Quadratic Formula (§7-7)

A way to solve a quadratic equation algebraically.

- the equation must be written in standard form

$$ax^2 + bx + c = 0$$

- use only if you cannot solve by factoring

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \leftarrow \text{stuff}$$

$$x = \frac{-b \pm \sqrt{\text{stuff}}}{2a}$$

$(b^2 - 4ac)$

if stuff < 0, there are no real roots

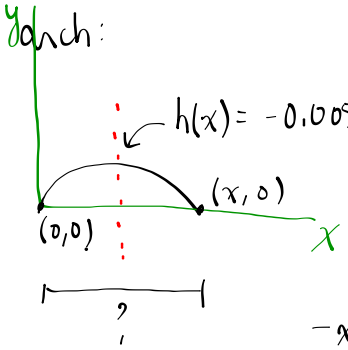
if stuff $= 0$, there is only 1 root (vertex is on x-axis)

if stuff > 0, there are two roots

§7-8 Solving Problems using Quadratic Models

Example 1

Determine the distance between the bases of the arch:



$-0.005061x^2 + 0.499015x = 0$

$-x(0.005061x - 0.499015) = 0$

$-x = 0$

$x = 0$

$0.005061x - 0.499015 = 0$

$0.005061x = 0.499015$

$x = \frac{0.499015}{0.005061}$

$x = 98.6\text{m}$

The distance between the bases of the bridge is 98.6m

What is the maximum height of the arch?

The maximum height (vertex) is halfway between the two ends.

$x = \frac{0 + 98.6}{2}$

$x = 49.3\text{m}$

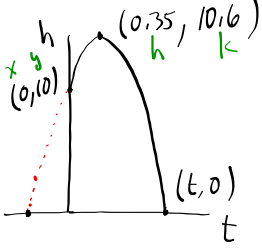
$h(x) = -0.005061x^2 + 0.499015x$

$h(49.3) = -0.005061(49.3)^2 + 0.499015(49.3)$

$h(49.3) = 12.3$

The height of the bridge is 12.3m

Example 3 (p434)



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

$10 = a(0-0.35)^2 + 10.6$

$10 = a(-0.35)^2 + 10.6$

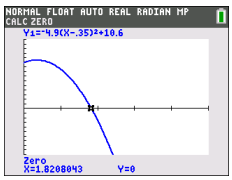
$-0.6 = a(-0.35)^2$

$a = \frac{-0.6}{(-0.35)^2}$

$a = -4.9$

equation: $y = -4.9(x-0.35)^2 + 10.6$

solve either by graphing on calc.
or algebraically.



$0 = -4.9(x-0.35)^2 + 10.6$

$-10.6 = -4.9(x-0.35)^2$

$2.16 = (x-0.35)^2$

$\pm\sqrt{2.16} = x - 0.35$

$\sqrt{2.16} = x - 0.35$ OR $-\sqrt{2.16} = x - 0.35$

$x = 0.35 + \sqrt{2.16}$

$x = 0.35 + 1.47$

$x = 1.82$ ←

The dive is in the air for 1.82s

$x = 0.35 - 1.47$

$x = -1.12$

extraneous (not in the domain $x \in \mathbb{R}, x \geq 0$)

TO DO

① CYU | 436

② p436-438 (omit 3,4,6-9,11,12)

③ Self Test (p440) (omit 5)

④ Chapter Review (p443-444) (omit 14,15+17)

TO DO

Examples 1 & 3 (Section 7-8)

① C4U | 436

② p436-438 (omit 3, 4, 6-9, 11, 12)

③ SelfTest (p440) (omit 5)

④ Chapter Review (p443-444) (omit 14, 15 + 17)

Quadratics

Standard form $y = ax^2 + bx + c$

Factored form $y = a(x - r)(x - s)$ r and s roots

Vertex form $y = a(x - h)^2 + k$ (h, k) vertex

Graphing

by hand
- table of values
- use factored form (roots, y-intercept, vertex)
- use vertex form (vertex, y-intercept, point to match y-intercept)
- use partial factoring
- use technology (min/max/zeros/intersections)

Solving Quadratics

if not, graph LS and RS → intersection

- graph + find zeros (tech) (must be in standard form)

algebraically
- factor (set equal to zero)
  - common factor
  - difference of squares
  - perfect square
  - simple trinomial
  - decomposition ?
- use quadratic formula (standard form = 0)

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

if $b^2 - 4ac > 0$ two roots

$b^2 - 4ac = 0$ one root

$b^2 - 4ac < 0$ no real roots