MCR3U 1.3 Maximum or minimum of a quadratic function

We can graph a quadratic function by determining its axis of symmetry, vertex, and step pattern if its equation is given in standard form:

$f(x) = ax^2 + bx + c$

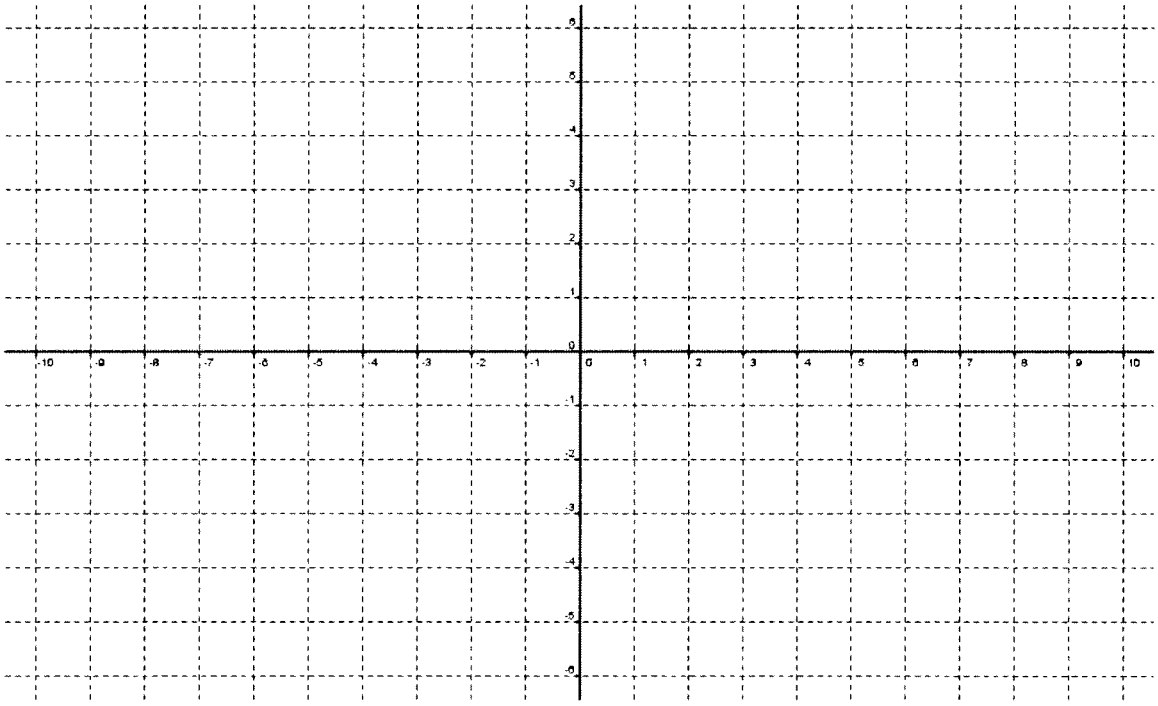
axis of symmetry: $x = \frac{-b}{2a}$

vertex: evaluate $f(x)$ at the axis of symmetry

step pattern: 1,3,5,7,... multiplied by the value of a

Ex. Graph the following parabolas and label each axis of symmetry, vertex, maximum, and minimum.

a) $f(x) = x^2 + 14x + 50$ b) $g(x) = 3x^2 + 6x - 3$ c) $h(x) = -2x^2 + 20x - 46$



We can use the axis of symmetry and vertex to solve problems involving maximum and minimum values of any quadratic function.

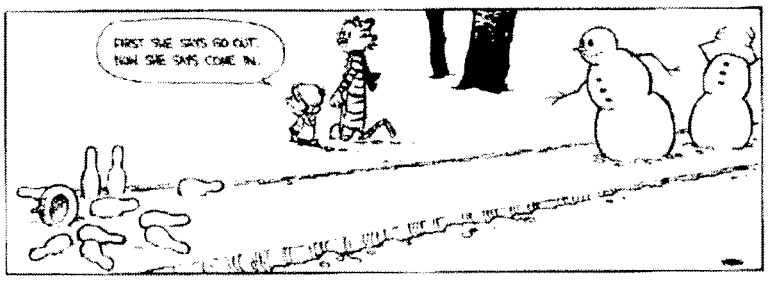
Ex. A soccer ball follows the path described by $h(t) = -4.9t^2 + 12t + 0.8$ where h represents the height (in metres) of the ball above the ground, and t represents the time in seconds after it was kicked.

a) Determine the maximum height the soccer ball reaches
b) Determine the initial height from which the ball was kicked
c) Sketch a graph of the path followed by the ball

Ex. A trucking company has modeled the monthly fuel cost for each truck $C(v) = 0.0035v^2 - 0.63v + 160$ where v represents the driving speed (in km/h) on the highway.

a) Determine the most efficient speed for the company to operate their trucks.
b) Determine the minimum monthly fuel cost for each truck.

Ex. Calvin and Hobbes run a bowling alley in the winter. The alley is usually booked for 200 hours each week at a rate of $10 per hour. Calvin wants to raise the hourly rate to maximize his revenue. Market research shows that for every $0.50 increase he will lose 4 hours of business each week.



a) Write an equation for his expected revenue after x number of $0.50 increases.
b) Determine the hourly rate that will maximise revenue.
c) Determine the maximum revenue.

Homework: p. 31 # 2ace, 3bdf, 6, 7, 8, 9.