IES MURILLO

Maths 3rd ESO

EXAM 2_3 (Simultaneous equations)

Name:_____

1. Solve the following equations: (2.5 points)
   a) $x+3(x+3)=5[(2-3x)-(x-3)]+3$
   b) $\frac{3(x^2-11)}{5}-\frac{2(x^2-60)}{7}=36$
   c) $2(x-1)^2+3x-(x+1)^2-x^2=2x-11$

2. A hunter and his dog, 230 km away from each other, are going to meet. The speed of the hunter is 5km/h and the speed of the dog is 12km/h. If the dog left 5 hours before, where and when will they meet? (1.5 points)

3. In a parking lot, there are 458 vehicles; cars and motorcycles. Find the number of each type of vehicle knowing that in total there are 1764 wheels. (1.5 points)

4. Solve the simultaneous equation: (1.5 points)

$$\left.\begin{array}{l} 2x+y=1 \\ 2x^2+y^2=3 \end{array}\right\}$$

5. Classify these systems depending on the number of solutions. In order to solve them use the most convenient method in each one (and graphing): (3 points)

a) $\left.\begin{array}{l} x-2y=7(1-y) \\ 2(x+y)-3(y-2)=x-6y \end{array}\right\}$

b) $\left.\begin{array}{l} 2x+\frac{3y}{4}=5 \\ 5x-\frac{y}{2}=3 \end{array}\right\}$

SOLUTION

1.

a) $x+3(x+3)=5[(2-3x)-(x-3)]+3 \rightarrow x+3x+9=5(2-3x-x+3)+3$

$x+3x+9=10-15x-5x+15+3 \rightarrow 24x=19 \rightarrow x=\frac{19}{24}$

b) $\frac{3(x^2-11)}{5}-\frac{2(x^2-60)}{7}=36 \rightarrow \frac{21(x^2-11)}{35}-\frac{10(x^2-60)}{35}=\frac{1260}{35}$

$21x^2-231-10x^2+600=1260 \rightarrow 11x^2-891=0 \rightarrow 11x^2=891$

$x^2=\frac{891}{11}=81 \rightarrow x=\pm\sqrt{81} \rightarrow x=\pm 9$

c) $2(x-1)^2+3x-(x+1)^2-x^2=2x-11$

$2(x^2-2x+1)+3x-(x^2+2x+1)-x^2=2x-11$

$2x^2-4x+2+3x-x^2-2x-1-x^2=2x-11 \rightarrow -3x+1=2x-11 \rightarrow x=\frac{12}{5}$

2. A hunter and his dog, 230 km away from each other, are going to meet. The speed of the hunter is 5km/h and the speed of the dog is 12km/h. If the dog left 5 hours before, where and when will they meet?

	speed	distance	time
hunter	5 km/h	230 - x	y
dog	12 km/h	x	y + 5

$d=s\cdot t \rightarrow \begin{cases} 230-x=5y \\ x=12(5+y) \end{cases} \rightarrow \begin{cases} x=230-5y \\ x=60+12y \end{cases} \rightarrow 230-5y=60+12y$

$230-60=5y+12y \rightarrow 170=17y \rightarrow y=10 \text{ hours}$

$x=230-5y=230-50=180$

ANSWER: They will meet after 10 hours (the hunter) and 50 km from the place the hunter left

3. In a parking lot, there are 458 vehicles; cars and motorcycles. Find the number of each type of vehicle knowing that in total there are 1764 wheels.

$\left.\begin{cases} x=\text{cars} \\ y=\text{motorcycles} \end{cases} \rightarrow \begin{matrix} x+y=458 \\ 4x+2y=1764 \end{matrix}\right\} \rightarrow \left.\begin{matrix} -2x-2y=-916 \\ 4x+2y=1764 \end{matrix}\right\} \rightarrow 2x=848$

$x=424 \rightarrow y=458-424=34$

ANSWER: there are 424 cars and 34 motorcycles in the parking

4. Solve the simultaneous equation:

$\left.\begin{matrix} 2x+y=1 \\ 2x^2+y^2=3 \end{matrix}\right\} \rightarrow y=1-2x \Rightarrow 2x^2+(1-2x)^2=3 \rightarrow 2x^2+1-4x+4x^2=3$

$6x^2-4x-2=0 \rightarrow 3x^2-2x-1=0 \rightarrow x=\frac{2\pm\sqrt{4+12}}{6}=\begin{cases} 1 \\ -\frac{1}{3} \end{cases}$

$$y = 1 - 2x = \begin{cases} 1 - 2 \cdot 1 = -1 \\ 1 - 2 \cdot \left(-\frac{1}{3}\right) = 1 + \frac{2}{3} = \frac{5}{3} \end{cases}$$

SOLUTION: $x_1 = 1, y_1 = -1$ and $x_1 = -\frac{1}{3}, y_1 = \frac{5}{3}$

5. Classify these systems depending on the number of solutions. In order to solve them use the most convenient method in each one (and graphing):

a) $\left.\begin{array}{l} x - 2y = 7(1 - y) \\ 2(x + y) - 3(y - 2) = x - 6y \end{array}\right\} \rightarrow \left.\begin{array}{l} x - 2y = 7 - 7y \\ 2x + 2y - 3y + 6 = x - 6y \end{array}\right\}$ by addition:

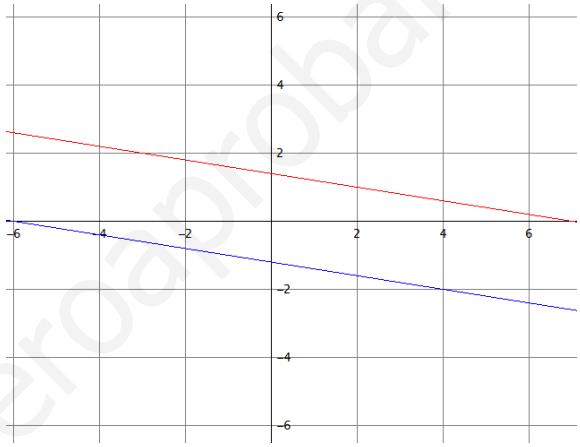
$\left.\begin{array}{l} x + 5y = 7 \\ x + 5y = -6 \end{array}\right\} \rightarrow 0x = 1$

No solution

By graphing:

$y = \frac{7 - x}{5}$	x	2	7
	y	1	0

$y = \frac{-6 - x}{5}$	x	-6	-1
	y	0	-1



PARALLEL LINES

INCONSISTENT SYSTEM

b) $\left.\begin{array}{l} 2x + \frac{3y}{4} = 5 \\ 5x - \frac{y}{2} = 3 \end{array}\right\} \rightarrow \left.\begin{array}{l} 8x + 3y = 20 \\ 10x - y = 6 \end{array}\right\} \rightarrow y = 10x - 6$ by substitution

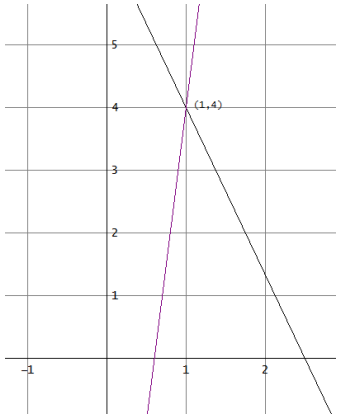
$8x + 3(10x - 6) = 20 \rightarrow 8x + 30x - 18 = 20 \rightarrow 38x = 38 \rightarrow x = 1$

$y = 10x - 6 = 10 - 6 = 4$ SOLUTION: x = 1, y = 4

By graphing:

$y = \frac{20 - 8x}{3}$	x	1	-2
	y	4	12

$y = 10x - 6$	x	1	0
	y	4	-6



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