

Find Minimum and Maximum Values and Zeros



Use appropriate tools strategically.

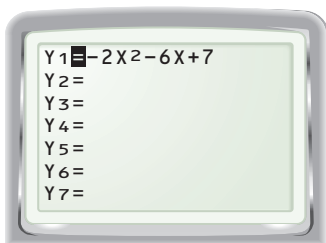
QUESTION How can you find the minimum or maximum value and the zeros of a quadratic function using a graphing calculator?

EXAMPLE 1 Find the maximum value of a function

Find the maximum value of the function $y = -2x^2 - 6x + 7$.

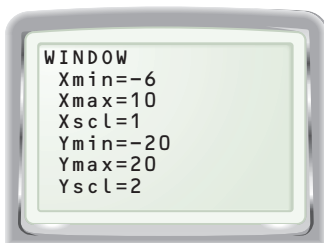
STEP 1 Enter the function

Press $\boxed{Y=}$ and enter the function $y = -2x^2 - 6x + 7$.



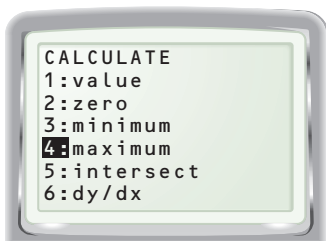
STEP 2 Adjust the window

Display the graph. Adjust the viewing window as needed so that the vertex of the parabola is visible.



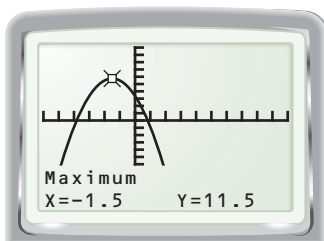
STEP 3 Use the maximum feature

The *maximum* feature is located under the CALCULATE menu.



STEP 4 Find the maximum value

Follow the graphing calculator's procedure to find the maximum of the function.



► The maximum value of the function $y = -2x^2 - 6x + 7$ is 11.5.

PRACTICE

Find the maximum or minimum value of the function.

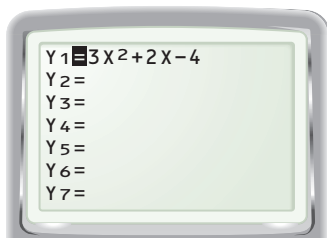
- $y = 3x^2 - 8x + 7$
- $y = -x^2 + 3x + 10$
- $y = -4x^2 - 6x - 6$
- $y = 5x^2 + 10x - 8$
- $y = -1.4x^2 + 3.8x - 6.1$
- $y = 2.57x^2 - 8.45x - 5.04$

EXAMPLE 2 Approximate the zeros of a function

Approximate the zeros of the function $y = 3x^2 + 2x - 4$.

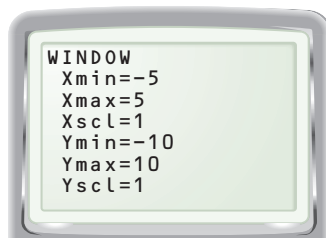
STEP 1 Enter the function

Press $\boxed{Y=}$ and enter the function
 $y = 3x^2 + 2x - 4$.



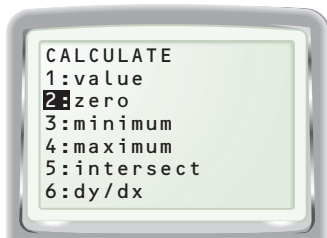
STEP 2 Adjust the window

Display the graph. Adjust the viewing window as needed so that the x -intercepts of the parabola are visible.



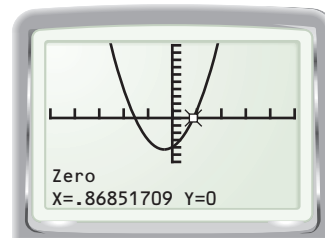
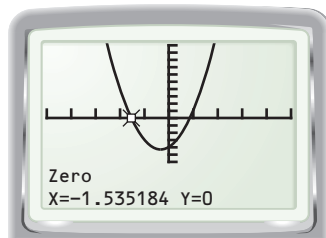
STEP 3 Use the zero feature

The *zero* feature is under the CALCULATE menu.



STEP 4 Find the zeros

Follow the graphing calculator's procedure to find a zero of the function. Then repeat the process to find the other zero.



► The zeros are about -1.54 and about 0.87 .

PRACTICE

Approximate the zeros of the quadratic function to the nearest hundredth.

- | | |
|--------------------------------|----------------------------------|
| 7. $y = 2x^2 - 5x - 8$ | 8. $y = -3x^2 + 6x - 2$ |
| 9. $y = -x^2 + 4x + 9$ | 10. $y = 4x^2 - 7x + 1$ |
| 11. $y = -2.5x^2 + 7.7x - 4.9$ | 12. $y = 1.56x^2 - 5.19x - 2.25$ |
| 13. $y = -0.82x^2 - 4x + 12.4$ | 14. $y = 5.36x^2 + 17x + 2.67$ |

DRAW CONCLUSIONS

- If a quadratic function has only one zero, what is the maximum or minimum value of the function? *Explain.*
- If a quadratic function has a maximum value that is greater than 0, how many zeros does the function have? *Explain.*