STATION #1 – QUADRATIC FUNCTIONS & TRANSFORMATIONS

Describe how the following functions were translated from the function $f(x) = x^2$

1. $f(x) = .5(x+3)^2 - 7$

2. $y = -2(x-7)^2 + 5$

Identify the axis of symmetry, the min or max, and the domain and range of each function.

3. $f(x) = x^2 - 9$

4. $y = (5x-2)^2$

5. Write the equation of the parabola in vertex form if the vertex is (-2, 7) and it contains the point (3, -4).

6. Write a quadratic equation with the discriminant less than zero.

KEY

STATION #1 – QUADRATIC FUNCTIONS & TRANSFORMATIONS

Describe how the following functions were translated from the function $f(x) = x^2$

1. $f(x) = .5(x+3)^2 - 7$
vertical stretch by 1/2, left 3, down 7

2. $y = -2(x-7)^2 + 5$
Reflection over x axis, vertical stretch by 2, right 7, up 5

Identify the axis of symmetry, the min or max, and the domain and range of each function.

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

$\frac{20}{2(25)}$ $25x^2 - 10x - 10x + 4$ $(5x-2)(5x-2)$

3. $f(x) = x^2 - 9$
AOS $x = 0$ $0^2 - 9 = -9$
vertex $(0, -9)$
Domain $(-\infty, \infty)$ Min
Range $[-9, \infty)$

$\frac{20}{50}$ 4. $y = (5x-2)^2$
$25x^2 - 20x + 4$
AOS $x = 2/5$
vertex $(2/5, 0)$ Min
Domain $(-\infty, \infty)$ Range $[0, \infty)$

5. Write the equation of the parabola in vertex form if the vertex is (-2, 7) and it contains the point (3, -4).

$y = a(x+2)^2 + 7$
$-4 = a(3+2)^2 + 7$
$-4 = a(5)^2 + 7$

$-4 = 25a + 7$
$-7 \quad\quad -7$
$\frac{-11}{25} = \frac{25a}{25}$

$a = -11/25$
$\boxed{y = -11/25(x+2)^2 + 7}$

6. Write a quadratic equation with the discriminant less than zero. negative

This must stay as a minus

$b^2 - 4ac < 0$

making $b = 0$ will guarantee a negative number

ex: $x^2 + 10$
$0^2 - 4(1)(10)$
$0 - 40$
-40

STATION #2 – STANDARD FORM

Identify the vertex, axis of symmetry, min or max, and domain and range of the following functions.

1. $y = x^2 + 12x + 36$

2. $y = -x^2 - 3x + 6$

3. $f(x) = 4x^2 - 8x + 12$ Find the vertex and y-intercept.

4. What is the x value of the vertex in the equation?

$$y = -5x^2 + \frac{4}{7}$$

5. What is the axis of symmetry in the equation?

$$y = 6x^2 + 4x - 7$$

KEY

STATION #2 – STANDARD FORM

Identify the vertex, axis of symmetry, min or max, and domain and range of the following functions.

$\frac{-b}{2a}$ $\frac{-12}{2(1)} = -6$

$\frac{3}{2(-1)} = \frac{-3}{2}$

1. $y = x^2 + 12x + 36$

AOS $x = -6$ min
Vertex $(-6, 0)$
Domain $(-\infty, \infty)$
Range $[0, \infty)$

2. $y = -x^2 - 3x + 6$

AOS $x = -3/2$ max
Vertex $(-1.5, 8.25)$
Domain $(-\infty, \infty)$
Range $[8.25, -\infty)$

3. $f(x) = 4x^2 - 8x + 12$ Find the vertex and y-intercept.

Yint

$\frac{8}{2(4)} \cdot \frac{8}{8} = 1$ Yintercept $(0, 12)$
Vertex $(1, 8)$

$4(1)^2 - 8(1) + 12$
$4 - 8 + 12$
$-4 + 12$
8

4. What is the x value of the vertex in the equation?

$$y = \overset{a}{-5}x^2 + \frac{4}{7} \leftarrow c$$

$\frac{-b}{2a} = \frac{0}{2(-5)} = \boxed{0}$ $b = 0$

5. What is the axis of symmetry in the equation?

$$y = 6x^2 + 4x - 7$$

$\frac{-b}{2a} = \frac{-4}{2(6)} = \frac{-4}{12} = \boxed{-1/3 = x}$

STATION #3 – MODELING WITH QUADRATIC FUNCTIONS

Find the equation in standard form of the parabola passing through the points.

1. (1,-2) (2,-2) (3,-4)

2. (-2,9) (-4,5) (1,0)

3. A parabola contains the points (0,-4) (2,4) and (4,4). Find the vertex of this parabola.

4. Put the parabola from #3 into vertex form.

5. List out the domain and range of the parabola in #3.

STATION #3 – MODELING WITH QUADRATIC FUNCTIONS

KEY

Find the equation in standard form of the parabola passing through the points.

Stat edit for L1 & L2

Stat calc 5: QuadReg $R^2 = 1$

1. (1,-2) (2,-2) (3,-4)

L1	L2
1	-2
2	-2
3	-4

$y = -x^2 + 3x - 4$

2. (-2,9) (-4,5) (1,0)

L1	L2
-2	9
-4	5
1	0

$y = -x^2 - 4x + 5$

3. A parabola contains the points (0,-4) (2,4) and (4,4). Find the vertex of this parabola.

L1	L2
0	-4
2	4
4	4

$y = -x^2 + 6x - 4$

$\frac{-b}{2a} = \frac{-6}{2(-1)} = \frac{-6}{-2} = 3$

$-(3)^2 + 6(3) - 4 = -9 + 18 - 4 = 9 - 4 = 5$

(3, 5)

4. Put the parabola from #3 into vertex form.

vertex (3, 5)

$a = -1$

$y = -(x-3)^2 + 5$

5. List out the domain and range of the parabola in #3.

domain $(-\infty, \infty)$

range $\cancel{[5, \infty)}$ $(-\infty, 5]$

STATION #4 – FACTORING

Factor the following polynomials completely.

1. $x^2 + 13x + 36$

2. $-x^2 + 11x - 18$

3. $8x^2 - 40x + 50$

4. $16x^2 - 36$

5. $\frac{1}{27}x^3 + 64$

KEY

STATION #4 – FACTORING

Factor the following polynomials completely. NOT SOLVE!

9, 4

1. $x^2 + 13x + 36$ $(x+9)(x+4)$

18

9, 2

2. $-x^2 + 11x - 18$ $-x^2 + 2x + 9x - 18$

$-x(x-2)\ 9(x-2)$

$(-x+9)(x-2)$

grouping is better when you have $-a$

3. $8x^2 - 40x + 50$

$2(4x^2 - 10x + 25)$

100

	$2x$	5
$2x$	$4x^2$	$-10x$
5	$-10x$	25

$2(2x-5)(2x-5)$

$= 2(2x-5)^2$

perfect square

4. $\sqrt{16x^2} - \sqrt{36}$ $(4x+6)(4x-6) = 4(2x-3)(2x+3)$

$4x$ $\quad 6$

5. $\sqrt[3]{\frac{1}{27}x^3} + \sqrt[3]{64}$ $a^2 \quad ab \quad b^2$

$\left(\frac{1}{3}x + 4\right)\left(\frac{1}{9}x^2 - \frac{4}{3}x + 16\right)$

S
O
A
P

*Don't be afraid of fractions, pretend they are normal numbers

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STATION #5 – SOLVING QUADRATIC EQUATIONS

Solve the following quadratic equations by factoring.

1. $x^2 + 11x + 18 = 0$

2. $2x^2 = 8x$

3. $2x^2 + 6x = -4$

Solve the following quadratic equations using your graphing calculator. Round to two decimal places.

4. $3x^2 - 5x = 4$

5. $x^2 = 4x + 8$

STATION #5 – SOLVING QUADRATIC EQUATIONS

KEY

Solve the following quadratic equations by factoring.

9, 2

1. $x^2 + 11x + 18 = 0$

$(x+9)(x+2)=0$

$x+9=0 \quad x+2=0$

$\boxed{x=-9,-2}$

$2x^2-8x=0$

2. $2x^2 = 8x$

$2x(x-4)=0$

$2x=0 \quad x-4=0$

$\boxed{x=0,4}$

3. $2x^2 + 6x = -4$ $\quad 2x^2+6x+4=0$

$2(x^2+3x+2)=0$

$2(x+2)(x+1)=0$

$2\neq 0 \quad x+2=0 \quad x+1=0$

$\boxed{x=-2,-1}$

Solve the following quadratic equations using your graphing calculator. Round to two decimal places.

$\boxed{2nd}$ $\boxed{trace}$ (calc)

2: zero

put into $y=$ → $3x^2-5x-4=0$

4. $3x^2 - 5x = 4$

$\boxed{x=-.59 \text{ \& } 2.26}$

5. $x^2 = 4x + 8$

$x^2-4x-8=0$

$\boxed{x=-1.46 \text{ \& } 5.46}$

STATION #6 – COMPLETETEING THE SQUARE

Solve each quadratic equation by completing the square.

1. $x^2 - 12x = -11$

2. $5x^2 = 60 - 20x$

3. $-x^2 + 6x + 10 = 0$

4. Put $y = x^2 - 10x + 4$ into vertex form, by completing the square.

5. What values of k would make this a perfect square trinomial? $x^2 + kx + 216$

KEY

STATION #6 – COMPLETEING THE SQUARE

Solve each quadratic equation by completing the square.

$\left(\frac{b}{2}\right)^2$

1. $x^2 - 12x = -11$

$\left(\frac{-12}{2}\right)^2 = (-6)^2$

$x^2 - 12x + (-6)^2 = -11 + (-6)^2$

$(x-6)^2 = -11 + 36$

$\sqrt{(x-6)^2} = \sqrt{25}$

$x - 6 = \pm 5$

$5 + 6 = 11$

$-5 + 6 = 1$

$\boxed{11 \quad 1}$

2. $5x^2 = 60 - 20x$

$x^2 = 12 - 4x$

$+4x \qquad +4x$

$\left(\frac{4}{2}\right)^2 = (2)^2$

$x^2 + 4x + (2)^2 = 12 + (2)^2$

$\sqrt{(x+2)^2} = \sqrt{16}$

$x + 2 = \pm 4$

$-2 \qquad -2$

$4 - 2 \qquad -4 - 2$

$\boxed{x = 2, -6}$

3. $-x^2 + 6x + 10 = 0$

$\left(\frac{-6}{2}\right)^2 \quad x^2 - 6x - 10 = 0$

$(-3)^2 \quad x^2 - 6x = 10$

$x^2 - 6x + (-3)^2 = 10 + (-3)^2$

$\sqrt{(x-3)^2} = \sqrt{19}$

$x - 3 = \pm\sqrt{19}$

$+3 \qquad +3$

$\boxed{x = 3 \pm \sqrt{19}}$

4. Put $y = x^2 - 10x + 4$ into vertex form, by completing the square.

zero

$x^2 - 10x = -4$

$\left(\frac{-10}{2}\right)^2 = (-5)^2 \quad x^2 - 10x + (-5)^2 = -4 + (-5)^2$

$(x-5)^2 = 21$

$-21 \quad -21$

$\boxed{y = (x-5)^2 - 21}$

5. What values of k would make this a perfect square trinomial? $x^2 + kx + 216$

216 → 54, 4 → 9, 6, 2, 2 → 3, 3, 3, 2

$\sqrt{216} = \sqrt{\left(\frac{b}{2}\right)^2}$

$(2)\, 6\sqrt{6} = \frac{b}{2}(2)$

$12\sqrt{6} = b$

$\boxed{k = 12\sqrt{6} \text{ OR } 29.4}$

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STATION #7 – THE QUADRATIC FORMULA

Solve each equation using the Quadratic Formula.

1. $x^2 - 7x + 14 = 0$

2. $2x^2 + 1 = 6x$

Evaluate the discriminant for each equation and determine the number and types of roots.

3. $4x + 1 = 2x^2$

4. $3x^2 + 4x = -1$

STATION #7 – THE QUADRATIC FORMULA

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

Solve each equation using the Quadratic Formula.

1. $x^2 - 7x + 14 = 0$

$x = \frac{7 \pm \sqrt{(-7)^2 - 4(1)(14)}}{2(1)} = \frac{7 \pm \sqrt{49 - 56}}{2} = \frac{7 \pm \sqrt{-7}}{2} = \boxed{\frac{7 \pm i\sqrt{7}}{2}}$

2. $2x^2 + 1 = 6x$

$2x^2 - 6x + 1 = 0$

$x = \frac{6 \pm \sqrt{(6)^2 - 4(2)(1)}}{2(2)} = \frac{6 \pm \sqrt{36 - 8}}{2} = \frac{6 \pm \sqrt{28}}{4} = \frac{6 \pm 2\sqrt{7}}{4} = \frac{\cancel{2}(3 \pm \sqrt{7})}{\cancel{4}} = \boxed{\frac{3 \pm \sqrt{7}}{2}}$

Evaluate the discriminant for each equation and determine the number and types of roots.

$b^2 - 4ac$ $\quad > 0;\ 2\mathbb{R} \quad = 0;\ 1\mathbb{R} \quad < 0;\ 0\mathbb{R}$

3. $4x + 1 = 2x^2$

$4x - 2x^2 + 1 = 0$

$(4)^2 - 4(-2)(1)$

$16 + 8 = 24$; $2\mathbb{R}$ Roots

4. $3x^2 + 4x = -1$

$3x^2 + 4x + 1 = 0$

$(4)^2 - 4(3)(1)$

$16 - 12 = 4$; $2\mathbb{R}$ Roots

STATION #8 – COMPLEX NUMBERS

Simplify each expression.

1. $(-5 + 7i) + (5 - 7i)$

2. $2i(4 + 3i)$

3. $\frac{7}{5-2i}$

4. Find all the solutions to $x^2 + 2x + 5 = 0$

KEY

STATION #8 – COMPLEX NUMBERS

Simplify each expression.

1. $(-\cancel{5} + \cancel{7i}) + (\cancel{5} - \cancel{7i})$

$\boxed{0}$

2. $2i(4 + 3i)$ $\quad i^2 = -1$

$8i + 6i^2 = 8i + 6(-1) = \boxed{-6 + 8i}$

3. $\frac{7}{5-2i} \cdot \frac{(5+2i)}{(5+2i)} = \frac{35 + 14i}{25 + \cancel{10i} - \cancel{10i} - 4i^2} = \boxed{\frac{35 + 14i}{29}}$

$-4(-1)$

4. Find all the solutions to $x^2 + 2x + 5 = 0$ → degree of 2 means there will be 2 roots

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

$$X = \frac{-2 \pm \sqrt{(2)^2 - 4(1)(5)}}{2(1)} = \frac{-2 \pm \sqrt{4 - 20}}{2}$$

$$= \frac{-2 \pm \sqrt{-16}}{2} = \frac{-2 \pm 4i}{2} = \frac{\cancel{2}(-1 \pm 2i)}{\cancel{2}}$$

$$= \boxed{-1 \pm 2i}$$