3U (HWK 2.5)

4. For each quadratic relation,
   i. express the relation in factored form
   ii. find the coordinates of the vertex
   iii. express the relation in vertex form
   iv. sketch the graph

(a) $y = x^2 - 6x + 5$ (b) $y = -2x^2 + 12x - 16$

(c) $y = \frac{1}{2}x^2 + x - 4$ (d) $y = 4x^2 - 12x + 5$

(e) $y = -3x^2 - 12x$ (f) $y = 2x^2 - 4x - 30$

5. For each quadratic relation,
   i. use partial factoring to find two points that are equidistant from the axis of symmetry
   ii. find the coordinates of the vertex
   iii. express the relation in vertex form
   iv. sketch the graph

(a) $y = x^2 - 6x + 5$ (b) $y = x^2 - 4x - 11$

(c) $y = -2x^2 + 12x - 11$ (d) $y = -x^2 - 6x - 13$

(e) $y = -\frac{1}{2}x^2 + 2x + 3$ (f) $y = 2x^2 - 10x + 11$

9. For each quadratic relation,
   i. complete the square to express the relation in vertex form
   ii. graph the relation

(a) $y = x^2 - 4x + 7$ (b) $y = x^2 + 8x + 6$

(c) $y = \frac{1}{2}x^2 - 2x + 5$ (d) $y = -x^2 + 6x - 11$

(e) $y = -3x^2 - 18x + 13$ (f) $y = 2x^2 + 20x + 43$

4. (a) $y = (x - 5)(x - 1)$, $(3, -4)$, $y = (x - 3)^2 - 4$
(b) $y = -2(x - 4)(x - 2)$, $(3, 2)$, $y = -2(x - 3)^2 + 2$
(c) $y = \frac{1}{2}(x + 4)(x - 2)$, $(-1, -\frac{9}{2})$, $y = \frac{1}{2}(x + 1)^2 - \frac{9}{2}$
(d) $y = (2x - 5)(2x - 1)$, $(\frac{3}{2}, -4)$, $y = (x - \frac{3}{2})^2 - 4$
(e) $y = -3x(x + 4)$, $(-2, 12)$, $y = -3(x + 2)^2 + 12$
(f) $y = 2(x - 5)(x + 3)$, $(1, -32)$, $y = 2(x - 1)^2 - 32$
5. (a) $(0, 5)$, $(6, 5)$, $(3, -4)$, $y = (x - 3)^2 - 4$
(b) $(0, -11)$, $(4, -11)$, $(2, -15)$, $y = (x - 2)^2 - 15$
(c) $(0, -11)$, $(6, -11)$, $(3, 7)$, $y = -2(x - 3)^2 + 7$
(d) $(0, -13)$, $(-6, -13)$, $(-3, -4)$, $y = -(x + 3)^2 - 4$
(e) $(0, 3)$, $(4, 3)$, $(2, 5)$, $y = -\frac{1}{2}(x - 2)^2 + 5$
(f) $(0, 11)$, $(5, 11)$, $(2.5, -1.5)$, $y = 2(x - 2.5)^2 - 1.5$
9. (a) $y = (x - 2)^2 + 3$
(b) $y = (x + 4)^2 - 10$
(c) $y = \frac{1}{2}(x - 2)^2 + 3$
(d) $y = -(x - 3)^2 - 2$
(e) $y = -3(x + 3)^2 + 40$
(f) $y = 2(x + 5)^2 - 7$

THREE FORMS TO GRAPH A QUADRATIC FUNCTION $y = ax^2 + bx + c$

Vertex Form

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

where the vertex is at (h,k)
where a is the vertical stretch/compression
where +a indicates parabola opens up
where –a indicates parabola opens down

1. Complete the square if necessary, to place equation into vertex form.
2. Plot vertex
3. Use step pattern to plot additional points, moving from the vertex initially. (Remember: Go over 1 and up/down by...)

Real Life Scenario – Find the maximum height of the ball.

Factored Form

$$y = a(x - s)(x - t)$$

where the zeros are (s,0) and (t,0)
where a is the vertical stretch/compression
where +a indicates parabola opens up
where –a indicates parabola opens down

1. Factor and set equation equal to zero.
2. Solve to find roots s and t. These are the x-intercepts.
3. Find the axis of symmetry (halfway between s and t)
4. Substitute the value of the axis of symmetry for x in the initial equation to find the coordinates of the vertex.
5. Plot zeroes and vertex, connect and label.

Real Life Scenario – When did the ball hit the ground?

Partial Factored Form

$$y = ax(x - s) + t$$

where t is the y co-ordinate of the two points you are finding at the same height

where the two points at the same height are (0,t) and (s,t)

where a is the vertical stretch/compression
where +a indicates parabola opens up
where –a indicates parabola opens down

1. Factor the first two terms by removing the common factor of **ax** from the standard form of a quadratic equation.
2. Substitute the value of 0 for x to find the first point (0,t)
3. Substitute the value of s for x to find the second point (s,t)
4. Identify the axis of symmetry (halfway between 0 and s)
5. Substitute the value of the axis of symmetry for x in the initial equation to find the coordinates of the vertex.
6. Plot the two points and the vertex, connect and label.

Real Life Scenario – What is the distance of the ball from the player if the height of the ball is 2m off the ground?