

Quadratic Motion Problems Worksheet

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Problems

1. A ball is thrown upward from the top of a 25-meter high building with an initial velocity of 15 m/s. Determine the time it will take for the ball to hit the ground. The height of the ball h in meters after t seconds is given by $h = -4.9t^2 + 15t + 25$.
2. A skydiver jumps out of an airplane and falls for t seconds before opening the parachute. The height h in meters above the ground is given by $h = -4.9t^2 + 500$. Determine the time it will take for the skydiver to reach an altitude of 300 meters.

Solutions

1. A ball is thrown upward from the top of a 25-meter high building with an initial velocity of 15 m/s. Determine the time it will take for the ball to hit the ground. The height of the ball h in meters after t seconds is given by $h = -4.9t^2 + 15t + 25$.

Solution:

The equation for the height of the ball as a function of time is given by $h(t) = -4.9t^2 + 15t + 25$. To find when the ball hits the ground, we set $h(t) = 0$ and solve for t :

$$-4.9t^2 + 15t + 25 = 0$$

Using the quadratic formula where $a = -4.9$, $b = 15$, and $c = 25$, we get:

$$t = \frac{-15 \pm \sqrt{15^2 - 4(-4.9)(25)}}{2(-4.9)}$$

Simplifying, we find two possible values for t , but only the positive value makes physical sense for time:

$$t \approx 3.02 \text{ seconds}$$

Thus, it takes approximately 3.02 seconds for the ball to hit the ground.

2. A skydiver jumps out of an airplane and falls for t seconds before opening the parachute. The height h in meters above the ground is given by $h = -4.9t^2 + 500$. Determine the time it will take for the skydiver to reach an altitude of 300 meters.

Solution:

To find when the skydiver reaches an altitude of 300 meters, we set $h(t) = 300$ and solve for t :

$$300 = -4.9t^2 + 500$$

Subtract 500 from both sides to isolate the term involving t :

$$-4.9t^2 = 300 - 500$$

$$-4.9t^2 = -200$$

Divide both sides by -4.9 to solve for t^2 :

$$t^2 = \frac{200}{4.9}$$

Taking the square root of both sides gives:

$$t = \sqrt{\frac{200}{4.9}}$$

Simplifying this expression gives the time it takes for the skydiver to reach 300 meters altitude.