

We present below mathematical problems which are related to **system of linear equation** concept. The graphing of this concept also relates to the geometrical line relations, such as two line are perpendicular, two lines are parallel.

Some online resources [1](#) & [2](#) discuss how to prepare SAT toward understanding this concept.

**Problem 1.1:** Solve this system of linear equations by graphing:  $y = -1/5 x$  and  $y = -x - 4$ .

*Problem Analysis: this problem investigates students' understanding of using graphing to understand the relation between two line equations. The narrative of this problem lies on algebraic side instead of geometric side. From the computing perspective, this problem follows the forward reasoning manner to solve it.*

**Problem 1.2:** Line A contains the point (0,5) and is perpendicular to the line B  $4y=x$ , what is the general form of line A?

*Problem Analysis: this problem investigates students' understanding upon the relation between two lines. In compared to the Problem 1.1, the narrative of this problem lies on the geometric side instead of algebraic side. From the computing perspective, this problem follows a forward relation building and a backward reasoning manner to solve it.*

**Problem 2.1:** Solve this linear system using your method:  $6x - 5y = 8$  and  $-12x + 2y = 0$ .

*Problem Analysis: this problem investigates students' strategy selection toward system of linear equation problem. We expect students know three different methods: graphing, method of substitution and method of elimination. This problem follows a forward reasoning manner to solve it. It is the student-produced response problem.*

**Problem 2.2:** Consider the system of linear equations  $9x - 14y = -3$  and  $2x - ay = -6$ . Which of the following choices of a will result in a system of equations with no solutions?

- A.  $-9/14$
- B.  $-28/9$
- C.  $9/14$
- D.  $28/9$

*Problem Analysis: this problem investigates students' strategy selection toward system of linear equation problem. In compared to Problem 2.1, this problem follows a backward reasoning manner to solve it. It is a multiple-choice problem.*

**Problem 3.1:** Tickets for a play were \$2 for each child and \$4 for each adult. At one showing of the play, one adult brought 4 children and the remaining adults brought 2 children each. The total ticket sales from the children and adults was \$60. How many children and adults attended the play?

- A. 12 children and 9 adults

- B. 14 children and 8 adults
- C. 16 children and 7 adults
- D. 18 children and 6 adults

*Problem Analysis: this problem comes from [KahnAcademy](#), it is labeled as a systems of linear equation word problem. It investigates students' ability to translate this word problem as a mathematical model and further solve it using the concept of systems of linear equation. It is an algebraic thinking to derive the concept understanding.*

**Problem 3.2:** As a construction manager, you are asked to build a new straight road, which crosses the point (0,0). There is another straight road already built, which can be expressed as  $y=2x-1$ . You are asked to build your road such that it will never cross this other road. Find the correct value for a and b in the following equation of your road( $y = ax+b$ ). Round any decimals to the nearest hundredth.

*Problem Analysis: This problem comes from [online](#), it is labeled as a systems of linear equation word problem. It investigates students' ability to translate this word problem as a mathematical model and further solve it using the concept of systems of linear equation. It is an geometrical thinking to derive the concept understanding.*