Math 20-1 Key

L32 – Word Problems

Key Ideas

Linear Functions can be built in Slope y-Intercept form:

$$y = mx + b$$

where the slope can be calculated as

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

and the y-intercept can be calculated using the slope and a single data point, (x,y).

Quadratic Functions can be built in Vertex Form:

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

where the vertex is located at (h,k)

and the a-value can be calculated using a single data point, (x,y).

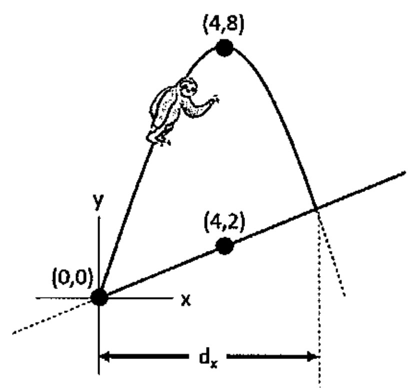
Math 20-1

KEY

Part 1 – Linear – Quadratic Systems

Use the following information to answer Q1-Q3:

A sloth jumps into the air, reaching a maximum height of 8m after a horizontal distance of 4m. It lands further up the hill.



Q1: Write a linear equation that models the hill.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2-0}{4-0} = \frac{1}{2}$

$y = \frac{1}{2}x + b$ Use $(0,0)$

$0 = \frac{1}{2}(0) + b$

$b = 0$

$\boxed{y = \frac{1}{2}x}$

Q2: Write a quadratic equation, in Standard Form, that models the jump of the sloth.

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

$y = a(x-4)^2 + 8$ Use $(0,0)$

$0 = a(0-4)^2 + 8$

$0 = a(16) + 8$

$-8 = a(16)$

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

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

$y = -\frac{1}{2}(x-4)(x-4) + 8$

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

$= -\frac{1}{2}x^2 + 4x - 8 + 8$

$\boxed{y = -\frac{1}{2}x^2 + 4x}$

Q3: Find the horizontal distance that the sloth covers prior to landing.

$y = y$

$\frac{1}{2}x = -\frac{1}{2}x^2 + 4x$

$-\frac{1}{2}x \qquad -\frac{1}{2}x$

$0 = -\frac{1}{2}x^2 + \frac{7}{2}x$

$0 = -\frac{1}{2}x(x-7)$

$-\frac{1}{2}x = 0$ $\quad$ $x - 7 = 0$

$\boxed{x = 0}$ $\quad$ $\boxed{x = 7}$

Horizontal distance of 7m.

KEY

Use the following information to answer Q4-Q5:

A baby grasshopper jumps upward. It's height, h(x), as a function of horizontal distance, x, is modelled by the equation

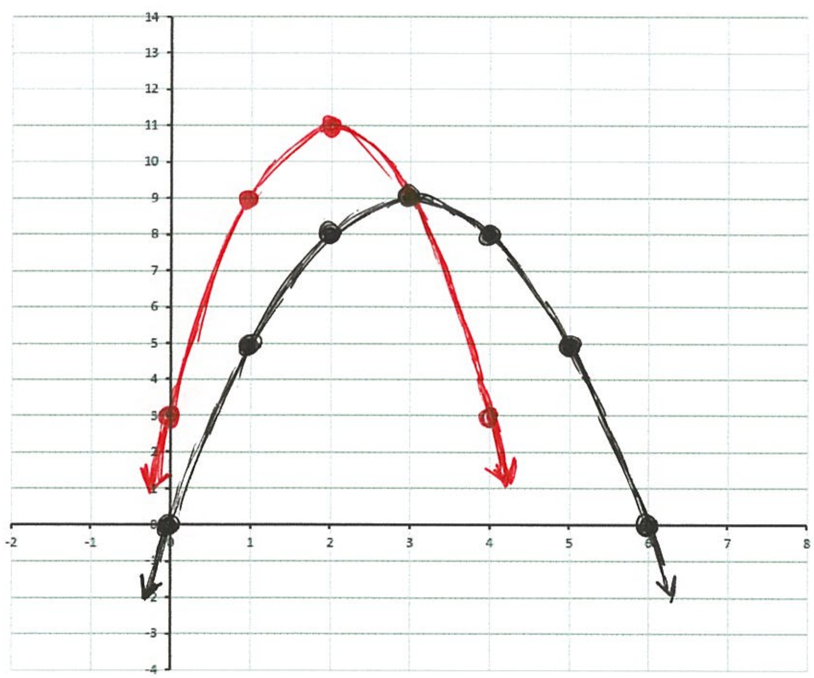
$$h(x) = -x^2 + 6x$$

where x and h(x) are modelled in centimeters.

A larger cannibal grasshopper jumps upward, snagging the baby grasshopper in midair. The equation of the cannibal grasshopper is models by the equation

$$g(x) = -2x^2 + 8x + 3$$

Q4: Sketch both quadratic functions below.



Q5: Algebraically solve for the coordinates where the grasshoppers' paths intersect.

$y = y$

$-x^2 + 6x = -2x^2 + 8x + 3$

$+2x^2 \quad +2x^2$

$x^2 + 6x = 8x + 3$

$-8x \quad -8x$

$x^2 - 2x = 3$

$-3 \quad -3$

$x^2 - 2x - 3 = 0$

$(x-3)(x+1) = 0$

$x - 3 = 0$ $\quad$ $x + 1 = 0$

$\boxed{x = 3}$ $\quad$ $\boxed{x = -1}$

$h(3) = -(3)^2 + 6(3)$

$= -9 + 18$

$= 9$

$\boxed{\text{Coordinates are } (3,9)}$