Mathematics 11U

3.1 – Properties of Quadratics

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Our dear friend from Grade 10 is back. What are quadratics?

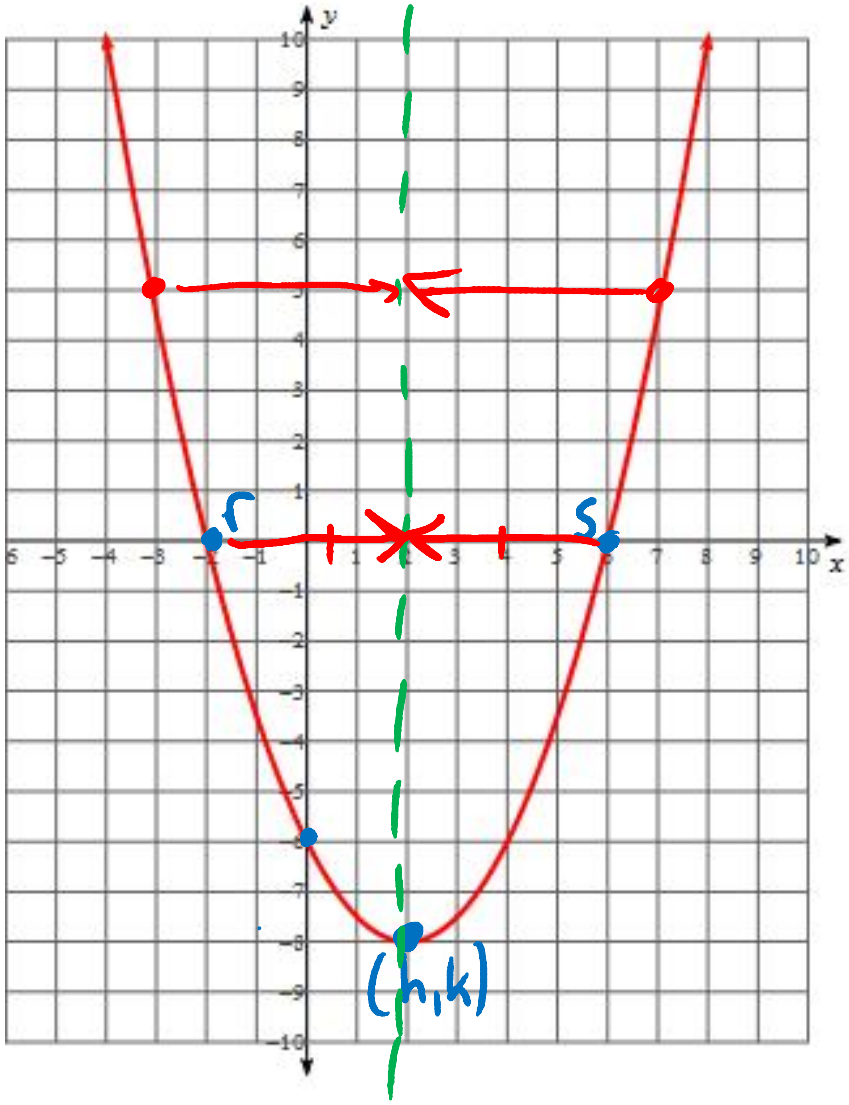
- Vertex : (h, k)
  - ↳ max or min
- x-intercepts / zeros / roots / solutions:

  $x = r$ and $x = s$

  $(r, 0)$ $(s, 0)$
- y-intercept

  $y = c$ $(0, c)$
- Axis of symmetry:

  $x = h$ $h = \frac{r+s}{2}$



Three forms (equations) of Quadratics:

If $a > 0$ ∪
$a < 0$ ∩

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

- vertex (h,k)
- graphing

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

- y-int of c
- great for solving quadratics

$f(x) = a(x-r)(x-s)$ Zeros Form or Factored Form

- gives r and s

Find the equation of the parabola:

$h = 2$ $\quad x = 6$

$k = -8$ $\quad y = 0$

$f(x) = a(x-h)^2 + k$

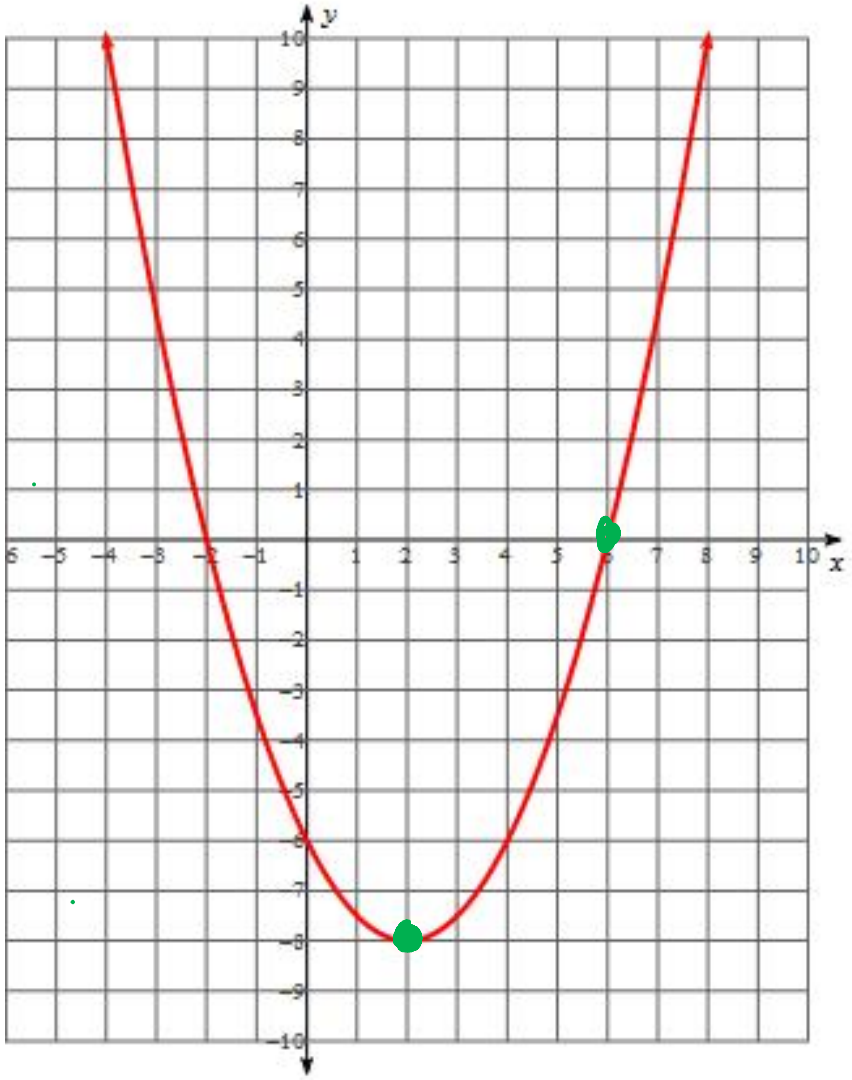
$0 = a(6-2)^2 - 8$

$8 = a(16)$

$\frac{8}{16} = a$

$\frac{1}{2} = a$

$\therefore f(x) = \frac{1}{2}(x-2)^2 - 8$



Write the standard form of the parabola:

$h = -6 \quad x = -5$

$k = 4 \quad y = 1$

$f(x) = a(x-h)^2 + k$

$1 = a(-5+6)^2 + 4$

$-3 = a(1)$

$-3 = a$

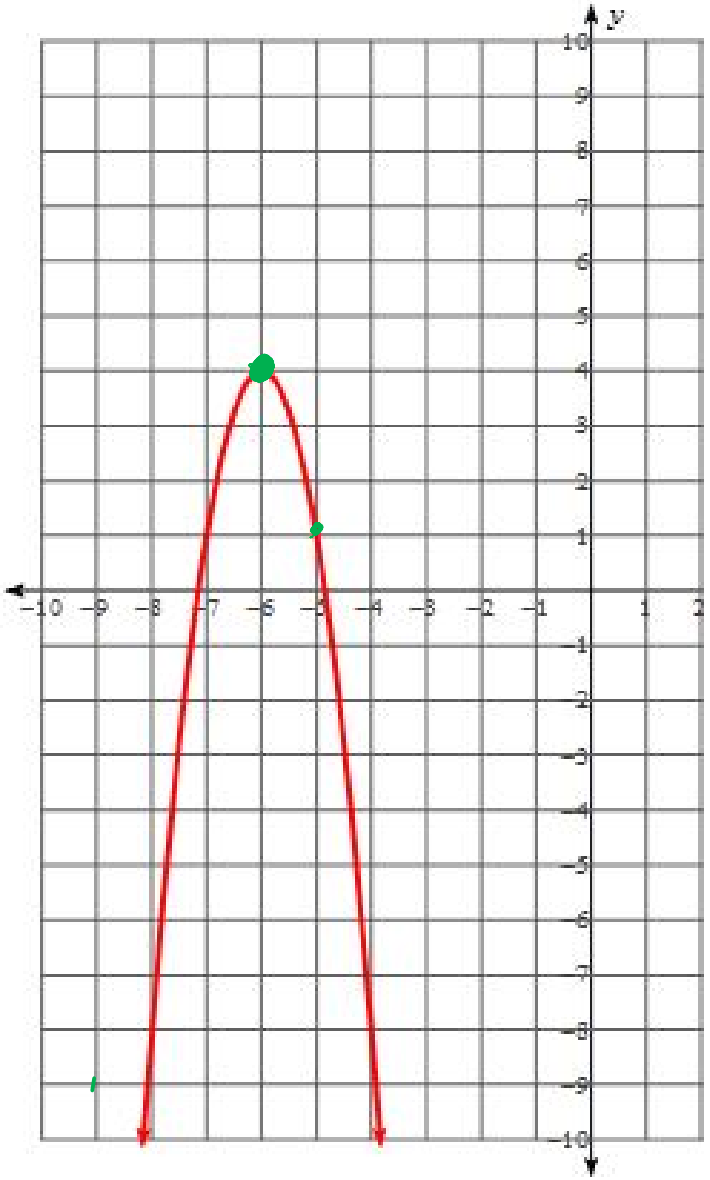
$\therefore f(x) = -3(x+6)^2 + 4$

$f(x) = -3(x+6)(x+6) + 4$

$f(x) = -3(x^2 + 12x + 36) + 4$

$f(x) = -3x^2 - 36x - 104$

y-int



Convert to Standard Form: Expand.

$f(x) = -2(x-4)(x+7)$

$f(x) = -2(x^2 + 7x - 4x - 28)$

$f(x) = -2x^2 - 6x + 56$

y-int is 56

$g(x) = \frac{1}{2}(x+4)^2 - 6$ (x+4)(x+4)

$g(x) = \frac{1}{2}(x^2 + 8x + 16) - 6$

$g(x) = \frac{1}{2}x^2 + 4x + 8 - 6$

$g(x) = \frac{1}{2}x^2 + 4x + 2$

y-int is 2

State the direction of opening, the equation of axis and the vertex:

$f(x) = 3(x+6)(x-2)$

since $3 > 0$, opens up

Zeros: $x = -6$, $x = 2$

AoS: $\frac{-6+2}{2} = \frac{-4}{2} = -2 = x$

→ Vertex $(-2, \_\_)$

$f(-2) = 3(-2+6)(-2-2)$

$f(-2) = 3(4)(-4)$

$f(-2) = -48$

∴ the vertex is $(-2, -48)$

Determine the equation of axis:

$(4, 3), (12, 3)$

AoS: $\frac{4+12}{2} = \frac{16}{2} = 8$