SAT MATH SECTION

Nonlinear Systems of Equations

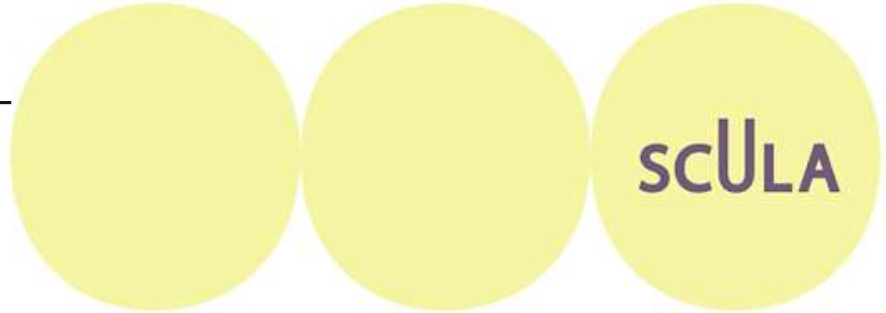
This session will be different.

We have discussed in the previous sessions the following :

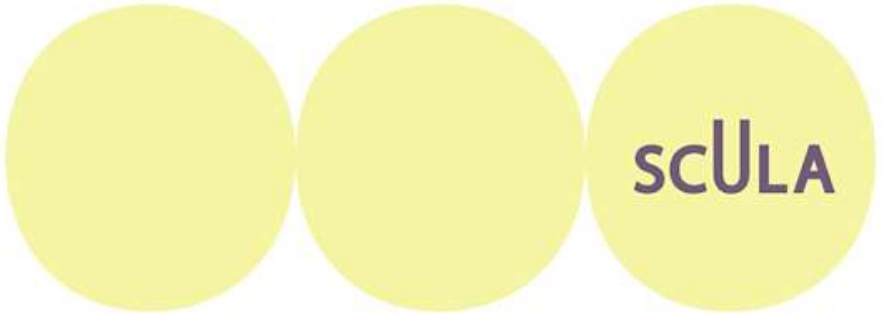
Quadratic equations

Linear Equations

Linear system of equations



This session we will see a mix of problem sets and use what learned so far .



Any system of equations is solved by elimination or substitution.

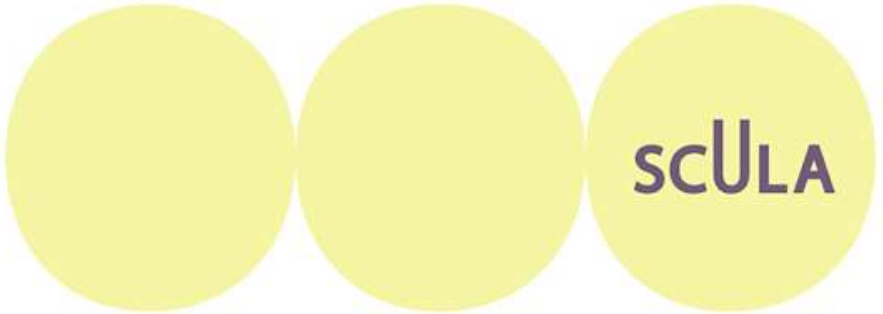
Nonlinear systems of equations are composed by linear and nonlinear equations .

The most classic questions in the SAT are comprised of circle equations and quadratic equations .

Problem : 1

$$If\ x^4 - y^4 = -15\ and\ x^2 - y^2 = -3\ what\ is\ the\ value\ of\ x^2 + y^2\ ?$$

The two equations represent a nonlinear system



Solution

$$x^4 - y^4 = -15$$

$$\Rightarrow (x^2 - y^2)(x^2 + y^2) = -15$$

$$\Rightarrow -3 \times (x^2 + y^2) = -15$$

$$\Rightarrow (x^2 + y^2) = \frac{-15}{-3} = 5$$

Problem :2

If the polynomial $p^4 + 4p^3 + 3p^2 - 4p - 4$ *can be written as* $(p^2 - 1)(p + 2)^2$ *what are all the roots of the polynomial?*

Solution

$$p^4 + 4p^3 + 3p^2 - 4p - 4 = (p^2 - 1)(p + 2)^2$$

$$p^4 + 4p^3 + 3p^2 - 4p - 4 = 0$$

$$\Rightarrow (p^2 - 1)(p + 2)^2 = 0$$

$$\Rightarrow (p^2 - 1) = 0 \ or \ (p + 2)^2 = 0$$

$$\Rightarrow (p - 1)(p + 1) = 0 \ or \ (p + 2) = 0$$

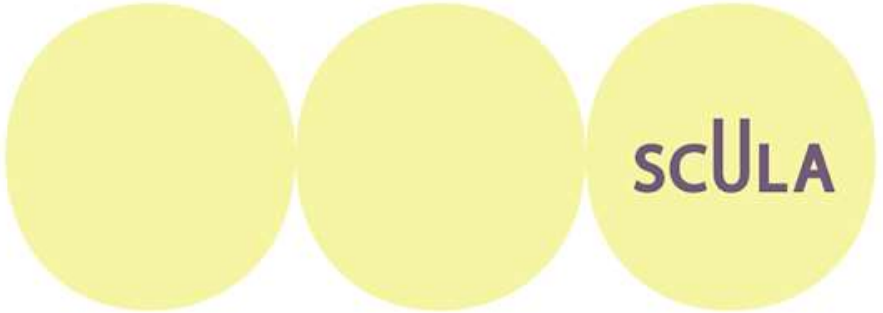
$$\Rightarrow p - 1 = 0 \ or \ p + 1 = 0 \ or \ p + 2 = 0$$

$$\Rightarrow p = 1 \ or \ p = -1 \ or \ p = -2$$

Problem :3

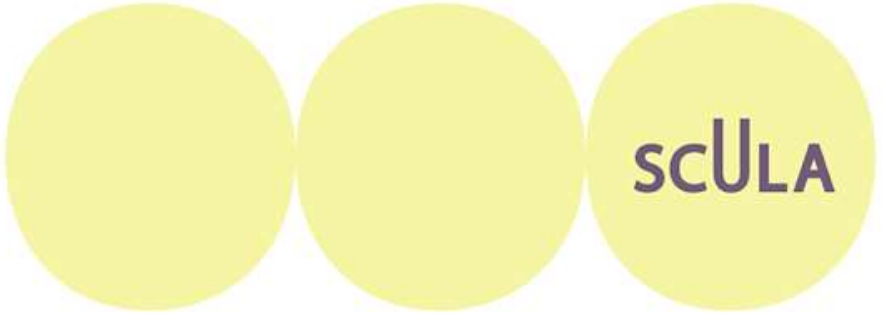
$$x^2 - 5x + 3 = 0$$

The solutions to the equation above can be written in the form $\frac{5 \pm \sqrt{k}}{2}$, where k is a constant. What is the value of k?



Solution

$$k = b^2 - 4ac$$
$$k = 25 - 12$$
$$k = 13$$



Problem :4

$$x(x+2)=8$$

Which of the following lists all solutions to the quadratic equation above?

- A. 8 and 6
- B. 4 and -2
- C. -4 and 2
- D. $\sqrt{6}$

SCULA

Solution

$$(E): \; x(x+2) = 8$$

$$\Rightarrow \; x^2 + 2x - 8 = 0$$

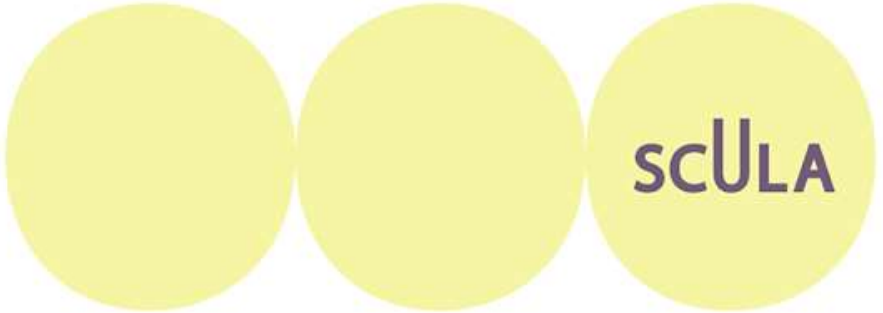
$$D = 4 - 4 \times (-8)$$

$$D = 36$$

$$x = \frac{-2 \pm \sqrt{36}}{2}$$

$$\Rightarrow x = 2 \; or \; x = -4$$

The equation has two real solutions 2 and -.4



THANK YOU!

DO YOU HAVE ANY QUESTIONS?