** Unit #4 Review **

* Quadratic Functions *

* Quadratic Equations *

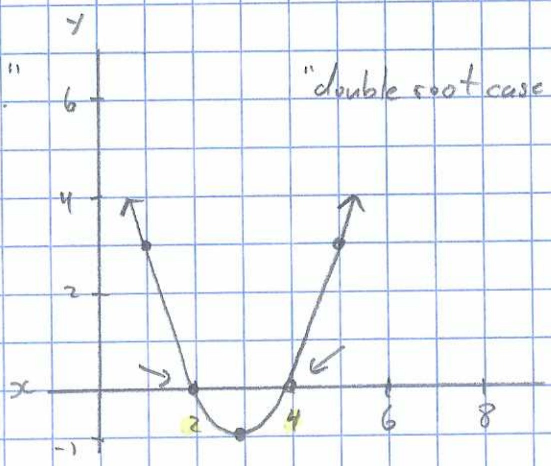
Recall: A quadratic equation has the form $ax^2+bx+c=0$. For example $x^2-6x+8=0$ is a quadratic equation. Notice that a quadratic equation is very similar to a quadratic function $ax^2+bx+c=y$. The only difference is that the y in the quadratic function has been replaced with a zero.

Recall: To solve a quadratic equation means to find the values of x that make equation $=0$. When we substitute a value of zero in for the y in the equation of a parabola and solve for x, we are finding the x-intercept(s) of the matching parabola.

Ex. Solve the following quadratic equations (aka find the roots or zeros of the equations.)

a) $x^2-6x+8=0$ ⟵ "This Quadratic Equation has 2 different real roots."

"double root case"



Sol'n Graph $y=x^2-6x+8$

$y=\underbrace{x^2-6x+9-9+8}$, special number

$y=(x-3)^2-1$, factor and tidy up

(C.T.S. process)

Mini table of easy points

x	y
V (3,	-1)
2	0
1	3

∴ The solutions are $x=2$ and $x=4$.

b) $2x^2+8x+12=0$

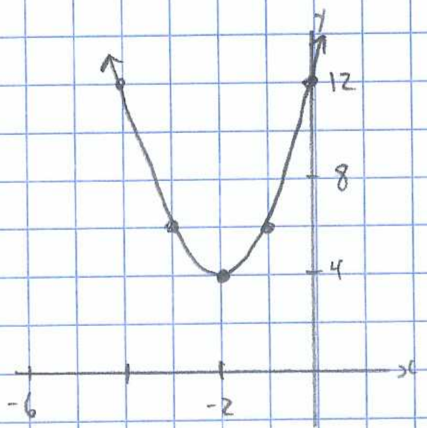
Sol'n Graph $y=2x^2+8x+12$.

($x=\frac{-b}{2a}$ process)

Min when $x=\frac{-b}{2a}=\frac{-(8)}{2(2)}=-2$

Min value is $y=2(-2)^2+8(-2)+12=4$

So $y=(x+2)^2+4$



"no real root case"

x	y
V(-2,	4)
-1	6
0	12

∴ This equation, $2x^2+8x+12=0$, has NO real roots.

Essential Learnings

MPM 2DI/W Name: ______________________ Date: ____________

Unit 4 – Essential Learnings – Quadratic Functions

You should know and apply the following:

- Domain and Range
- Relations and Functions and the Vertical Line Test
- Graphing Parabolas … $y = ax^2 + bx + c$ aka Standard Form
  … $y = a(x-h)^2 + k$ aka Vertex Form using Vertex, Mini-Table, and then Symmetry.
  … $y = a(x-d)(x-e)$ aka Factored Form using the intercepts and the Axis of Symmetry
- Finding the equation of the parabola …Given 1 point and 1 vertex. Sub in.
  …Given the graph
  …Given characteristics aka properties of the parabola
- Finding the vertex …using Complete the Square with $a = 1$, and with $a \neq 1$.
  … using $x = \frac{-b}{2a}$ for $y = ax^2 + bx + c$. Sub in for the y-coordinate of the vertex.
- Max / Min questions … (h, k) represents → when the optimal value occurs [ex: Max when…]
  → what the optimal value is. [ex: Max is…]
- Solving quadratic equations using the Formula Method…the Quadratic Formula $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- Solving quadratic equations using the Factoring Method…Factor, Zero Product Property, Take opposite number
- Solving quadratic equations using the Graphing Method…graph the matching parabola and see x-intercepts.

$\#$ $\#$ $\#$

Ex 2 Write $y = -3x^2 + 18x + 2$ into $y = a(x-h)^2 + k$ form using the complete the square process.

Sol'n
$y = -3(x^2 - 6x) + 2$, "a" to front
$y = -3(x^2 - 6x + 9 - 9) + 2$, special number: $\left(\frac{-6}{2}\right)^2$
$y = -3(x^2 - 6x + 9) - 9(-3) + 2$, pull
$y = -3(x-3)^2 + 20$, factor and tidy up.

Ex 3 Solve $\frac{x^2}{6} = \frac{2x}{3}$ using

a) Sol'n Graphing Method

$\frac{x^2}{6} = \frac{4x}{6}$, built common denom

$x^2 = 4x$

$x^2 - 4x = 0$

Graph $y = x^2 - 4x$

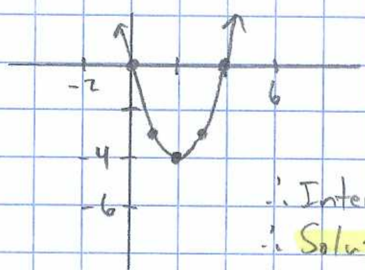
Min when $x = \frac{-b}{2a} = \frac{-(-4)}{2(1)} = 2$

Min is $y = (2)^2 - 4(2) = -4$

$\therefore$ Vertex $(2, -4)$

2 points

x	y
1	-3
0	0



$\therefore$ Intercepts are $(0, 0)$ and $(4, 0)$
$\therefore$ Solutions are $x = 0$ and $x = 4$.

b) Sol'n Factor Method

$\frac{x^2}{6} = \frac{4x}{6}$

$x^2 - 4x = 0$

$x(x-4) = 0$ Common Factor

$\therefore x = 0$ or $x = 4$.

$\therefore$ Solutions are $x = 0$ and $x = 4$

c) Sol'n Quadratic Formula Method

$\frac{x^2}{6} = \frac{4x}{6}$

$x^2 - 4x = 0$

$\therefore x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$a = 1$
$b = -4$
$c = 0$

$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(0)}}{2(1)}$

$x = \frac{4 \pm \sqrt{16 - 0}}{2}$

$x = \frac{4 \pm 4}{2}$

$x = \frac{4+4}{2}$ or $x = \frac{4-4}{2}$

$x = 4$ $\quad$ $x = 0$

$\therefore$ Solutions are $x = 4$ and $x = 0$.

p252 # 1, 4, 5, 6, 10c, 15cd, 17ab, 21bc
p301 # 1be, 4 odd letters, 6ae, 7ab, 8a, 9a,