What's Going On?

Checking In   Homework Logs

Minds on   Quadratic 'Basics'

Action!   Applying the Basics

Consolidation   Any Questions?

Learning Goal - I will be able to work with quadratic graphs and equations, grade 10 style.

Checking In

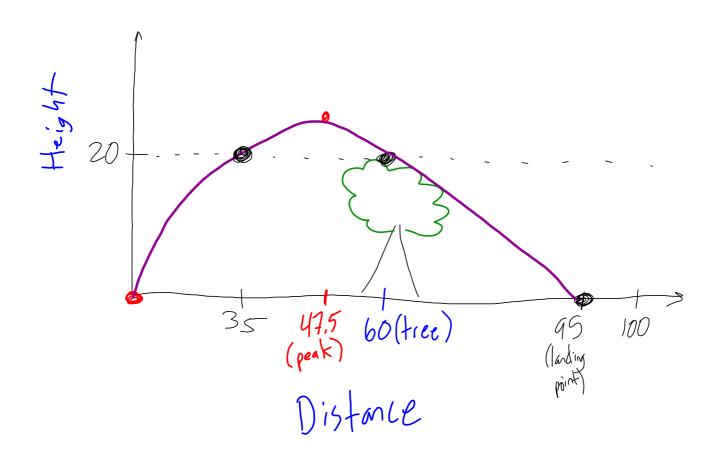Jim is golfing and has a difficult shot ahead of him!

His ball is 100 metres from the hole.

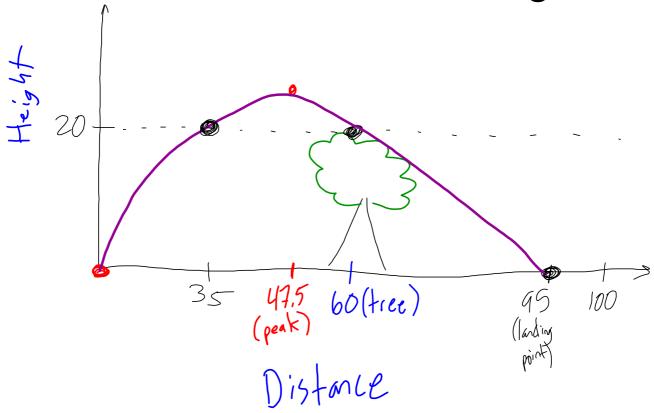He wants the ball to land 5 metres in front of the hole, so it rolls into the hole.

A 20 metre tall tree is between his ball and the hole, 40 metres from the hole and 60 metres from Jim's ball.

a.   Draw a diagram to model the situation.

Include the path of the ball.

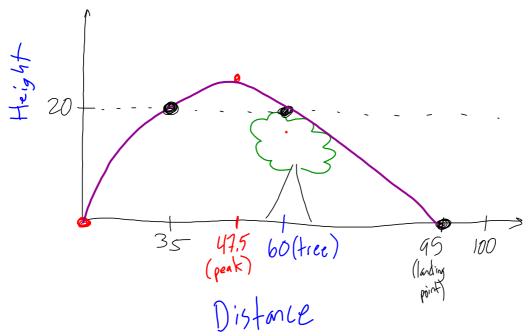***Assume the ball JUST clears the top of the tree brushing against the tippy-top.**

What's the maximum height?

Height

20 -

0 (peak)

35

47.5 (peak)

60 (tree)

95 (landing point)

100

Distance

$$f(x) = a(x - x_1)(x - x_2)$$

Use the information we have to find the a-value! Then plug in the x-value of the vertex to determine the y-value of the vertex. **THIS WILL BE OUR MAX HEIGHT**

Height

20

35　　47.5 (peak)　60 (tree)　　95 (landing point)　100

Distance

$$f(x) = a(x - x_1)(x - x_2)$$

Find a!

$$(20) = a(60 - 0)(60 - 95)$$

$$20 = a(60)(-35)$$

$$\frac{20}{-2100} = \frac{-2100a}{-2100}$$

$$a = -\frac{20}{2100}$$

$$= -\frac{2}{210}$$

$$= \frac{-1}{105}$$

Now we have the factored form equation.

Max Height

$$f(x) = -\frac{1}{105}x(x-95)$$

$$f(47.5) = -\frac{1}{105}(47.5)(47.5-95)$$

$$= \frac{-47.5(-47.5)}{105}$$

$$\doteq 21.49\,m$$

Write in VERTEX FORM

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

$$f(x) = \frac{-1}{105}(x - 47.5)^2 + 21.5$$

c. What is the height of the ball after it has travelled 10 m?

$h(d)$

$f(x) = -\dfrac{1}{105}(x - 47.5)^2 + 21.5$

$f(x) = -\dfrac{1}{105}x(x - 95)$

$f(10) = -\dfrac{1}{105}(10 - 47.5)^2 + 21.5$

$ = -\dfrac{1}{105}(-37.5)^2 + 21.5$

$ = -\dfrac{1}{105}(1406.25) + 21.5$

$ = -13.4 + 21.5$

$ = 8.1$

∴ the height is $8.1\,\text{m}$

> **Checking In**

d. How far has the ball travelled when it reaches a height of 10 m?

Sub in 10 for y, "SOLVE for x!!"

$$f(x) = \frac{-1}{105}(x - 47.5)^2 + 21.5$$

$$10 = \frac{-1}{105}(x - 47.5)^2 + 21.5$$

$$-21.5 \qquad\qquad -21.5$$

$$\frac{-11.5}{\frac{-1}{105}} = \frac{\frac{-1}{105}(x - 47.5)^2}{\frac{-1}{105}}$$

$$\sqrt{1207.5} = \sqrt{(x - 47.5)^2}$$

$$\pm 34.75 = x - 47.5$$

$$34.75 = x - 47.5 \qquad\bigg|\qquad -34.75 = x - 47.5$$
$$+47.5 \qquad +47.5 \qquad\bigg|\qquad +47.5 \qquad +47.5$$

$$x = 82.25 \qquad\bigg|\qquad x = 12.75$$

Checking In

d. How far has the ball travelled when it reaches a height of 10 m?

Note: We could have substituted in 10 for the y-value and then used the quadratic formula.

$$f(x) = \frac{-1}{105}(x - 47.5)^2 + 21.5$$

$$f(x) = \frac{-1}{105}x(x - 95)$$

$$10 = \frac{-1}{105}x(x - 95)$$

$$10 = \frac{-1}{105}x^2 + \frac{95}{105}x - 10$$
$$-10$$

$$\frac{-1}{105}x^2 + \frac{95}{105}x - 10 = 0$$

$$a \qquad b \qquad c$$

Minds on

Standard, Vertex and Factored Form

Standard Form

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

a: Controls the step pattern

If negative, curve is upside down

Stretch and compression

b: Don't worry about it

c: The y-intercept

Minds on

Standard, Vertex and Factored Form

Vertex Form

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

a: Same

h: The x-value of the vertex

k: The y-value of the vertex

Minds on

Standard, Vertex and Factored Form
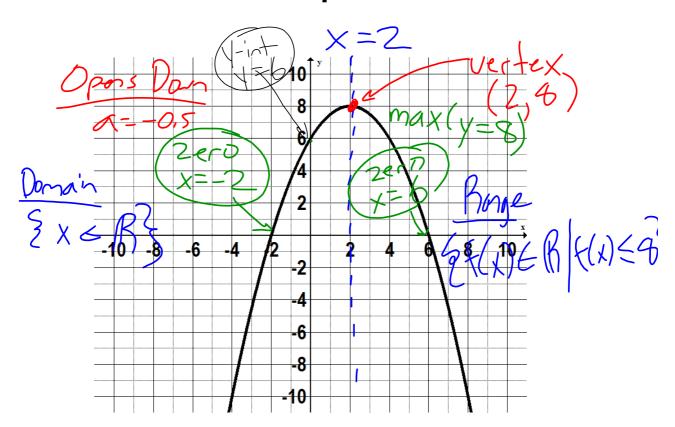
Factored Form

$$f(x) = a(x - x_1)(x - x_2)$$

a: Same

x_1:   One of the zeros / x-intercepts

x_2: The other zero / x-intercept

Minds on

Graphs

Action!

Graphs from a Vertex Form Equation

Given *f(x) = -3(x + 5)² - 1*, determine

- the vertex

- the axis of symmetry

- the direction of opening

- the y-intercept

- the step pattern

- the y-intercepts

- and the domain and range.

Use this information to draw a rough sketch of the curve.

Action!

Graphs from a Standard Form Equation
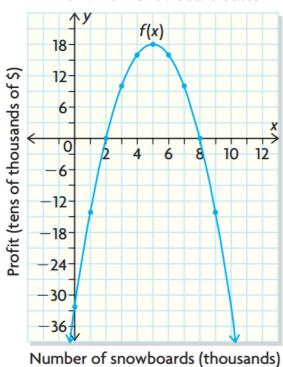
Given f(x) = 2(x + 1)(x - 3), determine

- the x-intercepts

- the vertex

- the axis of symmetry

- the direction of opening

- the y-intercept

- and the step pattern

Use this information to draw a rough sketch of the curve.

Action!

Equations from Graphs

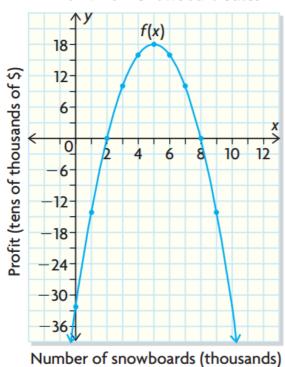**Profit from Snowboard Sales**

Determine an expression to model the situation.

Two options

1. Vertex Form

2. Factored Form

Action!

Equations from Graphs

Profit from Snowboard Sales

Determine an expression to model the situation.

Two options

1. Vertex Form

2. Factored Form

Action!

Information from Equations

A stone is thrown into the air from a bridge, over a river. It falls into the river.

The height of the stone, h metres, above the water t seconds after thrown is modelled by the equation: $h(t) = -5t^2 + 10t + 7$.

a. How high is the bridge?

b. How long does it take the stone to hit the water?

c. What is the maximum height reached by the stone, and when does this occur?

d. Determine the domain and range of the function in this situation.

Action!

Equations from Information

A quadratic function has a vertex at (5, 18) and zeros at x = 2, and x = 8.

1. Determine an equation in

   a. Vertex Form

   b. Standard Form

   c. Factored Form

2. Use your equations to draw a rough sketch of the curve.

Consolidation

Homework