

## Graphics Calculator Resources for Years 9 and 10

<b>Activity</b>	<i>Parabolic Aerobics</i>
<b>Year Group</b>	9
<b>Level</b>	1, 2
<b>Strand</b>	Algebra
<b>Sub-Strand</b>	Coordinate Geometry
<b>Author</b>	Based on <i>Parabola Guessing Game</i> , an activity from <i>Activities Integrating the TI-83+ into Algebra</i> by Vicki Fortson Shirley. Modified by Peter McIntyre (p.mcintyre@adfa.edu.au).
<b>Calculators</b>	TI-83 family
<b>Description</b>	The first activity investigates the effect of changing the numbers A, B and C on the graphs of the family of parabolas $Y=A(X-B)^2+C$ . In the second activity, you have to guess the numbers A, B and C for the graph of a mystery parabola generated by the PARABOLA program. The calculator checks your answers and keeps score.

# Parabolic Aerobics

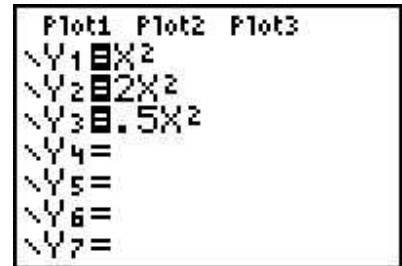
## Warm-ups

The graphics keys on the calculator are the top row. The  $\boxed{X,T,\theta,n}$  key (third row) is a quick way to get  $X$ , the independent variable that the calculator uses for its graphs.

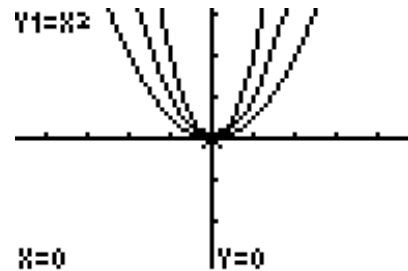
Set a WINDOW for plotting the graphs by pressing  $\boxed{ZOOM}$   $\boxed{4}$ .

### 1. Stretches and reflections

Press  $\boxed{Y=}$ . Set  $Y_1=X^2$ ,  $Y_2=2X^2$  and  $Y_3=0.5X^2$ .



Press  $\boxed{TRACE}$ . Use the arrow keys to see which graph is which.



Let  $A$  stand for the number multiplying  $X^2$ . You have just plotted graphs for  $A=1$ ,  $A=2$  and  $A=0.5$ .

Use your graphs to decide what happens when you multiply  $X^2$  by different positive numbers. Test your ideas with some other values of  $A$ , that is by graphing  $Y=AX^2$  for different values of  $A$ . Write down your conclusions in the space below.

What if  $A$  is a negative number? Again, test your ideas by plotting suitable graphs. Write down your conclusions in the space below.

## 2. Shifts or translations

Set  $Y_1=X^2$ ,  $Y_2=(X-2)^2$  and  $Y_3=(X+3)^2$ . What happens when you vary the number  $B$  in the family of graphs  $Y=(X-B)^2$ ? Test your ideas by trying some more values of  $B$ . Write down your conclusions in the space below.

Set  $Y_1=X^2$ ,  $Y_2=X^2+1$  and  $Y_3=X^2-2$ . What happens when you vary the number  $C$  in the family of graphs  $Y=X^2+C$ ? Test your ideas by trying some more values of  $C$ . Write down your conclusions in the space below.

## 3. Summary

In the space below, summarise the effects of changing the numbers  $A$ ,  $B$  and  $C$  in the family of graphs  $Y=A(X-B)^2+C$ .

## What parabola is that?

Run the PARABOLA program by pressing **PRGM** (fourth row, middle), pressing the number against the PARABOLA program and pressing **ENTER**.

As the first screen tells you, this program plots the graph of a mystery parabola  $Y=A(X-B)^2+C$  as a solid line, where A, B and C are generated randomly.

Just to make it a bit easier, A, B and C can take only a restricted number of values.

**A:**  $\pm 0.5$ ,  $\pm 1$  or  $\pm 2$ .

**B, C:** 0,  $\pm 1$  or  $\pm 2$ .

Press **ENTER** to generate the first mystery parabola. The program also plots the basic parabola  $Y=X^2$  as a dotted line to use for comparison.

Your job is to decide what values of A, B and C the calculator has chosen. When you have decided, press **ENTER** and input your values. The calculator will then plot the mystery parabola again as a solid line and the parabola with your values of A, B and C as a bold line. *Did you get the right values?*

Press **ENTER** again to see the calculator values, and **ENTER** once more for the NEXT... menu.

Here you can generate another mystery parabola by pressing **1**, increase or decrease the level of difficulty<sup>1</sup> or quit. When you quit, you will see your final score.

The PARABOLA program is available for download at [www.ma.adfa.edu.au](http://www.ma.adfa.edu.au) under *High School and College Activities*.

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<sup>1</sup>You start at Level 0, at which the graph of the mystery parabola remains on screen until you press **ENTER**. At higher levels, the parabola screen remains on view for a fixed time only; the higher the level, the shorter the time.