

Module 1 Introduction to System of Linear Equations

Module 2 Gauss-Jordan Elimination *Concept Check*

Student name:

Tutorial group:

INSTRUCTIONS

Write your name and tutorial group in the space provided on Page 1.

This exercise must be answered in English.

This exercise consists of FORTY-FIVE questions.

Attempt ALL questions in this exercise.

Unless otherwise specified, all working must be clearly shown.

Unless otherwise specified, numerical answer should be EXACT.

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Module 1 Introduction to System of Linear Equations

Module 2 Gauss-Jordan Elimination

Concept Check

Multiple Choices Question

- 1 If $2x + 5y = 21$ and $x + y = 3$, then what is the value of x ?
A $x = -5$ C $x = 2$
B $x = -2$ D $x = 5$
- 2 If $7x + 2y = 3$ and $x - 3y = 30$, then what is the value of y ?
A $y = -9$ C $y = 3$
B $y = -3$ D $y = 9$
- 3 If $2x + 5y = -1$ and $3x - 2y = 27$, then what is the value of x ?
A $x = -7$ C $x = 3$
B $x = -3$ D $x = 7$
- 4 If $4x - 3y = -18$ and $6x + 7y = -4$, then what is the value of y ?
A $y = -3$ C $y = 2$
B $y = -2$ D $y = 3$
- 5 If $2x - 3y = 24$ and $3x + 4y = 2$, then what is the value of $x - y$?
A 2 C 22
B 10 D 26
- 6 If $a + b = 5$ and $3a + 2b = 20$, then what is the value of $3a + b$?
A 10 C 20
B 15 D 25
- 7 If $3p - 2q = 4$ and $7p - 3q = 1$, then what is the value of $4p - 5q$?
A -33 C 5
B 3 D 17
- 8 Tina has 20 balls of four colors: yellow, green, blue and black. 17 of them are not green, 5 are black and 12 are not yellow. How many blue balls does Tina have?
A 4 C 7
B 6 D 8
- 9 Given the system of linear equations:
$$\begin{cases} x - 2y + z = 10 \\ 2x + 2y + 3z = 13 \\ -2x + 5y + z = -7 \end{cases}$$
 what is the value of $x + y + z$?
A 2 C 4
B 3 D 5

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9.
$$\begin{cases} x + 2y - z = 1 \\ 2x + 3y + z = 2 \\ x + 3y - 2z = 1 \end{cases}$$

10.
$$\begin{cases} x + y + 2z = 4 \\ x - 2y + z = 0 \\ x - 5y = -4 \end{cases}$$

11.
$$\begin{cases} x + 2y + 3z = 14 \\ 3x + 2y + z = 10 \\ 3x + y + 2z = 11 \end{cases}$$

12.
$$\begin{cases} x + y + z = 4 \\ x + 2y + 4z = 12 \\ 2x - 3y - z = 4 \end{cases}$$

- 13 Using Gaussian Elimination to solve the following system of four linear equations. Determine the system is (a) a homogeneous linear system? if yes, separate the solution(s) to trivial solution and/or nontrivial solution(s)? (b) consistent or not? (c) dependent or independent?

1.
$$\begin{cases} 2a + 2b - c + d = 4 \\ 4a + 3b - c + 2d = 6 \\ 8a + 5b - 3c + 4d = 12 \\ 3a + 3b - 2c + 2d = 6 \end{cases}$$

2.
$$\begin{cases} b - a - c + d = 0 \\ b - 2a + c - 3d = 0 \\ a + 2b - 3c + d = 0 \\ 2a + 3b + 4c - d = 0 \end{cases}$$

3.
$$\begin{cases} 2a + b - c + d = 1 \\ 3a - 2b + 2c - 3d = 2 \\ 2a - b + c - 3d = 4 \\ 5a + b - c + 2d = -1 \end{cases}$$

4.
$$\begin{cases} a + 2b + 3c - 2d = 6 \\ 3a + 2b - c + 2d = 4 \\ 2a - b - 2c - 3d = 2 \\ 2a - 3b + 2c + d = 8 \end{cases}$$

5.
$$\begin{cases} 2a + 3b + 11c + 5d = 2 \\ a + b + 5c + 2d = 1 \\ 2a + b - 3c + 2d = -3 \\ a + b - 3c + 4d = -3 \end{cases}$$

6.
$$\begin{cases} 2a + 5b + 4c + d = 20 \\ a + 3b + 2c + d = 11 \\ 2a + 10b + 9c + 7d = 40 \\ 3a + 8b + 9c + 2d = 37 \end{cases}$$

7.
$$\begin{cases} a - 3b - 26c + 22d = 0 \\ a - 8c + 7d = 0 \\ a + b - 2c + 2d = 0 \\ 4a + 5b - 2c + 3d = 0 \end{cases}$$

8.
$$\begin{cases} a + 2b + 3c + 4d = 0 \\ 7a + 14b + 20c + 27d = 0 \\ 5a + 10b + 16c + 19d = -2 \\ 3a + 5b + 6c + 13d = 5 \end{cases}$$

- 14 Which of these equations are linear equations?

1. $2x - 11y = z$
2. $\alpha x - \beta y - z = t$
3. $2x_1x_2 - 11x_3 = 0$
4. $-14x_1 + 76x_2 = 3 - x_3 - 7x_2$
5. $\sqrt{3}x_1 + \pi x_2 - x_3 = 2x_2$
6. $5000x_1 + 7000x_2^2 - 11000x_3 = 10^5$

- 15 Write down the augmented matrix of each of the following systems of linear equations.

1.
$$\begin{cases} 8x_1 - 11x_2 + 2x_3 - 25x_4 = 50 \\ -3x_1 + x_2 + x_3 - x_4 = -12 \end{cases}$$

2.
$$\begin{cases} \pi x_1 + 2x_2 + 27x_3 = 2 \\ -x_1 + 22x_2 - 3x_3 = -1 \\ 17x_2 - 15x_3 = 0 \\ \pi x_1 + x_3 = 84 \end{cases}$$

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$$\begin{aligned} 3. \quad & \begin{cases} 5x_2 + 9x_3 = -3 \\ -4x_1 + 12x_2 - 4x_3 = -8 \\ x_1 + 22x_2 - 4x_3 = 5 \\ -13x_1 + 5x_3 = -8 \end{cases} \\ 4. \quad & \begin{cases} 15x_2 + 2x_3 = -3x_1 + x_4 - 7 \\ x_2 = -3x_3 + 1 \end{cases} \\ 5. \quad & \begin{cases} 15x_2 + 2x_3 = -3x_2 + x_4 - 7 \\ x_2 = -3x_3 + 1 - x_1 \\ 0 = 2x_1 - 3x_3 + 11x_1 - 32 + 88x_3 \end{cases} \end{aligned}$$

16 Write down the linear systems corresponding to the following matrices.

$$\begin{aligned} 1. \quad & \left[\begin{array}{ccc|c} 19 & 14 & -2 & 8 \end{array} \right] \\ 2. \quad & \left[\begin{array}{ccccc|c} 1 & 5 & 0 & 0 & 0 & 41 \\ 0 & 0 & 1 & -3 & 0 & 99 \\ 0 & 0 & 0 & 0 & 1 & 19 \end{array} \right] \\ 3. \quad & \left[\begin{array}{cccc|c} 87 & -1 & 0 & 15 & 9 \\ 0 & 0 & 0 & 8 & 7.5 \\ 0 & 0 & 9 & -1 & 33 \end{array} \right] \end{aligned}$$

$$\begin{aligned} 4. \quad & \left[\begin{array}{cccc|c} 1 & 9 & -56 & 23 & 4000 \end{array} \right] \\ 5. \quad & \left[\begin{array}{cccc|c} 55 & 300 & 0 & 350 & 4000 \\ 0 & 0 & 8 & 125 & 400 \end{array} \right] \\ 6. \quad & \left[\begin{array}{cccc|c} -40 & 50 & -20 & 200 & 300 \\ 0 & 30 & 0 & 90 & 110 \\ 0 & 0 & 0 & 0 & 0 \end{array} \right] \end{aligned}$$

17 For each matrix in **Question 16**, determine if it's in echelon form or in reduced echelon form.

18 For each of the following matrices on reduced echelon form, determine the pivot columns and the free variables. Using this to solve the corresponding system of linear equations.

$$\begin{aligned} 1. \quad & \left[\begin{array}{ccc|c} 1 & 0 & -2 & 7 \\ 0 & 1 & 8 & 6 \end{array} \right] \\ 2. \quad & \left[\begin{array}{ccccc|c} 1 & 3 & 0 & 0 & 5 & 36 \\ 0 & 0 & 1 & 0 & 2 & 29 \\ 0 & 0 & 0 & 1 & 1 & 19 \end{array} \right] \\ 3. \quad & \left[\begin{array}{ccc|c} 1 & 0 & 0 & 9 \\ 0 & 1 & 0 & -7 \\ 0 & 0 & 1 & 3 \end{array} \right] \end{aligned}$$

$$\begin{aligned} 4. \quad & \left[\begin{array}{cccc|c} 1 & -25 & 0 & 3.5 & 400 \\ 0 & 0 & 1 & -40 & 300 \end{array} \right] \\ 5. \quad & \left[\begin{array}{cccc|c} 1 & 0 & 0 & 0 & 37 \\ 0 & 1 & 10 & 0 & 400 \\ 0 & 0 & 0 & 1 & \sqrt{2} \end{array} \right] \\ 6. \quad & \left[\begin{array}{cccc|c} 0 & 1 & 0 & -5 & 14 \\ 0 & 0 & 1 & 2 & 3 \\ 0 & 0 & 0 & 0 & 0 \end{array} \right] \end{aligned}$$

19 Julianna and Jimmy are solving systems of linear equations by

- (1) writing up the augmented matrix to the linear system on standard form,
- (2) doing Gauss elimination (row reduction) on the augmented matrix as to obtain a matrix on reduced echelon form,
- (3) solving the corresponding equivalent linear system.

Julianna is doing elementary row operations. Explain in each case which operation she has performed and determine whether this brings the Gauss elimination forward or not.

$$1. \quad \left[\begin{array}{cccc|c} 1 & 5 & -9 & 3 & 6 \\ 0 & 2 & 7 & -4 & -12 \\ -5 & -4 & -1 & 3 & 10 \end{array} \right] \sim \left[\begin{array}{cccc|c} 1 & 5 & -9 & 3 & 6 \\ 0 & 2 & 7 & -4 & -12 \\ 0 & 21 & -46 & 18 & 40 \end{array} \right]$$

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$$2. \begin{bmatrix} 7 & 35 & -14 & 70 & -21 \\ 0 & 0 & 6 & -4 & 16 \\ 0 & 1 & -1 & 5 & 0 \\ 1 & 5 & -2 & 10 & -3 \end{bmatrix} \sim \begin{bmatrix} 1 & 5 & -2 & 10 & -3 \\ 0 & 0 & 6 & -4 & 16 \\ 0 & 1 & -1 & 5 & 0 \\ 7 & 35 & -14 & 70 & -21 \end{bmatrix}$$

$$3. \begin{bmatrix} 3 & -12 & -6 & 0 & -33 \\ 0 & 7 & -5 & 2 & 24 \\ 2 & -8 & -1 & 5 & -22 \\ 0 & 0 & 0 & 3 & -15 \end{bmatrix} \sim \begin{bmatrix} 3 & -12 & -6 & 0 & -33 \\ 0 & 7 & -5 & 2 & 24 \\ 0 & 0 & 1 & 5 & 0 \\ 0 & 0 & 0 & 3 & -15 \end{bmatrix}$$

$$4. \begin{bmatrix} 0 & 0 & -2 & 14 & -6 \\ 0 & 5 & 7 & 8 & -30 \\ 8 & -3 & 0 & 2 & 72 \end{bmatrix} \sim \begin{bmatrix} 0 & 5 & 7 & 8 & -30 \\ 0 & 0 & -2 & 14 & -6 \\ 8 & -3 & 0 & 2 & 72 \end{bmatrix}$$

$$5. \begin{bmatrix} 1 & 7 & 5 & -2 & -11 \\ 6 & 9 & 15 & 27 & -18 \\ -4 & -6 & 11 & 16 & -19 \end{bmatrix} \sim \begin{bmatrix} 1 & 7 & 5 & -2 & -11 \\ 6 & 9 & 15 & 27 & -18 \\ 0 & 0 & 21 & 34 & -25 \end{bmatrix}$$

$$6. \begin{bmatrix} 3 & 7 & 0 & 9 & 17 \\ 0 & 14 & 0 & 2 & 4 \\ 0 & 0 & 1 & 0 & 19 \end{bmatrix} \sim \begin{bmatrix} 3 & 0 & 0 & 8 & 15 \\ 0 & 14 & 0 & 2 & 4 \\ 0 & 0 & 1 & 0 & 19 \end{bmatrix}$$

$$7. \begin{bmatrix} 5 & 3 & 6 & 7 & 18 & 23 \\ 0 & 11 & 0 & 2 & -1 & 6 \\ 0 & 0 & -6 & 3 & 24 & 15 \\ 0 & 0 & 0 & 0 & -1 & 1 \end{bmatrix} \sim \begin{bmatrix} 5 & 3 & 0 & 10 & 42 & 38 \\ 0 & 11 & 0 & 2 & -1 & 6 \\ 0 & 0 & -6 & 3 & 24 & 15 \\ 0 & 0 & 0 & 0 & -1 & 1 \end{bmatrix}$$

$$8. \begin{bmatrix} 80 & 0 & 0 & 120 & 80 & 60 \\ 0 & 45 & 0 & 15 & 20 & 35 \\ 0 & 0 & 50 & 30 & 20 & 15 \end{bmatrix} \sim \begin{bmatrix} 80 & 0 & -200 & 0 & 0 & 0 \\ 0 & 45 & 0 & 15 & 20 & 35 \\ 0 & 0 & 50 & 30 & 20 & 15 \end{bmatrix}$$

$$9. \begin{bmatrix} -3 & 6 & 0 & 9 & 3 & 15 \\ 0 & 0 & 1 & 9 & 3 & 15 \end{bmatrix} \sim \begin{bmatrix} -3 & 6 & -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 9 & 3 & 15 \end{bmatrix}$$

$$10. \begin{bmatrix} 0 & 3 & 7 & 2 & 0 & 27 \\ 5 & 0 & 7 & 2 & 4 & 27 \end{bmatrix} \sim \begin{bmatrix} 5 & 0 & 7 & 2 & 4 & 27 \\ 0 & 3 & 7 & 2 & 0 & 27 \end{bmatrix}$$

Jimmy is not always taking sufficiently care with his elementary row operations. In each of the following transformation, explain what Jimmy does, determine whether the transformation is an elementary row operation, and whether the matrices are row equivalent.

$$11. \begin{bmatrix} 4 & 3 & 1 & 11 \\ 0 & 5 & 9 & -2 \\ -12 & 5 & -7 & 30 \end{bmatrix} \sim \begin{bmatrix} 4 & 3 & 1 & 11 \\ 0 & 5 & 9 & -2 \\ 0 & -4 & -10 & -3 \end{bmatrix}$$

$$12. \begin{bmatrix} 5 & 3 & 0 & 10 \\ -15 & 8 & 7 & -4 \\ 10 & 0 & -3 & 20 \end{bmatrix} \sim \begin{bmatrix} 5 & 3 & 0 & 10 \\ 0 & 17 & 7 & 26 \\ 0 & -6 & -3 & 0 \end{bmatrix}$$

$$13. \begin{bmatrix} 3 & 7 & -6 & 4 & 3 \\ 0 & 0 & 7 & -4 & 5 \\ 3 & 7 & 1 & 0 & 8 \end{bmatrix} \sim \begin{bmatrix} 0 & 0 & -7 & 4 & -5 \\ 0 & 0 & 7 & -4 & 5 \\ 0 & 0 & 7 & -4 & 5 \end{bmatrix}$$

$$14. \begin{bmatrix} 3 & 0 & -3 \\ 0 & 2 & 2 \\ 2 & 3 & 1 \\ 7 & 16 & 9 \end{bmatrix} \sim \begin{bmatrix} 3 & 0 & 0 \\ 0 & 2 & 2 \\ 2 & 3 & 3 \\ 7 & 16 & 16 \end{bmatrix}$$

$$15. \begin{bmatrix} 8 & 1 & -2 & 5 & 1 \\ 9 & -9 & 4 & -4 & 2 \\ 8 & 1 & 7 & 2 & 7 \end{bmatrix} \sim \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 9 & -9 & 4 & -4 & 2 \\ 0 & 0 & 9 & -3 & 6 \end{bmatrix}$$

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Concept Check

20 Using Gauss elimination to find row equivalent matrices on reduced echelon form.

1.
$$\left[\begin{array}{ccc|c} 1 & -2 & 0 & -2 \\ 0 & 1 & -3 & -3 \\ 0 & 0 & 4 & 8 \end{array} \right]$$

2.
$$\left[\begin{array}{ccc|c} 1 & -2 & 0 & -2 \\ 1 & -1 & -3 & -5 \\ -1 & 0 & 10 & 16 \end{array} \right]$$

3.
$$\left[\begin{array}{cccc|c} 1 & 4 & 26 & 0 & 56 \\ 0 & 1 & 5 & -2 & -9 \\ 0 & 2 & 10 & -1 & 12 \end{array} \right]$$

4.
$$\left[\begin{array}{cccc|c} 1 & 2 & 16 & 1 & 44 \\ 2 & 9 & 57 & -2 & 103 \\ 2 & 8 & 52 & 0 & 112 \end{array} \right]$$

5.
$$\left[\begin{array}{cccc|c} 0 & 0 & 0 & 7 & 21 \\ 0 & 0 & 3 & -6 & -6 \\ 1 & 2 & -3 & 3 & 2 \end{array} \right]$$

6.
$$\left[\begin{array}{cccc|c} 4 & 8 & -6 & 7 & 17 \\ 1 & 2 & 0 & -3 & -4 \\ 3 & 6 & -9 & 9 & 6 \end{array} \right]$$

7.
$$\left[\begin{array}{ccc|c} 1 & 1 & 2 & 23 \\ 0 & 1 & 2 & 16 \\ 5 & 0 & 1 & 40 \end{array} \right]$$

8.
$$\left[\begin{array}{ccc|c} 5 & 5 & 10 & 115 \\ 5 & 10 & 20 & 195 \\ 5 & 1 & 3 & 56 \end{array} \right]$$

Word problems (Solve with ELIMINATION)

(Hints: It may have no solution, if it has no solution, explain briefly of why)

- 21 There are 5500 men, women and children altogether at the swimming pool. There are twice as many women as men and for times as many children as women. How many men, women and children are at the swimming pool?
- 22 If one side of the triangle increases by 11 cm and the other side decreases by the same value, we get an equilateral triangle. When the first side is multiplied by four, it is 10 cm longer than three times the third side. Find the lengths of the triangle's sides.
- 23 If one dimension of the cuboid increases by 1 cm, the surface area of the cuboid increases by 54 cm^2 . If the second dimension of the cuboid increases by 2 cm, the surface area of the cuboid increases by 96 cm^2 . If the third dimension of the cuboid increases by 3 cm, its surface area increases by 126 cm^2 . Find the dimensions of the cuboid.
- 24 The admission fee at a small fair is \$1.50 for children and \$4.00 for adults. On a certain day, 2200 people entered the fair and \$5050 is collected. How many children and adults attended?
- 25 The sum of the digits of a two-digit number is 7. When the digits are reversed, the number is increased by 27. Find the number.
- 26 A landscaping company placed two orders with a nursery. The first order was for 13 bushes and 4 trees, and totaled \$487. The second order was for 6 bushes and 2 trees, and totaled \$232. The bills do not list the per-item price. What were the costs of one bush and of one tree?

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- 27 Dr. JC provides vaccinations against polio and measles. Each polio vaccination consists of 4 doses and each measles vaccination consists of 2 doses. Last year, Dr. JC gave a total of 60 vaccinations that consisted of a total of 184 doses. How many polio vaccinations and measles vaccinations did Dr. JC give last year?
- 28 Krystal bought 3 liters of milk and 5 loaves of bread for a total of \$11. A month later, he bought 4 liters of milk and 4 loaves of bread at the same prices for a total of \$10. How much does a liter of milk cost and a loaf of bread cost?
- 29 LauB genetically engineered a new type of fir tree and a new type of pine tree. The combined height of one fir tree and one pine tree is 21 meters. The height of 4 fir trees stacked on top of each other is 24 meters taller than one pine tree. How tall are the types of trees that LauB genetically engineered?
- 30 Soso lived in Portugal and Brazil for a total period of 14 months in order to learn Portuguese. He learnt an average of 130 new words per month when he lived in Portugal and an average of 150 new words per month when he lived in Brazil. In total, he learnt 1920 new words. How long did Soso live in Portugal and live in Brazil?
- 31 Tom's bookstore sold 40 notebooks and 20 newspapers for a total of \$130. A day later, the bookstore sold 8 notebooks and 4 newspapers at the same prices for a total of \$28. How much does a notebook and a newspaper cost at Tom's bookstore?
- 32 Tina inflated a huge balloon in 19 minutes. Then she poked a hole in the balloon so that it slowly leaked air out until it was completely deflated. The rate at which the air leaked out of the balloon (in liters of air per minute) was half of the rate at which Tina inflated the balloon. It took the balloon 38 minutes to completely deflate. At what rate did Tina inflate the balloon and at what rate did the balloon deflate?
- 33 When Jimmy charges his phone, it gains 2 percentage points each minute. When Jimmy uses his phone, it loses 5 percentage points each minute. Once, Jimmy used his phone for some time and then charged it for twice the amount of time he used it. In the end, his phone lost 10 percentage points. How long did Jimmy use his phone and how long did he charge it?
- 34 JC's Fashion Store is world renowned for its buttoned uniforms. A collection of 36 shirts and 42 jackets contains 842 buttons. A collection of 6 shirts and 7 jackets contains 137 buttons. Each shirt has the same number of buttons and each jacket has the same number of buttons. How many buttons are there in a JC's Fashion shirt and how many buttons are there in a jacket?

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- 35 Jacky and Oliva are adventurous travelers. They skydive twice in every island they visit and skydive thrice in every peninsula he visits. In the last year, they went skydiving a total of 45 times in the 19 islands and peninsulas that he visited. How many islands and Peninsulas did they visit?
- 36 The Capulet and Montague families love writing. Last year, each Capulet wrote 4 essays and each Montague wrote 6 essays, and both families wrote 100 essays in total. This year, each Capulet wrote 8 essays and each Montague wrote 12 essays, and both families wrote 200 essays in total. How many Capulets and Montagues are there?
- 37 Julianna is at a Parisian café with her friend. A local in front of Julianna bought a cup of coffee and a croissant for 5.30 Euro. When Julianna and her friend get 2 cups of coffee and 2 croissants, they are charged 14 Euro. What is the price of a cup of coffee and a croissant?
- 38 The four-digit number has a digit sum of 20. The sum of its last two digits is equal to its second digit increased by 5, the sum of its outer digits equals to its second digit decreased by 3. If we write the digits of the number in reverse order, the number increases by 2178. Find the number.
- 39 A cylinder made out of the yellow copper has the weight of 6297 kg and the volume of 750 cm^3 . Given that the density of copper is 8900 kg/m^3 , and the density of zinc is 7100 kg/m^3 . How many kilograms of copper and zinc the cylinder contains?
- 40 By adding 30 kg of pure tin we have to prepare a bronze alloy A made out of 75% of copper and 25% of tin. For our disposal we have a bronze alloy B made out of 85% of copper and 15% of tin. How many kilograms of the of the alloy B do we have to use and how many kilograms of the alloy A will we obtain?
- 41 Two containers contain a water of different temperatures. If we mix 240 g of water from the first container with 260 g of water from the second container, the resulting water temperature will be 52°C . If we mix 180 g of water from the first container with 120 g of water from the second container, the resulting water temperature will be 46°C . what is the temperature of water in the containers?
- 42 How many grams of an 80% solution and how many grams of a 54% solution do we have to mix in order to obtain 100 g of a 60% solution? (% is meant as by weight)
- 43 How many liters of a 30% solution and how many liters of a 50% solution do we have to mix in order to obtain 25 liters of a 42% solution? (% is meant as by volume)
- 44 The sulfuric acid consists of hydrogen, oxygen and sulfur, wherein the weight ratio of the hydrogen and the sulfur in 1:16 and the weight ratio of the oxygen and the sulfur is 2:1. How many of each element contains 1323 grams of the acid?

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Special Question

45 The Norwegian economist Trygve M. Haavelmo (Nobel laureate 1989) devised a model for the U.S. economy for the years 1929–1941 based on the following equations:

1. $c = 0.712y + 95.05$

2. $s = 0.158(c + x) - 34.30$

3. $y = c + x - s$

4. $x = 93.53$

Here x denotes total investment, y is disposable income, s is the total saving s by firms, and c is total consumption. Write the system of linear equations in standard form with the variables in the order x , y , s , and c . Solve the system.¹

¹ From Sydsæter and Hammond, *Essential Mathematics for Economics*, Chap. 15