

Systems of Equations Linear/Quadratic Word Problems

Solve each word problem by setting up a system of equations using two variables first.

- The revenue for the school play is given by: $R = -50t^2 + 300t$, where "t" is the ticket price in dollars. The cost to produce the play is given by: $C = 600 - 50t$. Determine the ticket price that will allow Script & Cue to break even. (Note: breaking even means that revenue = cost.)

$$-50t^2 + 300t = 600 - 50t$$

$$-50t^2 + 350t - 600 = 0$$

- SOLVE -

Solve using factor, quadratic formula or t R
 (3, 450)
 (4, 400)
 At \$3 you'll break even, where revenue is \$450 then at \$4.

- A daredevil jumps off a tall building. He falls freely for several seconds before releasing his parachute. His height (h) in meters, t seconds after jumping can be modeled by: $h = -4.9t^2 + t + 360$ before he releases his parachute and $h = -4t + 142$ after he released his parachute. How long after jumping did he release his parachute?

(The exact pt where they meet would be actual opening)

$$-4t + 142 = -4.9t^2 + t + 360$$

$$0 = -4.9t^2 + 5t + 218$$

- SOLVE -

7.2 seconds
 can't have a negative time

(7.2, 113.2)

$$-4(7.2) + 142 = 113.2$$

- A punter kicks a football. Its height (h) in meters, t seconds after the punt is given by the equation: $h = -4.9t^2 + 18.24t + 0.8$. The height of an approaching blocker's hands is modeled by the equation: $h = -1.43t + 4.26$, using the same time. Can the blocker knock down the punt? If so, at what time does this happen?

At height 1, not possible

$$-4.9t^2 + 18.24t + 0.8 = -1.43t + 4.26$$

$$-4.9t^2 + 19.67t - 3.46 = 0$$

- SOLVE -

At 3.89 seconds
 or .18 seconds (at height of 4)

He can, but he needs to move quickly!

- Justin is skeet shooting during the Olympic trials. The height of the skeet is modeled by the equation: $h = -5t^2 + 32t + 2$, where h is the height in meters t seconds after the skeet is released. The path of Justin's bullet is modeled by the equation: $h = 31.5t + 1$ with the same units. How long will it take for the bullet to hit the skeet? How high off the ground will the skeet be when it's been hit?

$$-5t^2 + 32t + 2 = 31.5t + 1$$

$$-5t^2 + .5t + 1 = 0$$

solve

.5 seconds At 16.75 meters up

$$31.5(.5) + 1$$

(The other pt of reaction is negative, not possible)

5. The height of a baseball, in meters at t seconds after it is tossed out of a window is modeled by: $h = -5t^2 + 20t + 15$. A boy shoots at the baseball with a paintball gun. The trajectory of the paintball is given by the equation: $h = 3t + 3$. Will the paintball hit the baseball? If so, when? At what height will the baseball be?

(4, 15) Yes, the paintball will hit the baseball at 4 seconds when it's 15 meters.

$$-5t^2 + 20t + 15 = 3t + 3$$

$$-5t^2 + 17t + 12 = 0$$

$$t = 4$$

plug in for h

6. Two Cirque du Soleil performers are launched toward each other from two slightly offset seesaws. The first performer is launched, and one second later, the second performer is launched in the other direction. They both perform a flip and give each other a high five in the air. Each performer is in the air for 2 seconds. The height above the seesaw (h) at any given time (t) is approximated by the parabolas:

$$h = -5(t-1)^2 + 5 \quad -5(t-1)(t-1) + 5 \rightarrow -5(t^2 - 2t + 1) + 5 \rightarrow -5t^2 + 10t$$

$$h = -5(t-2)^2 + 5 \quad -5(t-2)(t-2) + 5 \rightarrow -5(t^2 - 4t + 4) + 5 \rightarrow -5t^2 + 20t - 15$$

Determine the height of the performers when they "high five".

They high fived at 3.75 meters up

$$-5t^2 + 10t = -5t^2 + 20t - 15$$

$$-10t = -15$$

$$t = 1.5$$

plug in for y

7. The sum of two integers is 21. Fifteen less than double the square of the integer is equal to the larger integer. What are the two numbers?

$$x + y = 21 \rightarrow y = 21 - x$$

$$2(x^2) - 15 = y \rightarrow 2x^2 - 15 = y$$

$$21 - x = 2x^2 - 15$$

$$0 = 2x^2 + x - 36$$

8. The revenue for a company producing electronic components is given by $R = -20x^2 - 50x + 200$, where x is the price in dollars of each component. The cost for the production is given by: $C = 60x - 10$. Determine the price that will allow the company to break even.

$$(1.5, 80)$$

price

The price of the component needs to be \$1.50 to break even after selling 80 parts

9. A car manufacturer does performance tests on its cars. During one test, a car starts from rest and accelerates at a constant rate for 20 seconds. Another car starts from rest three seconds later and accelerates at a faster constant rate. The equation that models the distance the first car travel travels is: $d = 1.16t^2$ and the equation for the second car is: $d = 1.74(t-3)^2$, where t is time, in seconds, after the first car starts the test and d is the distance in meters. At what time will both cars have driven the same distance? How far will they have driven at this time?

After 1.7 seconds they will have both driven 3.16 meters