# 4th lesson - Systems of equations

https://www2.karlin.mff.cuni.cz/~kuncova/en/teaching.php
kuncova@karlin.mff.cuni.cz

## Algorithm

1. Find, if there is an equation with product or division, which is equal to zero. This gives various conditions.
2. Consider every such case separately and apply to the other equations.
3. Solve the other equations - it gives solutions.
4. Write out all solutions from all cases.
5. Another way: express one variable using the others (be careful about dividing by a variable). Then apply to the other equations and solve.

## Exercises

Solve

1. (a)
$$\begin{aligned} 2x - 4 &= 0 \\ 2y + 2 &= 0 \end{aligned}$$

(b)
$$\begin{aligned} 2x + 3y - 5 &= 0 \\ 3x + 4y - 8 &= 0 \end{aligned}$$

(c)
$$\begin{aligned} 2x^2 + 3y^2 + 10x &= 0 \\ xy + 3y &= 0 \end{aligned}$$

(d)
$$\begin{aligned} 3x^2 - 3y &= 0 \\ 3y^2 - 3x &= 0 \end{aligned}$$

(e)
$$\begin{aligned} 2x - 2y + 2 &= 0 \\ -2x + 4y - 6 &= 0 \end{aligned}$$

(f)
$$\begin{aligned} 6x^2 - 6y &= 0 \\ -6x + 2y + 4 &= 0 \end{aligned}$$

(g)
$$\begin{aligned} y(5x + y - 15) + 5xy &= 0 \\ x(5x + y - 15) + xy &= 0 \end{aligned}$$

(h)
$$\begin{aligned} e^{y^2-2x^2} + xe^{y^2-2x^2}(-4x) &= 0 \\ 2yxe^{y^2-2x^2} &= 0 \end{aligned}$$

(i)
$$\begin{aligned} 3x^2 - 4x - 2y + z &= 0 \\ 2y - 2x - z &= 0 \\ 2z + x - y + 3 &= 0 \end{aligned}$$

2. (a)

$$\begin{aligned} 2x - 2 &= \lambda \\ 8y + 8 &= 2\lambda \\ x + 2y &= 7 \end{aligned}$$

(b)

$$\begin{aligned} 48 - 2x - 2y &= 5\lambda \\ 96 - 2x - 18y &= \lambda \\ 5x + y &= 54 \end{aligned}$$

(c)

$$\begin{aligned} 5 &= 2\lambda x \\ -3 &= 2\lambda y \\ x^2 + y^2 &= 136 \end{aligned}$$

(d)

$$\begin{aligned} 2x - 6 &= 2x\lambda \\ 2y + 6 &= 2y\lambda \\ x^2 + y^2 &= 4 \end{aligned}$$

(e)

$$\begin{aligned} yz &= \lambda \\ xz &= \lambda \\ yx &= \lambda \\ x + y + z &= 1 \end{aligned}$$

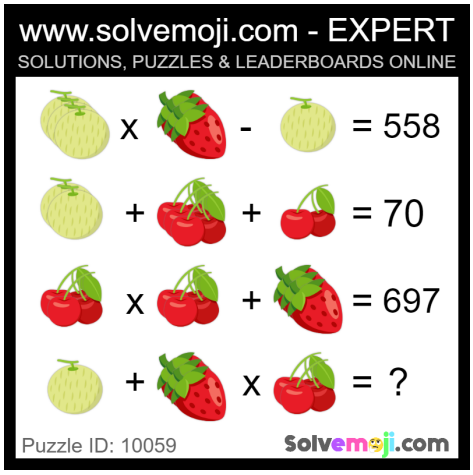
(f)

$$\begin{aligned} 2x &= \lambda(2x - 2) \\ 4y &= \lambda(4y + 4) \\ x^2 - 2x + 2y^2 + 4y &= 0 \end{aligned}$$

(g)

$$\begin{aligned} 2x &= \lambda \\ 3(y + 3) &= \lambda \\ 2(z - 2) &= -\lambda \\ x + y - z &= 1 \end{aligned}$$

3. (a) $|x - 1| + |x - 3| + |x - 5| = 4$
   (b) $||x - 1| - 2| < 1$
   (c) $|x - 1| - |x - 3| > x$
   (d) $|2x + 3| + |2x + 5| > |x - 1|$
   (e) $|x + 2| > |x| - x$
   (f) $|x + 2| > |x + 1| + x$
   (g) $|x - |x + 2|| < x$
   (h) $|x + |x + 2|| < 4x$

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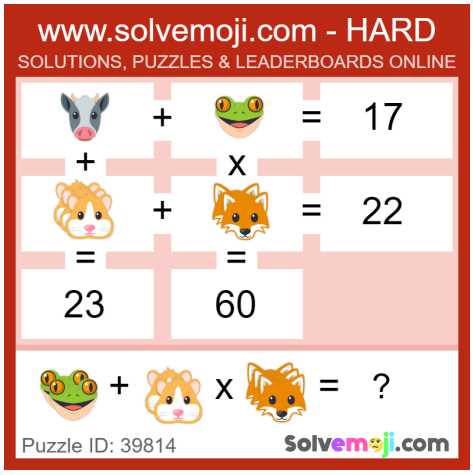


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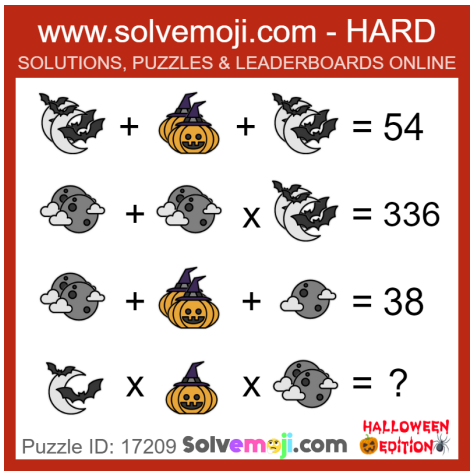


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