Graphing Calculator Lab

# The Family of Quadratic Functions

A quadratic function can be described by an equation of the form $ax^2 + bx + c$, where $a \neq 0$. The graph of a quadratic function is called a parabola. The parent function of the family of quadratic functions is $y = x^2$.

## EXAMPLE

Graph $y = x^2$ and $y = x^2 + 4$ and describe how they are related.

**Step 1** Enter the function $y = x^2$.

- Enter $y = x^2$ as Y1.

  KEYSTROKES: Y= X/θ/T/n $x^2$ ENTER

**Step 2** Enter the function $y = x^2 + 4$.

- Enter $y = x^2 + 4$ as Y2.

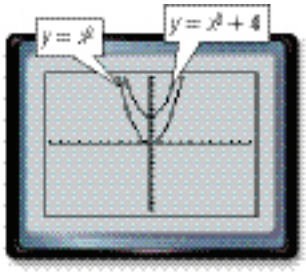
  KEYSTROKES: Y= X/θ/T/n $x^2$ + 4 ENTER

**Step 3** Graph both quadratic functions on the same screen.

- Display the graph.

  KEYSTROKES: ZOOM 6

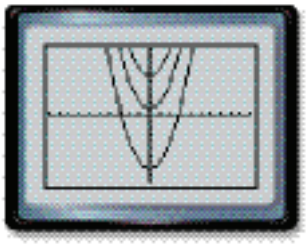
The first function graphed is Y1 or $y = x^2$. The second is Y2 or $y = x^2 + 4$. Press TRACE and move along each function by using the right and left arrow keys. Move from one function to another by using the up and down arrow keys.




The graphs are similar in that they are both parabolas. However, the graph of $y = x^2$ has its vertex at (0, 0), whereas the graph of $y = x^2 + 4$ has its vertex at (0, 4).

## EXERCISES

1. Graph $y = x^2$, $y = x^2 - 5$, and $y = x^2 - 3$ on the same screen and draw the parabolas on grid paper. Compare and contrast the three parabolas.
2. MAKE A CONJECTURE How does adding or subtracting a constant c affect the graph of a quadratic function?
3. The three parabolas at the right are graphed in the standard viewing window and have the same shape as the graph of $y = x^2$. Write an equation for each, beginning with the lowest parabola.



4. Clear all functions from the Y= menu. Enter $y = 0.4x^2$ as Y1, $y = x^2$ as Y2, and $y = 3x^2$ as Y3. Graph the functions in the standard viewing window on the same screen. Then draw the graphs on the same coordinate grid. How does the shape of the parabola change as the coefficient of $x^2$ increases?