Before we begin, are there any questions from last day's work?

Today's Learning Goal(s):

By the end of the class, I will be able to:

a) sketch quadratic relations using a table of values.
b) use "finite differences" to determine if a relation is linear or quadratic.
c) identify key properties of quadratic relations.

MPM 2DI 4.2 Quadratic Relations Date: Oct. 25/16

Recall: The order of mathematical operations is: BEDMAS

Evaluate: a) $(-5)^2$ b) -5^2

$3+7-5^2$

$= (-5)(-5)$ $= -(5)(5)$

$= 25$ $= -25$

A **relation** is an identified pattern (or relationship) between two variables.

Ex. 1

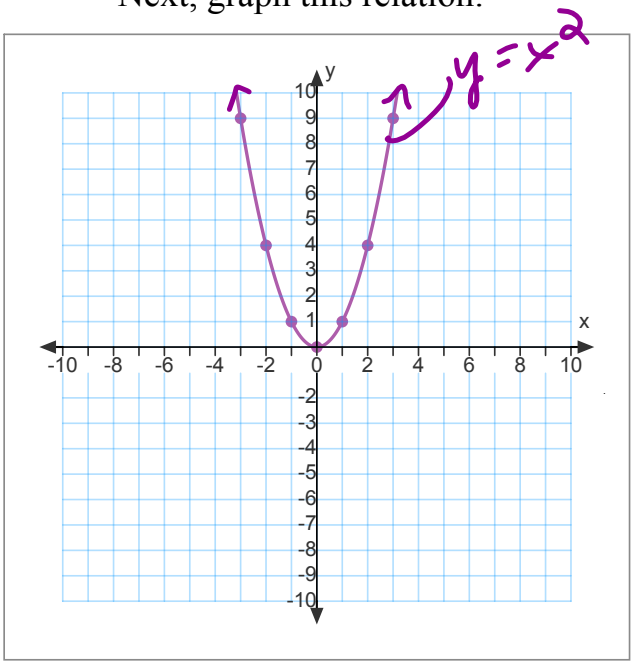
Given the relation $y = x^2$ complete:

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

1st Differences: $4-9 = -5$; $1-4 = -3$; $0-1 = -1$; $1-0 = 1$; $4-1 = 3$; $9-4 = 5$

2nd Difference: $-3-(-5) = -3+5 = 2$; $-1-(-3) = -1+3 = 2$; $1-(-1) = 2$; $3-1 = 2$; $5-3 = 2$

Next, graph this relation:



Don't click until Ex.3

∴ the **2nd** differences are **constant**

∴ the relation is **quadratic**

Ex. 2

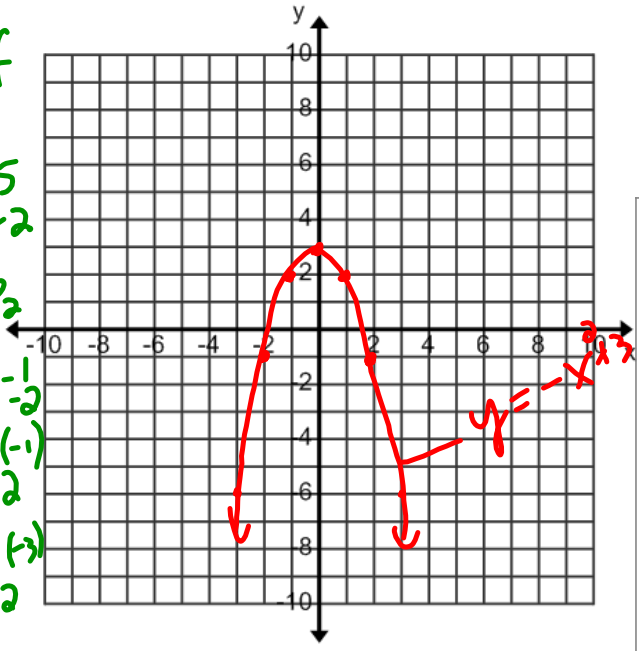
Given the relation $y = -x^2 + 3$ complete:

x	y
-3	$-(-3)^2+3 = -9+3 \to -6$
-2	$-(-2)^2+3 = -4+3 \to -1$
-1	$-(-1)^2+3 = -1+3 \to 2$
0	3
1	$-(1)^2+3 = -1+3 \to 2$
2	$-(2)^2+3 = -4+3 \to -1$
3	$-(3)^2+3 = -9+3 \to -6$

1st Diff: $-1-(-6) = 5$; $2-(-1) = 3$; $3-2 = 1$; $2-3 = -1$; $-1-2 = -3$; $-6-(-1) = -6+1 = -5$

2nd Diff: $3-5 = -2$; $1-3 = -2$; $-1-1 = -2$; $-3-(-1) = -2$; $-5-(-3) = -2$

Next, graph this relation:



Ex. 3

For Ex. 1 and 2, complete the first differences and second differences.

∴ 2nd differences are constant

∴ the table represents a quadratic.

Ex. 4

Calculate the first differences and second differences for the linear relation $y = 2x + 3$

x	y
-3	$2(-3)+3 = -3$
-2	$2(-2)+3 = -1$
-1	$2(-1)+3 = 1$
0	$2(0)+3 = 3$
1	$2(1)+3 = 5$
2	$2(2)+3 = 7$
3	$2(3)+3 = 9$

1ST Diff: $-1-(-3) = 2$, $1-(-1) = 2$, $3-1 = 2$, $5-3 = 2$, $7-5 = 2$, $9-7 = 2$

2nd Diff: $2-2 = 0$, $2-2 = 0$, 0, 0, 0

- ∵ the **1st** differences are **constant**
- ∴ the relation is **linear**

A **quadratic relation** is a relation of the form $y = ax^2 + bx + c$, a≠0 where a **cannot** be zero.

standard form

Ex. 5

Using the relations in Ex. 1 and 2, identify a, b and c.

Ex. 1 $y = x^2$ $a = 1$ $b = 0$ $c = 0$

Ex. 2 $y = -x^2 + 3$ $a = -1$ $b = 0$ $c = 3$

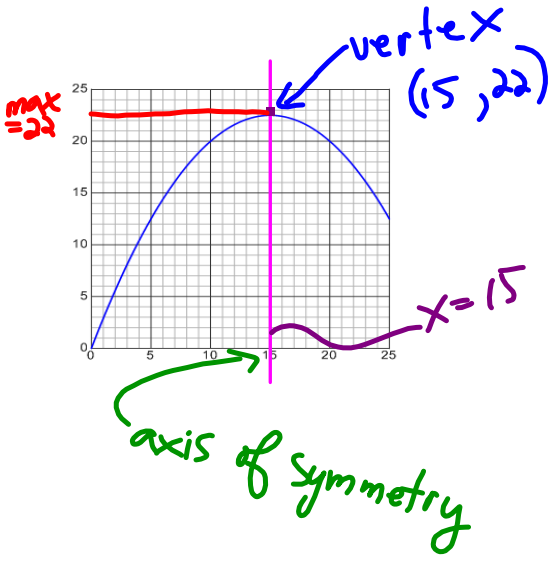
SUMMARY

The graph of a quadratic relation is called a **parabola**.

The **vertex** of a **parabola** is either the **minimum point** or the **maximum point** on the graph.

A **parabola** is symmetric about a vertical line that passes through the **vertex**. This line is the **axis of symmetry**.

If a relation is **quadratic**, the **second** differences are **constant**, but the **first** differences are **NOT**.



Today's practice: pp. 172-173 # 1, 3, 9
***Enrichment*:** p.173 #10, 11