

1. The x larger of two numbers is 15 more than three times the smaller number. If the sum of the two numbers is 63, write a system of equations to find the numbers.

$$\begin{aligned} x &= 3y + 15 \\ x + y &= 63 \end{aligned}$$

$$\begin{aligned} (3y + 15) + y &= 63 \\ 4y + 15 &= 63 \\ 4y &= 48 \\ y &= 12 \end{aligned}$$

$$\begin{aligned} x &= 3(12) + 15 \\ x &= 51 \end{aligned}$$

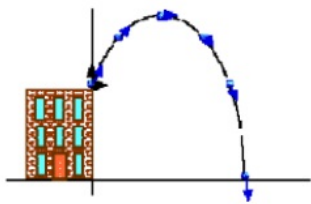
$(51, 12)$

2. Translate then solve:

The square of a number is decreased by 15. This value is twice the original number. Find the number(s).

$$\begin{aligned} n^2 - 15 &= 2n \\ -2n & \quad -2n \\ \hline n^2 - 2n - 15 &= 0 \\ (n+3)(n-5) &= 0 \end{aligned}$$

$$\begin{aligned} n+3 &= 0 & n-5 &= 0 \\ -3 & -3 & +5 & +5 \\ \hline n &= -3 & n &= 5 \end{aligned}$$



PROJECTILE MOTION

$$h = y \quad t = x$$

1. A soccer ball is kicked from the ground with an initial upward velocity of 90 feet per second. The equation $h = -16t^2 + 90t$ gives the height h of the ball after t seconds.

a. Find the maximum height of the ball.

$$t = \frac{-90}{2(-16)} = 2.8125$$

$$h = -16(2.8125)^2 + 90(2.8125)$$

$$h = 126.5625$$

b. How many seconds will it take for the ball to reach the ground?

$$\frac{-16t^2}{-2t} + \frac{90t}{-2t} = 0$$

$$-2t(8t - 45) = 0$$

~~$$\frac{-2t}{-2} = \frac{0}{-2}$$

$$t = 0$$~~

$$8t - 45 = 0$$

$$\frac{+45}{+45} \quad \frac{+45}{+45}$$

$$\frac{8t}{8} = \frac{45}{8}$$

$$t = 5.625$$

- 1a. 126.56 ft.
b. 5.625 sec.

2. An apple is launched directly upward at 64 feet per second from a platform 80 feet high. The equation for this apple's height h at time t seconds after launch is $h = -16t^2 + 64t + 80$.

a. Find the maximum height of the apple.

$$t = \frac{-64}{2(-16)} = 2 \quad h = -16(2)^2 + 64(2) + 80$$

$$h = 144$$

b. How many seconds will it take for the apple to reach the ground?

$$-16t^2 + 64t + 80$$

$$-16(t^2 - 4t - 5) = 0$$
~~$$-16 = 0$$~~
$$(t-5)(t+1) = 0$$

$$t-5=0 \quad t+1=0$$

$$\begin{array}{r} +5 +5 \\ \hline t=5 \end{array}$$

2a. 144 ft.

b. 5 sec.

3. In science class, the students were asked to create a container to hold an egg. They would then drop this container from a window 25 feet above the ground. The equation $h = -16t^2 + 25$, gives the container's height h after t seconds.

a. Find the maximum height of the container.

$$t = \frac{0}{2(-16)} = 0 \quad h = -16(0)^2 + 25$$

$$h = 25$$

b. How many seconds will it take for the container to reach the ground?

$$-16t^2 + 25 = 0$$

~~$$(16t^2 - 25) = 0$$~~

$$(4t+5)(4t-5) = 0$$

$$4t+5=0 \quad 4t-5=0$$

$$\begin{array}{r} +5 \quad +5 \\ \hline \end{array}$$

$$\frac{4t}{4} = \frac{5}{4} \quad t = 1.25$$

3a. 25 ft.
b. 1.25 sec.

4. A penny is dropped off the Empire State Building, which is 1,250 feet tall. If the penny's pathway can be modeled by the equation $h = -16t^2 + 1250$, how long would it take the penny to strike a 6 foot tall person?

4. 8.82 sec.

$$-16t^2 + 1250 = 6$$

$$\begin{array}{r} -6 \quad -6 \\ \hline \end{array}$$

$$-16t^2 + 1244 = 0$$

$$-4(4t^2 - 311) = 0$$

$$4t^2 - 311 = 0$$

$$\begin{array}{r} +311 \quad +311 \\ \hline \end{array}$$

$$4t^2 = 311$$

$$\frac{4t^2}{4} = \frac{311}{4}$$

$$\sqrt{t^2} = \sqrt{77.75}$$

$$t = 8.82 \text{ sec}$$

5. Some fireworks are fired vertically into the air from the ground at an initial speed of 80 feet per second. The equation for this object's height h at time t seconds after launch is $h = -16t^2 + 80t$. How long will it take the fireworks to reach the ground?

5. _____

6. The Apollo's Chariot, a rollercoaster at Busch Gardens, moves at 110 feet per second. The equation of the ride can be represented by the equation $h = -16t^2 + 101t + 10$. What is the maximum height reached by this ride?

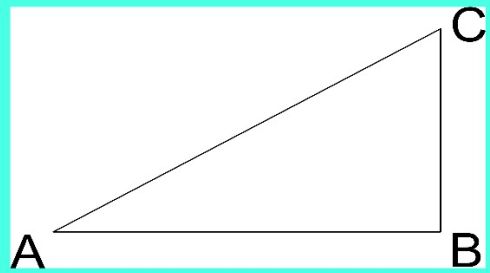
6. _____

7. Eva is jumping on a trampoline. Her height h at time t can be modeled by the equation $h = -16t^2 + 20t + 6$. Would Eva reach a height of 14 feet?

7. _____

Challenge!

One leg of a right triangle exceeds the other leg by four inches. The hypotenuse is 20 inches. Find the length of the shorter leg of the right triangle.



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