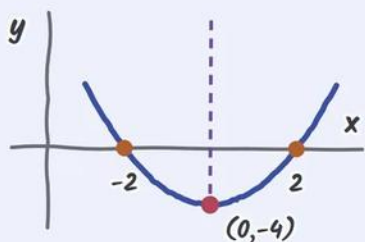


a line, a curve, and the two, one or none places they meet

What a nonlinear system is asking

- a system is two equations that have to hold at the same time. Nonlinear only means one of them is not a straight line, and on this test that curve is nearly always a parabola
- a solution is an ordered pair (x,y) satisfying both equations, and on a graph it is a point where the two graphs cross
- a line and a parabola can cross twice, touch once, or miss entirely, so the number of solutions is always two, one or zero
- the question almost never wants the full pair. Read the last line again: it asks for the positive x , or for y , or for the sum of the solutions



$y = x^2 - 4$ on its own. It meets the horizontal axis at -2 and at 2 , so pairing it with the line $y = 0$ gives a system with exactly those two solutions. The dashed line is the axis of symmetry and the lowest point sits on it

The setup, every single time

the curve, in the shape the question hands you

$$y = ax^2 + bx + c$$

the line

$$y = mx + k$$

set the two expressions for y equal, then collect on one side

$$Ax^2 + Bx + C = 0$$

the discriminant of THAT collected quadratic decides how many solutions

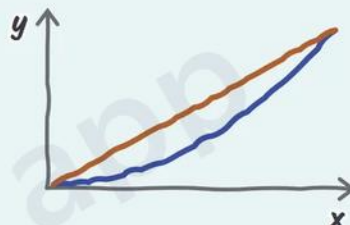
$$D = B^2 - 4AC$$

when both equations are already solved for y , substitution is nothing more than writing one expression equal to the other. When one is not, rearrange the easier of the two first

Worked: substitution start to finish

Q. $y = x^2 - 4$ and $y = x - 2$. If (x,y) is a solution of the system and $x > 0$, what is the value of y ?

- both equations already give y , so the two expressions are equal: $x^2 - 4 = x - 2$
- collect everything on one side: $x^2 - x - 2 = 0$
- factorise: $(x-2)(x+1) = 0$, so $x = 2$ or $x = -1$
- the question fixes $x > 0$, so $x = 2$. Substitute into the easier equation: $y = x - 2 = 2 - 2 = 0$
- check the other one: $x^2 - 4 = 4 - 4 = 0$, the same y , so the pair $(2,0)$ really does satisfy both



a curve and a straight line on one pair of axes. They set off from the same point on the left and come back together at the top, and each of those two meetings is one solution pair (x,y)

Answer $y = 0$, from the solution point $(2,0)$