Precalculus
Compute parabola with given vertex and passing through a point

Todor Milev

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Example
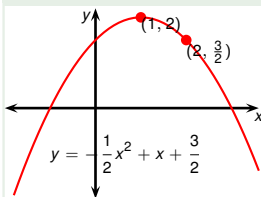
$y = -\dfrac{1}{2}x^2 + x + \dfrac{3}{2}$

Write an equation of a parabola with vertex at $(1, 2)$ that passes through the point $\left(2, \frac{3}{2}\right)$.

$$
\begin{aligned}
a(x - h)^2 + k &= y & & \text{Standard form} \\
a(x - 1)^2 + 2 &= y & & \text{Vertex at } (1, 2) \\
a(2 - 1)^2 + 2 &= \frac{3}{2} & & \text{Passes through } \left(2, \frac{2}{3}\right) \\
a &= \frac{3}{2} - 2 = -\frac{1}{2} & & \\
y &= -\frac{1}{2}(x - 1)^2 + 2 & & \text{Final answer} \\
y &= -\frac{1}{2}x^2 + x + \frac{3}{2} & & \text{Alternative answer}
\end{aligned}
$$