Warm Up

State two different scenarios that could be modelled by a quadratic. Identify the meaning of the vertex, y-intercept and the zeros.

Kicking a ball

Throwing a ball

Arch of a building

Diving into a lake

Properties of Quadratics

Lesson objectives

- I know how to identify the vertex, zeros, y-intercept, axis of symmetry, and the max/min value (optimal value) from the graph.
- I know how to identify the vertex, standard, and factored form of a quadratic equation.
- I know the key information given from each form of the equation.

1.1   Lesson objectives   Teachers' notes   Lesson notes

Nelson Page 145 #s 1, 2, 3ab, 4ab, 7abc, 8abc, 9, 10 & 14

KEY TERMS

Vertex: The point on a parabola where the curve changes direction. It is a maximum if the parabola opens down and it is a minimum if the parabola opens up.

Zero: A value for x for which the dependent variable has a value of 0. It corresponds to the x-intercept on the graph.

Root: The value of the variable that makes an equation true. The same as the solution of the equation.

y-intercept: The y-coordinate of the point where a line or curve crosses the y-axis. At this point, x = 0.

KEY TERMS

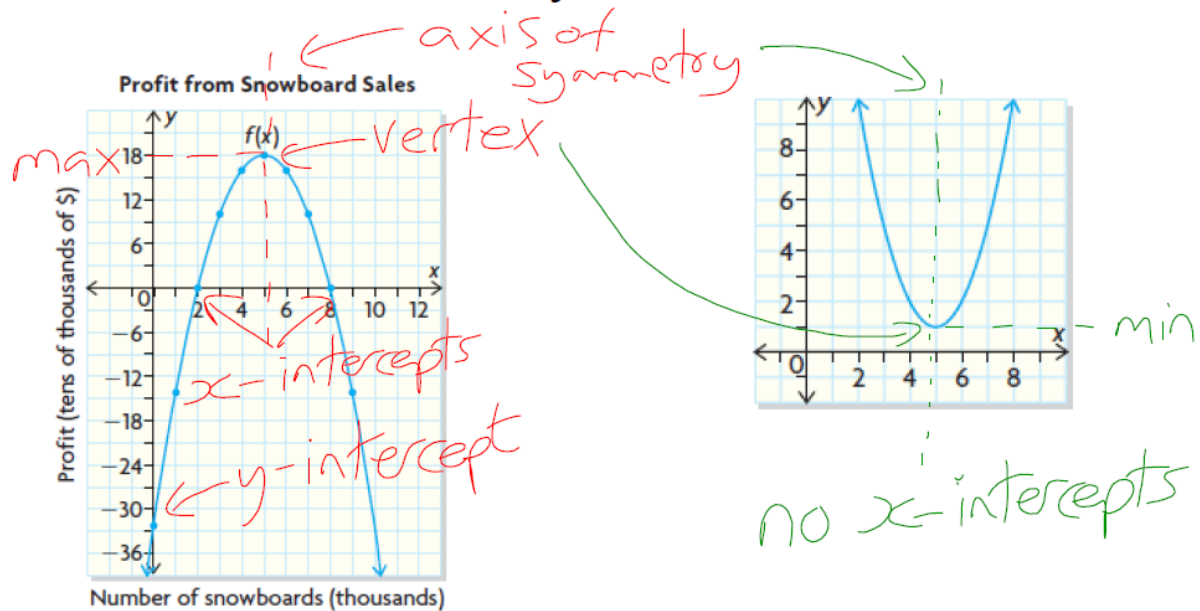**Axis of symmetry:** A line that divides a figure into two congruent parts.

Minimum value: The point on the graph of a non-linear relation at which the curve changes from decreasing to increasing.

Maximum value: The point on the graph of a non-linear relation at which the curve changes from increasing to decreasing.

The Parabola!

What information can you deduce?

Annotations on left graph: axis of symmetry, vertex, max, x-intercepts, y-intercept

Annotations on right graph: min, no x-intercepts

Forms of the Quadratic Equation

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

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

Factored Form $y = a(x - r)(x - s)$

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

To be honest, standard form is not a very useful form for us to gather information. It tells us 2 pieces of information quickly:

1. The direction of opening
- If a > 0, then it opens up (min)
- If a < 0, then it opens down (max)

2. The y-intercept
- "c" is the y-intercept

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

We can get quite a bit of information from vertex form. We can get all of the transformations (we will revisit this topic later in this unit) as well as the vertex, direction of opening (same as standard form), axis of symmetry and max/min value.

1. Vertex
- The vertex is the point (h,k) [note: switch the sign of h]

2. Axis of symmetry
- The line with equation x = h [again change the sign!]

3. Max/Min Value
- The max or min value of the parabola is y = k

Factored Form $y = a(x-r)(x-s)$

From factored form we can also get the direction of opening (same as standard form) and the zeros.

1. Zeros (x-intercepts)
- To find the zeros, we take each factor and set it equal to zero and solve for x.

Example
Give all of the important information from the given form of each equation.

a) $y = 3(x-2)^2 + 5$ b) $y = 2x(3x - 5)$ c) $y = -2x^2 - x + 10$

opens up
$(a = positive)$

Axis of
Symmetry
$x = 2$
Min value of 5
Vertex $(2, 5)$

opens up
zeros of
$x = 0$
and
$x = \frac{5}{3}$

$3x - 5 = 0$
$3x = 5$
$\frac{3x}{3} = \frac{5}{3}$
$x = \frac{5}{3}$

opens down
$(a = negative)$
y-intercept
of 10