

Math 150 Lecture Notes for Chapter 7 Systems of Equations

Math 150 Lecture Notes for Section 7A Systems of Linear Equations

Geometry of Solutions

Which pairs of numbers (3, 25), (18, 1), and (−12, 4) are solutions to the following system?

$$x + 10y = 28$$

$$x - 3y = -24$$

In a plane two lines can intersect at

- One point – there is a unique solution point; the solution point lies on both lines
- Infinite points – there are an infinite number of solution points; the lines are the same
- No points – there is no solution; the solution set is empty; the lines are parallel

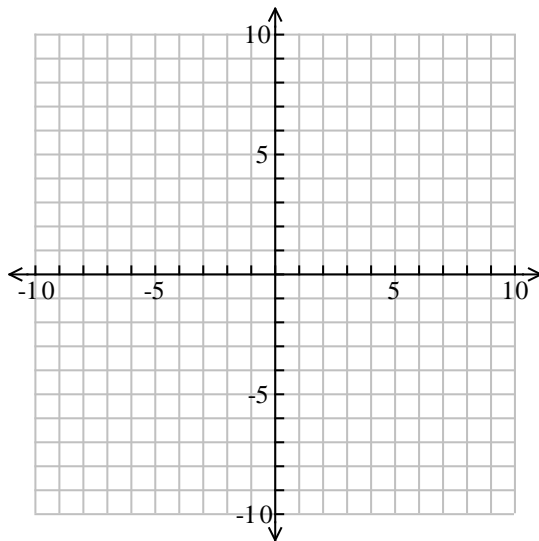
There are two main problems when graphing is used to find a solution. It takes more time than other methods, and it is not always exact (even when using a calculator).

Solve the system of equations by graphing.

$$x - y = 0$$

$$8x + 7y = 56$$

$$2x + 5y = 14$$



Algebraic Methods of Solution

There are basically two algebraic methods used for solving a system of equations: *substitution* (usually for very simple systems) and *elimination* (which is more efficient).

The Method of Substitution

The method of substitution involves solving for one variable in one equation and then substituting it in the other equation(s) to solve for the remaining variable(s). Then back substitute to determine the value of the other unknown(s).

Solve the system of equations by substitution. Check your answer.

$$2x - y = 3$$

$$x + 2y = 4$$

Solve the system of equations by substitution.

$$5x - 13y = -71$$

$$3x - 16y = -59$$

The Method of Elimination

The key to the elimination method is to ask, “What can we multiply one equation by, so that when we add the two equations together, one of the variables will be eliminated?” Then we solve for the remaining variable(s).

Solve the system of equations by elimination.

$$5x - 13y = -71$$

$$3x - 16y = -59$$

Solve the system of equations.

$$9x - 3y = 6$$

$$6x - 2y = 4$$

Solve the system of equations.

$$-2x + y = 3$$

$$-4x + 2y = 2$$

Natalie has a customer that wants 8 pounds of a nuts and bolt mixture containing 35% nuts by weight. She has a nut and bolt mixture containing 24% nuts and another one containing 40% nuts. How much of each kind of available nut and bolt mix would she need to combine together to meet her customer's demand?

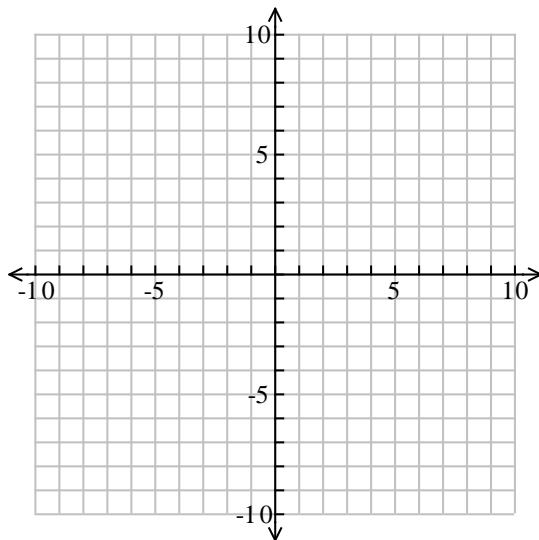
A submarine makes a round trip between two points in the ocean. The trip from Point Maroon to Point Aggie is with the current and takes 3 days and 9 hours. The return trip is against the current and takes 4 days and 3 hours. If the points are 2227.5 nautical miles apart, what are the submarine's speed and the current's speed in nautical miles per hour? Assume that both the submarine's and the current's speed are constant.
[FYI: 1 knot = 1 nautical mile per hour]

Math 150 Lecture Notes for Section 7B Systems of Non-Linear Equations

Solve the system of equations and then graph.

$$x^2 + y^2 = 25$$

$$x^2 + (y - 5)^2 = 9$$



Solve the system of equations:

$$x + 2y = 10$$

$$y^2 - 2y - x + 1 = 0$$

Suppose a population of rabbits satisfies an exponential growth model, $p(t) = ae^{kt}$, where t is time in years. If $p(2) = 720$ and $p(4) = 6480$, find the exact values of a and k .

Solve the system of equations:

$$x + y + 9 = 0$$

$$x^2 - 18x - 2y^2 + 22y = -160$$

Solve the system of equations:

$$y - 2 = \ln x$$

$$y + \ln x = 2$$