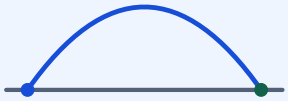
Projectile Motion Practice Worksheet

30 problems in three parts: level ground, platforms, and walls · AP Physics 1

Name _____ Date _____ Period _____

Use g = 9.8 m/s^2 and neglect air resistance. For each problem, sketch the situation and mark your origin and positive direction before you write any numbers. Keep unrounded values between steps and give final answers to two significant figures unless a problem says otherwise. Full worked solutions are in the answer key.

Part A · Level ground (problems 1 to 10)



Launch and landing heights are equal. The time comes from symmetry, $T = 2v_{0y}/g$, and $R = v_0^2 \sin(2\theta)/g$ applies.

Blue: launch point and path. Green: landing point, at the launch height.

1 A ball is kicked from level ground at 18 m/s at 35° above the horizontal. Find the time of flight, the range, and the apex height.

Answer

2 Using the same launch speed of 18 m/s, find the two launch angles that produce a range of exactly 30 m.

Answer

3 A projectile leaves level ground at 22 m/s at 55°. Find its speed and its direction 1.2 s after launch, and state whether it is rising or falling at that moment.

Answer

4 A projectile launched at 30° above level ground travels 40 m before landing. Find its launch speed.

Answer

5 Two balls leave level ground at 20 m/s, one at 25° and one at 65°. Compare their ranges, their times of flight, and their apex heights, with numbers.

Answer

6 Show that on level ground the apex height equals one quarter of the range only when the launch angle is 45°. Start from H/R and simplify.

Answer

7 A projectile on level ground has a time of flight of 2.4 s and a range of 36 m. Find the vertical and horizontal components of its launch velocity, then its launch speed, launch angle, and apex height.

Answer

8 Two projectiles leave level ground at 16 m/s, at 20° and at 70°. Which lands first, and by how many seconds?

Answer

9 A punt has a hang time of 4.2 s and travels 52 m downfield before being caught at the height it was kicked. Find the launch speed, the launch angle, and the apex height.

Answer

10 At what point on a level ground trajectory is the speed smallest, and why? Find that speed for a launch of 24 m/s at 50°.

Answer

Part B · Platforms (problems 1 to 10)



Launch and landing heights differ. Solve $4.9t^2 - v_{0y}t + \Delta y = 0$ for the time and say which root you keep. The range formula does not apply.

Left: launched off a platform to lower ground. Right: launched up onto a ledge. Blue: launch and path. Green: landing.

1 A ball leaves the edge of a 12 m roof at 14 m/s directed 25° above the horizontal. Find the time to reach the ground, the horizontal distance, and the impact speed.

Answer

2 The same ball is thrown from the same roof at 14 m/s but directed 25° below the horizontal. Find the time and the horizontal distance, and compare the impact speed with the previous answer.

Answer

3 A marble leaves a 9.0 m ledge horizontally at 7.5 m/s. Find the time in the air, the horizontal distance, the impact speed, and the angle below the horizontal at which it lands.

Answer

4 A ball is launched from the ground at 20 m/s at 60° and lands on top of a platform 8.0 m high. Find both times at which it is 8.0 m above the ground, state which is the landing, and find the horizontal distance and the landing speed.

Answer

5 A ball is thrown from the ground at 15 m/s at 55° toward a garage roof 3.0 m high. What is the greatest distance the near edge of the roof can be if the ball is to land on the roof rather than hit the wall?

Answer

6 A ball is thrown at 11 m/s at 40° above the horizontal from a balcony 5.0 m above the ground. Find the maximum height above the ground, the time to reach the ground, the horizontal distance, and the impact speed.

Answer

7 Two balls are thrown from a 10 m platform at 16 m/s, one at 30° above the horizontal and one at 60°. Find each impact speed, each time in the air, and each horizontal distance. Comment on the pattern.

Answer

8 A ball rolls off a table 0.95 m high and lands 1.35 m from the base of the table. Find the time in the air, the speed it left the table, and the impact speed.

Answer

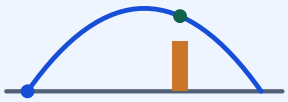
9 A ball is launched at 18 m/s at 32° from a platform 6.0 m above the ground. Find its velocity and horizontal position at the moment it returns to launch height, then find the time and horizontal distance when it reaches the ground.

Answer

10 A ramp launches an object at 21 m/s at 28° from a lip 4.0 m above the ground onto a landing pad 1.5 m high. Find the time in the air, the horizontal distance traveled, the maximum height above the ground, and the impact speed.

Answer

Part C · Walls and barriers (problems 1 to 10)



Find the height at the barrier, either from $t = d/v_{0x}$ or from the trajectory equation, then report the clearance with its sign.

Orange: the barrier. Green: the object as it passes the barrier. Blue: launch and path.

1 A free kick leaves the ground at 18 m/s at 25°. A defensive wall 2.0 m tall stands 9.15 m away. Find the height of the ball at the wall and state whether it clears.

Answer

2 For the same kick geometry, find the minimum launch speed at 25° that would just clear the 2.0 m wall at 9.15 m.

Answer

3 A ball is struck from level ground at 24 m/s at 35°. A fence 7.0 m tall stands 40 m away. Does the ball clear it, and by how much?

Answer

4 The same ball as problem 3 continues past the fence. A second barrier 4.0 m tall stands 50 m from the launch point. Does the ball clear that one?

Answer

5 A volleyball is struck at 10 m/s at 30° from a height of 2.2 m. The net is 2.43 m high and stands 4.5 m away, and the court boundary is 9.0 m from the point of contact. Determine whether the ball clears the net, then whether it lands in.

Answer

6 A golf ball leaves the tee at 34 m/s at 28°. A tree 14 m tall stands 55 m down the fairway. Does the ball clear the tree?

Answer

7 For the shot in problem 6, find the minimum launch speed at 28° that would clear the tree.

Answer

8 A ball is launched at 20 m/s from level ground toward a wall 6.0 m tall standing 25 m away. Find the two launch angles at which the ball just grazes the top of the wall, and state the range of angles that clear it.

Answer

9 A ball is launched at 26 m/s toward a wall 7.0 m tall standing 32 m away, first at 25° and then at 35°. Find the clearance in each case and comment on the size of the change.

Answer

10 A ball is launched from level ground at 20 m/s at 35°. It must clear a wall 4.0 m tall standing 20 m away and then land before a boundary line 45 m from the launch point. Check both conditions.

Answer