Math 120 Intermediate Algebra

Quadratic Functions and Their Graphs

Vertex Form: \( f(x) = a(x - h)^2 + k \)

The graph of \( f(x) = a(x - h)^2 + k \) has the same shape as the graph of \( y = ax^2 \).

- If \( h > 0 \), the graph of \( y = ax^2 \) is shifted \( h \) units to the ________. \( \text{ex } f(x) = 2(x - 3)^2 \)
- If \( h < 0 \), the graph of \( y = ax^2 \) is shifted \( |h| \) units to the ________. \( \text{ex } f(x) = 2(x - (-3))^2 = 2(x + 3)^2 \)
- If \( k > 0 \), the graph of \( y = ax^2 \) is shifted \( k \) units ______. \( \text{ex } f(x) = 2x^2 + 3 \)
- If \( k < 0 \), the graph of \( y = ax^2 \) is shifted \( |k| \) units ______. \( \text{ex } f(x) = 2x^2 + (-3) = 2x^2 - 3 \)
- The vertex is \((h, k)\) and the axis of symmetry is \( x = h \).
- If \( a > 0 \), the parabola opens ____________ and the ____________ function value is \( k \).
- If \( a < 0 \), the parabola opens ____________ and the ____________ function value is \( k \).

Ex 1 Graph the function, label the vertex, draw the axis of symmetry, and find the maximum/minimum value (extremum).

a) \( f(x) = -\frac{3}{4}x^2 \)

b) \( g(x) = 3(x - 5)^2 \)
c) \( h(x) = -(x - 1)^2 + 2 \)

d) \( r(x) = \frac{3}{2} (x + 2)^2 - 4 \)

**Ex 2** Without graphing, find the vertex, the axis of symmetry, and the extremum.

a) \( f(x) = 2(x - 1)^2 - 10 \)  

b) \( f(x) = -2\pi(x - 0.01)^2 + \sqrt{15} \)

**Ex 3** Write an equation for a function having a graph with the same shape as the graph of \( f(x) = \frac{3}{5}x^2 \), but with the given point as the vertex.

a) \((9, -6)\)  

b) \((\text{Prac Prob}) \left(-1, \frac{2}{5}\right)\)

**Ex 4** Write the equation of the parabola that has the shape of \( f(x) = 2x^2 \) or \( g(x) = -2x^2 \) and has a maximum/minimum value at the specified point.

- Maximum; \((-4, 0)\)
- Minimum; \((-4, 0)\)