SIMULTANEOUS EQUATIONS 2

1) Three bags and four pens together cost 257 dollars whereas four bags and three pens together cost 324 dollars. Find the cost of a bag.

2) The difference of two numbers is 3, and the sum of three times the larger one and twice the smaller one is 19. Find the two numbers.

3) A father is 28 years older than his daughter. In 2 years' time he will be three times as old as his daughter. Find their present ages.

4) The admission fee at a small fair is $1.50 for children and $4.00 for adults. On a certain day, 2200 people enter the fair and $5050 is collected. How many children and how many adults attended?

5) There are 13 animals in the barn. Some are chickens and some are pigs. There are 40 legs in all. How many of each animal are there?

6) A group of 195 students went on a field trip. They took 7 vehicles, some cars and some buses. Find the number of cars and the number of buses they took if each car holds 5 students and each bus hold 45 students.

7) The school is selling tickets to a choral performance. On the first day of ticket sales the school sold 3 senior tickets and 1 child ticket for a total of €38. The school took in €52 on the second day by selling 3 senior tickets and 2 child tickets. Find the price of a senior citizen ticket and the price of a child ticket.

8) A test has twenty questions worth 100 points. The test consists of True/False questions worth 3 points each and multiple choice questions worth 11 points each. How many multiple choice questions are on the test?

9) The Lakers scored a total of 80 points in a basketball game against the Bulls. The Lakers made a total of 37 two-point and three-point baskets. How many two-point shots did the Lakers make? How many three-point shots did the Lakers make?

10) A company employs 60 people. Of this amount, 16% of the men wear glasses and 20% of the women also wear glasses. If the total number of people who wear glasses is 11, how many men and women are there in the company?

11) In three years' time a pet mouse will be as old as his owner was four years ago. Their present ages total 13 years. Find the age of each now.

12) A train covers the distance between two cities A and B at 70 km/h during certain time. If it goes 10km/h faster, it will cover the same distance in one hour less. Find the distance between the two cities and the time it takes to do the first trip.

SOLUTION

1) Three bags and four pens together cost 257 dollars whereas four bags and three pens together cost 324 dollars. Find the cost of a bag.

$$\begin{cases} \text{Cost of a bag } x \\ \text{Cost of a pen } y \end{cases} \rightarrow \begin{cases} 3x + 4y = 257 \\ 4x + 3y = 324 \end{cases}$$

$$\begin{array}{l} \times(-4) \rightarrow -12x - 16y = -1028 \\ \times(3) \rightarrow \quad 12x + 9y = 972 \end{array} \Big\} \rightarrow -7y = -56 \rightarrow y = 8 \rightarrow 3x = 225 \rightarrow 75$$

ANSWER: A bag costs 75 dollars

2) The difference of two numbers is 3, and the sum of three times the larger one and twice the smaller one is 19. Find the two numbers.

$$\begin{cases} \text{the larger one } x \\ \text{the smaller one } y \end{cases} \rightarrow \begin{cases} x - y = 3 \\ 3x + 2y = 19 \end{cases} \rightarrow x = 3 + y \rightarrow 3(3 + y) + 2y = 19$$

$$9 + 3y + 2y = 19 \rightarrow 5y = 10 \rightarrow y = 2 \Rightarrow x = 3 + 2 \rightarrow x = 5$$

ANSWER: Numbers are 5 and 2

3) A father is 28 years older than his daughter. In 2 years' time he will be 3 times as old as his daughter. Find their present ages.

$$\begin{cases} \text{father's age } x \\ \text{daughter's age } y \end{cases} \rightarrow \begin{cases} x = y + 28 \\ x + 2 = 3(y + 2) \end{cases} \rightarrow x = y + 28 \rightarrow y + 28 = 3y + 6$$

$$28 - 6 = 3y - y \rightarrow 2y = 22 \rightarrow y = 11 \Rightarrow x = 11 + 28 = 39$$

ANSWER: The father is 39 years old and the daughter is 11 years old

4) The admission fee at a small fair is $1.50 for children and $4.00 for adults. On a certain day, 2200 people enter the fair and $5050 is collected. How many children and how many adults attended?

$$\begin{cases} \text{number of children } x \\ \text{number of adults } y \end{cases} \rightarrow \begin{cases} x + y = 2200 \\ 1.50x + 4y = 5050 \end{cases} \rightarrow y = 2200 - x$$

$$1.5x + 4(2200 - x) = 5050 \rightarrow 1.5x + 8800 - 4x = 5050 \rightarrow -2.5x = -3750$$

$$x = \frac{-3750}{-2.5} = 1500 \Rightarrow y = 2200 - 1500 = 700$$

ANSWER: They attended 1500 children and 700 adults

5) There are 13 animals in the barn. Some are chickens and some are pigs. There are 40 legs in all. How many of each animal are there?

$$\begin{cases} \text{number of chickens } x \\ \text{number of pigs } y \end{cases} \rightarrow \begin{cases} x + y = 13 \\ 2x + 4y = 40 \end{cases} \rightarrow \begin{array}{l} \times(-2) \rightarrow -2x - 2y = -26 \\ \quad\quad\quad\quad 2x + 4y = 40 \end{array} \Big\}$$

$$\rightarrow 2y = 14 \rightarrow y = 7 \Rightarrow x + 7 = 13 \rightarrow x = 6$$

ANSWER: There are 6 chicken and 7 pigs in the barn

6) A group of 195 students went on a field trip. They took 7 vehicles, some cars and some buses. Find the number of cars and the number of buses they took if each car holds 5 students and each bus hold 45 students.

$$\left. \begin{matrix} \text{number of cars } x \\ \text{number of buses } y \end{matrix} \right\} \rightarrow \left. \begin{matrix} x + y = 7 \\ 5x + 45y = 195 \end{matrix} \right\} \rightarrow y = 7 - x \rightarrow 5x + 45(7 - x) = 195$$

$$5x + 315 - 45x = 195 \rightarrow 315 - 195 = 45x - 5x \rightarrow 40x = 120 \rightarrow x = 3 \rightarrow y = 4$$

ANSWER: They took 3 cars and 4 buses

7) The school is selling tickets to a choral performance. On the first day of ticket sales the school sold two senior tickets and two child ticket for a total of €40. The school took in €88 on the second day by selling four senior tickets and five child tickets. Find the price of a senior ticket and the price of a child ticket.

$$\left. \begin{matrix} \text{price senior ticket } x \\ \text{price child ticket } y \end{matrix} \right\} \rightarrow \left. \begin{matrix} 2x + 2y = 40 \\ 4x + 5y = 88 \end{matrix} \right\} \begin{matrix} \times(-2) \rightarrow -4x - 4y = -80 \\ 4x + 5y = 88 \end{matrix} \right\} \rightarrow y = 8$$

$$2x + 2 \times 8 = 40 \Rightarrow 2x = 40 - 16 \Rightarrow 2x = 24 \Rightarrow x = 12$$

ANSWER: Senior ticket costs €12 and child ticket €8

8) A test has twenty questions worth 100 points. The test consists of True/False questions worth 3 points each and multiple choice questions worth 11 points each. How many multiple choice questions are on the test?

$$\left. \begin{matrix} \text{number of True/False questions } x \\ \text{number of multiple choice questions } y \end{matrix} \right\} \rightarrow \left. \begin{matrix} x + y = 20 \\ 3x + 11y = 100 \end{matrix} \right\} \rightarrow y = 20 - x$$

$$3x + 11(20 - x) = 100 \Rightarrow 3x + 220 - 11x = 100 \Rightarrow -8x = -120 \Rightarrow x = 15 \rightarrow y = 5$$

ANSWER: There are 5 multiple choice questions

9) The Lakers scored a total of 80 points in a basketball game against the Bulls. The Lakers made a total of 37 two-point and three-point baskets. How many two-point shots did the Lakers make? How many three-point shots did the Lakers make?

$$\left. \begin{matrix} \text{Three - point shots } x \\ \text{Two - point shots } y \end{matrix} \right\} \rightarrow \left. \begin{matrix} x + y = 37 \\ 3x + 2y = 80 \end{matrix} \right\} \rightarrow y = 37 - x \rightarrow 3x + 2(37 - x) = 80$$

$$3x + 74 - 2x = 80 \Rightarrow 3x - 2x = 80 - 74 \Rightarrow x = 6 \rightarrow y = 31$$

ANSWER: The Lakers made 6 three-point shots

10) A company employs 60 people. Of this amount, 16% of the men wear glasses and 20% of the women also wear glasses. If the total number of people who wear glasses is 11, how many men and women are there in the company?

$$\begin{cases} \text{Men in the company } x \\ \text{Women in the company } y \end{cases} \rightarrow \left.\begin{array}{l} x + y = 60 \\ 0.16x + 0.2y = 11 \end{array}\right\} \rightarrow y = 60 - x$$

$$0.16x + 0.2(60 - x) = 11 \Rightarrow 0.16x + 12 - 0.2x = 11 \Rightarrow -0.04x = -1 \Rightarrow x = 25 \rightarrow y = 35$$

ANSWER: There are 25 men and 35 women in the company

11) In three years' time a pet mouse will be as old as his owner was four years ago. Their present ages total 13 years. Find the age of each now.

	Now	In three years' time	Four years ago
Mouse's age	x	x + 3	x - 4
Owner's age	y	Y + 3	Y - 4

$$\left.\begin{array}{l} x + y = 13 \\ x + 3 = y - 4 \end{array}\right\} \rightarrow y = 13 - x \Rightarrow x + 3 = 13 - x - 4 \rightarrow 2x = 6 \rightarrow x = 3$$

$$x = 3 \rightarrow y = 13 - x = 13 - 3 = 10$$

ANSWER: The pet mouse is 3 years old and the owner 10

12) A train covers the distance between two cities A and B at 70 km/h during certain time. If it goes 10km/h faster, it will cover the same distance in one hour less. Find the distance between the two cities and the time it takes to do the first trip.

	Speed	Distance	Time
1st travel	70 km/h	x	y
2nd travel	80 km/h	x	Y - 1

$$d = \text{speed} \cdot \text{time} \rightarrow \left.\begin{array}{l} x = 70y \\ x = 80(y - 1) \end{array}\right\} \rightarrow 70y = 80y - 80 \Rightarrow 10y = 80 \rightarrow y = 8$$

$$d = \text{speed} \cdot \text{time} = 70y = 70 \cdot 8 = 560$$

ANSWER: It takes 8 hours and the distance between the two cities is 560 km