he throws a rock at a gull flying directly in front of him, but he misses, and the rock splashes into the ocean 36 m from the base of his 20.0 m high cliff. How fast did he throw the rock?

2.4) A forest ranger on a rainy day decides to calculate the height of his watchtower. He throws an apple core from his lunch straight out the window at 6.0 m/s. (He just *knows* what 6.0 m/s feels like, ok?) After work, he finds that the core landed 18.0 meters from the base of his tower. So, he figures that the height of the tower is...

2.5) Two kids are playing catch on the flat roof of a city tenement, 15 m high. One throws the ball a little wide and the other kid sees it fly by horizontally at 10.0 m/s. If the next building is 15 m away, will the ball land in the street or will it hit the next building? Defend your answer with numbers, please.

2.6) While hiking with a friend, you reach the summit of a hill, and your friend wonders aloud how high up you are. You pick up a small stone and throw it horizontally, at any old speed, and you count to estimate the number of seconds that pass before the stone hits the ground below. You find that the stone was in the air for about 5.0 seconds, and so you tell you friend, "This peak is about ..." How high? Why doesn't it matter how fast you throw the stone?

3.7) A pigeon cruising in level flight at 5.0 m/s, sees a fluorescent velvet painting of Elvis for sale in a gas station parking lot 20.0 meters below. He decides to drop his, uhm, let's say, art review on the painting. How far ahead of the painting should he be when, uhm, you know...

3.8) A United Nations relief plane needs to drop supplies for Bosnian Muslims into a clearing in the forest. The pilot is reluctant to fly any lower than 500.0 m, for fear of sniper fire from the ground. If the plane is in level flight at 100.0 m/s, how far ahead of the clearing should the supplies be dropped? Where will the plane be at the moment the supplies land?