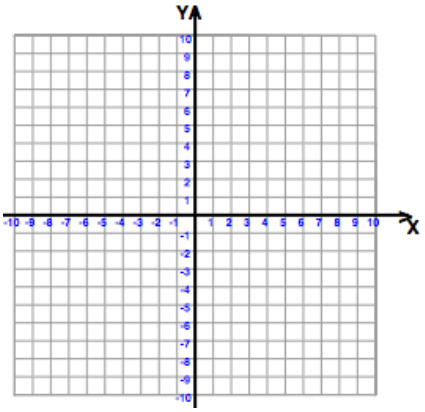
College Bound Math Problems #12
week of January 19, 2015

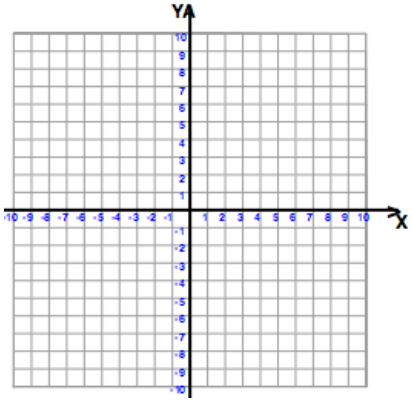
All three problems are about the parabolic shape: (1) graphing it, (2) learning about a variety of important applications and, (3) seeing that a parabola is the set of all points at the same distance from a given point and a given line.

1. For each function, find y for values of x from –4 to 1, plot the points, and draw the graph.

$y = (x + 1)^2$



$y = -(x + 2)^2 - 3$



2. A web search on Google yielded the following ways that parabolas are commonly used in the real world. Pick one and explain it to your mentor.

- making it easier to turn on skis
- the flight path of a smooth spherical ball
- the braking distance formula
- reflectors for car headlights and flashlights
- satellite dishes for TV reception
- radar antennas
- solar heating and energy

3. (a) Show that each of the points (0,1), (2,2) and (4,5) is equidistant from the x-axis and the point (0,2). **Hint**: The distance from a point to the *x*-axis is the magnitude of its *y*-coordinate. (Can you see why?)

(b) Find two more points each of which is equidistant from the *x*-axis and the point (0,2). **Hint**: You can use the reflection in the *y*-axis of two of the points given in part (a).

(c) Plot the first three points mentioned in (a) and the two points you found in (b). Draw a *smooth* curve through all five of them. Also plot (0,2) and darken the *x*-axis.

You have now plotted *some* of the points that are equidistant from a *particular* point and a *particular* line and you have seen that a smooth curve through them looks like a parabola. In fact, it is possible to *prove*, with ordinary algebra, that *all* of the points equidistant from *any* chosen point and line *must* lie on a parabola.