H=7+44t-16^2Find All Values Of T For Which The Balls Height Is 27 Feet PLEASE HELP ME :(

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If you're grappling with a physics problem involving the height of a ball over time, you're not alone. Many students encounter the challenge of solving quadratic equations related to projectile motion. In this article, we will explore how to find all values of t when the height of a ball reaches 27 feet, especially when given a height function like $H = 7 + 44t - 16t^2$. We will break down the problem step-by-step, explain the relevant concepts, and provide a clear method to solve similar questions. Whether you're working on homework, preparing for an exam, or just curious about projectile motion, this guide aims to clarify the process and help you succeed.

Understanding the Height Equation in Projectile Motion

What Does the Equation Represent?

The equation $H = 7 + 44t - 16t^2$ models the height (in feet) of a ball at any given time t (in seconds). It is a quadratic function, typical of projectile motion under gravity, where:
- The initial height is 7 feet.
- The initial velocity contributes to the linear term (44t).
- The quadratic term ($-16t^2$) accounts for the acceleration due to gravity (assuming standard gravity in ft/sec²).

This equation allows us to analyze the path of the ball and determine specific moments when it reaches a certain height.

Key Concepts in Solving for t

To find the times when the ball's height is 27 feet, we set H = 27 and solve for t. This involves:
- Substituting 27 for H.
- Rearranging the equation into a standard quadratic form.
- Applying algebraic methods (factoring, completing the square, or quadratic formula) to find solutions.

Step-by-Step Guide to Find All Values of t When Height Is 27 Feet

Step 1: Set the Height Equation Equal to 27

Begin by substituting 27 into the height function:
$$ 27 = 7 + 44t - 16t^2 $$

Step 2: Rearrange into Standard Quadratic Form

Subtract 27 from both sides:
$$ 0 = 7 + 44t - 16t^2 - 27 $$
Simplify:
$$ 0 = -20 + 44t - 16t^2 $$

Rewrite in standard quadratic form:
$$ -16t^2 + 44t - 20 = 0 $$

For clarity, multiply through by -1 to make the quadratic coefficient positive:
$$ 16t^2 - 44t + 20 = 0 $$

Step 3: Use the Quadratic Formula

The quadratic formula is:
$$ t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} $$
where $a = 16$, $b = -44$, and $c = 20$.

Calculate the discriminant:
$$ D = b^2 - 4ac = (-44)^2 - 4 \times 16 \times 20 $$
$$ D = 1936 - 1280 = 656 $$

Since $D > 0$, there are two real solutions.

Compute the square root:
$$ \sqrt{656} \approx 25.61 $$

Calculate the two solutions:
$$ t = \frac{44 \pm 25.61}{2 \times 16} $$
$$ t = \frac{44 \pm 25.61}{32} $$

Solution 1:
\[t = \frac{44 + 25.61}{32} \approx \frac{69.61}{32} \approx 2.175 \text{

seconds} \]

Solution 2:
$$ t = \frac{44 - 25.61}{32} \approx \frac{18.39}{32} \approx 0.574 \text{ seconds} $$

Interpreting the Results

What Do These Values of t Mean?

The two solutions—approximately 0.574 seconds and 2.175 seconds—represent the moments when the ball reaches a height of 27 feet. The ball is on its way up at about 0.574 seconds, reaches 27 feet, then comes back down and hits 27 feet again at approximately 2.175 seconds.

Practical Implications

Understanding these times can help in:
- Analyzing the trajectory of the projectile.
- Planning events such as sports plays.
- Designing experiments involving projectile motion.

Additional Tips for Solving Projectile Motion Problems

Check the Discriminant

Always verify the discriminant (D):
- If $D > 0$, two real solutions exist.
- If $D = 0$, one solution (the ball reaches the height at the peak).
- If $D < 0$, no real solutions (the ball never reaches that height).

Remember the Physical Context

- Negative t values are generally not physically meaningful in this context.
- Only consider positive solutions as valid times when the ball reaches the specified height.

Practice with Similar Problems

Try solving for different heights or initial velocities to strengthen your understanding of projectile motion equations.

Summary: How to Find All Times When a Ball Reaches a Specific Height

1. Set the height equation equal to the desired height.
2. Rearrange into standard quadratic form: $a t^2 + b t + c = 0$.
3. Calculate the discriminant ($D = b^2 - 4ac$).
4. Apply the quadratic formula to find solutions for t.
5. Interpret the solutions in the context of the problem, considering only positive t values.

Conclusion

Finding the moments when a projectile reaches a specific height involves straightforward algebra once you understand the quadratic nature of the motion. In the example of $H = 7 + 44t - 16t^2$ and the height of 27 feet, the key steps are setting the equation equal to 27, rewriting it in standard form, calculating the discriminant, and applying the quadratic formula. The solutions—approximately 0.574 seconds and 2.175 seconds—represent the times when the ball is at 27 feet. Mastering this approach will allow you to analyze similar projectile motion problems confidently and accurately.

Remember, practice makes perfect. Keep working through different scenarios to deepen your understanding of quadratic equations in physics, and you'll be well-equipped to solve complex motion problems with ease.

Frequently Asked Questions

Given the height equation $H = 7 + 44t - 16t^2$, how do I find the values of t when the ball's height is 27 feet?

Set $H = 27$ and solve for t: $27 = 7 + 44t - 16t^2$. Simplify to get $-16t^2 + 44t + (7 - 27) = 0$, or $-16t^2 + 44t - 20 = 0$. Then, solve this quadratic equation for t.

What is the quadratic equation to solve for t when the height is 27 feet?

The quadratic equation is $-16t^2 + 44t - 20 = 0$.

How do I solve the quadratic equation $-16t^2 + 44t - 20 = 0$?

Use the quadratic formula $t = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$, where $a = -16$, $b = 44$, and $c = -20$.

What are the steps to find the roots for t in this problem?

Calculate the discriminant $D = b^2 - 4ac$, then find t using $t = [-b \pm \sqrt{D}] / (2a)$. Plug in the values: $D = 44^2 - 4(-16)(-20)$.

What is the value of the discriminant in this problem?

$D = 44^2 - 4(-16)(-20) = 1936 - 4 (-16) (-20) = 1936 - 1280 = 656$.

What are the numerical solutions for t when the height is 27 feet?

$t = [-44 \pm \sqrt{656}] / (2 -16)$. Simplify $\sqrt{656} \approx 25.61$. So, $t = [-44 \pm 25.61] / -32$. Calculate both to find the two values of t.

What are the approximate values of t when the height reaches 27 feet?

$t \approx (-44 + 25.61) / -32 \approx -18.39 / -32 \approx 0.574$ seconds, and $t \approx (-44 - 25.61) / -32 \approx -69.61 / -32 \approx 2.175$ seconds.

What is the significance of these t-values in the

context of the problem?

These t-values represent the times during the ball's flight when its height is exactly 27 feet—once on the way up and once on the way down.

Additional Resources

H = 7 + 44t - 16t² Find All Values Of T For Which The Ball's Height Is 27 Feet — this is a classic quadratic problem in physics and algebra, involving projectile motion. Whether you’re a student working through your homework or someone interested in understanding the mechanics behind a ball’s trajectory, this guide will walk you through the process step-by-step. By the end, you'll be equipped to find all values of time t when the height of the ball reaches 27 feet, using algebraic techniques and a clear understanding of quadratic equations.

Understanding the Problem

Before diving into calculations, it's essential to understand what the equation represents and what we're asked to find.

The given height function:

$H(t) = 7 + 44t - 16t^2$

- H(t): The height of the ball at time t (in feet).
- t: Time in seconds since the ball was launched or released.
- The problem asks: For which values of t does the height H(t) equal 27 feet?

Mathematically, this is equivalent to solving:

$7 + 44t - 16t^2 = 27$

for t.

Step 1: Setting Up the Equation

Start with the given height function and the condition that height is 27 feet:

$H(t) = 27$

Substitute into the equation:

$7 + 44t - 16t^2 = 27$

Step 2: Rearranging the Equation

Bring all terms to one side to set the equation to zero:

$7 + 44t - 16t^2 - 27 = 0$

Simplify:

$-16t^2 + 44t + (7 - 27) = 0$

which simplifies further to:

$-16t^2 + 44t - 20 = 0$

To make calculations easier, multiply through by -1 to eliminate the negative leading coefficient:

$16t^2 - 44t + 20 = 0$

Step 3: Recognizing the Quadratic Equation

Now, we have a standard quadratic form:

$ax^2 + bx + c = 0$

where:

- $a = 16$
- $b = -44$
- $c = 20$

Our task is to find all t satisfying this quadratic.

Step 4: Using the Quadratic Formula

The quadratic formula:

$t = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$

Plugging in the values:

$t = [-(-44) \pm \sqrt{((-44)^2 - 4\ 16\ 20)}] / (2\ 16)$

Simplify numerator:

$$t = [44 \pm \sqrt{(1936 - 1280)}] / 32$$

Calculate discriminant:

$$\sqrt{(1936 - 1280)} = \sqrt{656}$$

Step 5: Simplifying the Discriminant

Find the square root of 656:

- 656 can be factored as $16\ 41$, so:

$$\sqrt{656} = \sqrt{(16\ 41)} = \sqrt{16}\ \sqrt{41} = 4\sqrt{41}$$

Thus, the solutions are:

$$t = [44 \pm 4\sqrt{41}] / 32$$

Step 6: Final Expression for t

Divide numerator and denominator by 4:

$$t = [44/4 \pm \sqrt{41}] / (32/4)$$

which simplifies to:

$$t = [11 \pm \sqrt{41}] / 8$$

Step 7: Calculating Numerical Values

Now, approximate $\sqrt{41}$:

$\sqrt{41} \approx 6.4$ (since $6.4\ 6.4 \approx 40.96$)

Plugging back:

- First solution:

$t \approx (11 + 6.4) / 8 \approx 17.4 / 8 \approx 2.175$ seconds

- Second solution:

$t \approx (11 - 6.4) / 8 \approx 4.6 / 8 \approx 0.575$ seconds

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Summary of Solutions

Time t (seconds)	Approximate value	Interpretation
t_1	≈ 0.575 seconds	When the ball reaches height 27 ft on the way up
t_2	≈ 2.175 seconds	When the ball descends back through 27 ft

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Key Takeaways and Practical Insights

- The quadratic nature of the height function reflects the parabolic trajectory of the ball.
- The two solutions correspond to two points in time: as the ball rises to 27 feet and then as it falls past 27 feet again.
- Knowing how to solve these quadratics enables you to determine specific moments in projectile motion, which can be applied in various physics problems and real-world scenarios.

Additional Tips for Solving Similar Problems

1. Identify the quadratic form: Recognize when your equations are quadratic and recall the quadratic formula.
2. Simplify coefficients: If possible, divide through by common factors to make calculations easier.
3. Calculate discriminant carefully: The value inside the square root determines if solutions are real, repeated, or complex.
4. Approximate roots prudently: Use a calculator for square roots and approximate solutions, especially in applied contexts.
5. Interpret solutions physically: Remember that negative time values typically don't make physical sense in these contexts unless the problem is time-symmetric or involves different reference points.

Conclusion

In summary, to find all values of t when the height of the ball reaches 27 feet, you solve the quadratic equation derived from the height function:

$t = [11 \pm \sqrt{41}] / 8$

which numerically approximates to t ≈ 0.575 seconds and t ≈ 2.175 seconds. This process demonstrates how algebraic techniques and understanding quadratic functions are essential tools in analyzing projectile motion, physics, and many other fields involving quadratic relationships.

If you're tackling similar problems, remember to carefully set up your equations, simplify where possible, and interpret your solutions within the physical context. Happy solving!

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