Problem: Find the coefficients a, b, and c so that the graph of $f(x) = ax^2 + bx + c$ passes through the points (1, 2), (-1, 6), and (2, 3). From Linear Algebra by Jim Hefferon

Solution: f(1) = 2, f(-1) = 6, and f(2) = 3

So we set up a linear system.

$f(1) = a(1)^2 + b(1) + c = 2$

$f(-1) = a(-1)^2 + b(-1) + c = 6$

$f(2) = a(2)^2 + b(2) + c = 3$

So to solve this system, we set up an augmented matrix and solve it, using Gauss-Jordan elimination.

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| 1   1   1 | 2 |
| 1  -1   1 | 6 |
| 4   2   1 | 3 |
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$$R2 + -1(R1) = \left|\begin{array}{ccc|c} 1 & 1 & 1 & 2 \\ 0 & -2 & 0 & 4 \\ 4 & 2 & 1 & 3 \end{array}\right|$$

$$R3 + -4(R1) = \left|\begin{array}{ccc|c} 1 & 1 & 1 & 2 \\ 0 & -2 & 0 & 4 \\ 0 & -2 & -3 & -5 \end{array}\right|$$

$$R3 + -1(R2) = \left|\begin{array}{ccc|c} 1 & 1 & 1 & 2 \\ 0 & -2 & 0 & 4 \\ 0 & 0 & -3 & -9 \end{array}\right|$$

$$R1 + 1/2(R2) = \left|\begin{array}{ccc|c} 1 & 0 & 1 & 4 \\ 0 & -2 & 0 & 4 \\ 0 & 0 & -3 & -9 \end{array}\right|$$

$$R1 + 1/3(R3) = \left| \begin{array}{ccc|c} 1 & 0 & 0 & 1 \\ 0 & -2 & 0 & 4 \\ 0 & 0 & -3 & -9 \end{array} \right|$$

$$R2 * -1/2(R2) = \left| \begin{array}{ccc|c} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & -2 \\ 0 & 0 & -3 & -9 \end{array} \right|$$

$$R3 * -1/3(R3) = \left| \begin{array}{ccc|c} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & -2 \\ 0 & 0 & 1 & 3 \end{array} \right|$$

So, then $a = 1$, $b = -2$, and $c = 3$. We have found the coefficients of the quadratic equation that passes through the three points, (1, 2), (-1, 6), and (2, 3).

$f(x) = 1x^2 + -2x + 3$, or simply $f(x) = x^2 - 2x + 3$