

Finding Max/Min Values Using Zeroes

Feb 8/2011

Our motivation for completing the square is generally to find the vertex of the quadratic relation.

It is also possible to find the vertex from the zeroes, or roots, of the quadratic, and the fact that the parabola is symmetric about the vertex.

In other words, the axis of symmetry is half-way between the zeroes, and it matches the x-coordinate of the vertex.

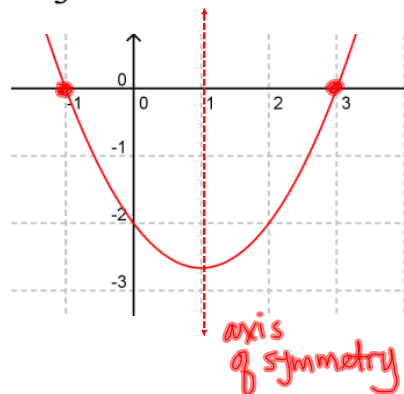
Sub this value into the equation to find the y-coordinate of the vertex, or the optimal value.

Feb 6-3:52 PM

Ex.1 Given the graph of $y = \frac{2}{3}x^2 - \frac{4}{3}x - 2$, determine the minimum value.

zeroes at $-1, 3$

$$\begin{aligned}x_{\text{vertex}} &= \text{MP}_{\text{zeroes}} \\ &= \frac{(-1) + (3)}{2} \\ &= \frac{2}{2} \\ &= 1\end{aligned}$$



To find y_{vertex} , sub x_v into eqn.

$$y = \frac{2}{3}(1)^2 - \frac{4}{3}(1) - \left(2 \times \frac{2}{3}\right)$$

$$y = \frac{2}{3} - \frac{4}{3} - \frac{6}{3}$$

$$y = -\frac{8}{3}$$

\therefore the min value is $-\frac{8}{3}$

Feb 7-8:57 PM

Ex.2 Find the optimal value of $y = -35(2x - 11)(3x + 5)$

* completing the square could be a difficult task

→ find zeroes, set $y = 0$

$$0 = -35(2x - 11)(3x + 5)$$

one of these must be zero

$$2x - 11 = 0 \quad \text{or} \quad 3x + 5 = 0$$

$$2x = 11$$

$$x = \frac{11}{2}$$

$$3x = -5$$

$$x = -\frac{5}{3}$$

$$x_v = \frac{\frac{11}{2} - \frac{5}{3}}{2}$$

$$= \frac{1}{2} \left(\frac{33}{6} - \frac{10}{6} \right)$$

$$= \frac{1}{2} \left(\frac{23}{6} \right)$$

$$x_v = \frac{23}{12}$$

$$\frac{-11 \times 6}{1 \times 6}$$

$$\frac{2}{12} = \frac{1}{6} \quad \frac{12}{2} =$$

$$y_v = -35 \left(2 \left(\frac{23}{12} \right) - 11 \right) \left(3 \left(\frac{23}{12} \right) + 5 \right)$$

$$y_v = -35 \left[\frac{23}{6} - \frac{66}{6} \right] \left[\frac{23}{4} + \frac{20}{4} \right]$$

$$y_v = -35 \left(-\frac{43}{6} \right) \left(\frac{43}{4} \right)$$

$$u_v = 64715$$

Feb 7-9:09 PM

Ex.3 The city transit system carries 24,800 bus riders per day for a fare of \$3.15. The city hopes to reduce car pollution by getting more people to ride the bus, while maximizing the transit system's revenue at the same time. A survey indicates that the number of riders will increase by 800 for every \$0.05 decrease in the fare. What fare will produce the greatest revenue?

$$R = (\# \text{ riders})(\text{fare})$$

$$= (24800 + 800x)(3.15 - 0.05x)$$

$$= (24800 + 800x)(3.15 - 0.05x)$$

let x represent # of \$0.05 decreases.

① find zeroes

② find MP

③ sub to find y vertex

Feb 7-9:20 PM

Ex.4 Find the optimal value of $y = -20x^2 + 180x + 4400$

Feb 7-9:09 PM

Homework: 14, 16 (prev. lesson)

p.115 # 2f, 3bcfgk, 9, 13

Feb 1-7:30 PM