Level 2.

Red bird (0,0) vertex = (5,4) Pig (10,0)

Vertex Form

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

$0 = a(0-5)^2 + 4$

$-4 = a(-5)^2$

$\frac{25a}{25} = \frac{-4}{25}$ $a = -\frac{4}{25}$

$\Rightarrow y = -\frac{4}{25}(x-5)^2 + 4$

Intercept form.

x-intercepts → $x = 0$ $x = 10$

$y = (x-0)(x-10)$

Working: change from vertex to intercept.

$y = -\frac{4}{25}(x-5)(x-5) + 4$

$-\frac{4}{25}(x^2 - 10x + 25) + 4 \rightarrow -\frac{4}{25}x^2 + \frac{8}{5}x - 4 + 4$

$-\frac{4}{25}x^2 + \frac{8x}{5} = 0 \rightarrow \frac{25}{4} \times \frac{4}{25}x^2 - \frac{8}{5}x^{\times 25/4} = 0$

$\Rightarrow x^2 - 10x = 0$

$x(x-10) = 0$

$x = 0$ $x - 10 = 0$ $x = 10$

$\therefore y = (x-0)(x-10)$

⇒ How far was the Red bird after 2 secs.

General form = $x^2 - 10x = y$.

$x = 2 \rightarrow 2^2 - 10(2) = y$

Using intercept →

Using vertex → $y = -\frac{4}{25}(2-5)^2 + 4 \rightarrow -\frac{4}{25}(-3)^2 + 4$

$y = 2.56$ yards

Level 3

Red (0,0) Pig (15,3)

Starting (0,0)

target (15,3)

Assume vertex (7.5, k) with k = 8

At (0,0): → $0 = a(0)^2 + b(0) + c$

$c = 0$

At (7.5, 8)

$8 = a(7.5)^2 + b(7.5) + 0$

$8 = 56.25a + 7.5b$

$7.5b + 56.25a = 8$ ---- 1

At (15, 3):

$3 = a(15)^2 + b(15) + 0$

$3 = 225a + 15b$

$15b + 225a = 3$ ---- 2

$7.5b + 56.25a = 8$) 15

$15b + 225a = 3$) 7.5

~~$= 7.5b + 112.5a = 16$~~

$112.5b + 843.75a = 120$ ⇒ $1687.5a = 22.5$

$112.5b + 1687.5a = 22.5$ − $843.75a = 120$

− $\frac{843.75a}{843.75} = \frac{-97.5}{843.75}$

$a = -0.1156$

$7.5b + 56.25(-0.1156) = 8$

$7.5b - 6.5025 = 8$

$7.5b = 14.5025$

$b = \frac{14.5025}{7.5} = 1.9337$

$a = -0.1156$, $b = 1.9337$, $c = 0$

General form → $y = -0.1156x^2 + 1.9337x$

Proof.

At (0, 0)

$$y = -0.1156(0)^2 + 1.9337(0) = 0$$ ✓

At (7.5, 8)

$$y = -0.1156(7.5)^2 + 1.9337(7.5)$$ ✓

$$y = -6.5025 + 14.50275 = 8$$

At (15, 3)

$$y = -0.1156(15)^2 + 1.9337(15)$$ ✓

$$y = -25.91 + 28.005 = 3$$

∴ Vertex → (7.5, 8)

Equation : $y = -0.1156x^2 + 1.9337x$

Results in a hit.