MFM 2P   **Quadratics in Factored Form**   Date: **SOLUTIONS**

Part A (answer each of the following)

1. In the Gizmo™, use the slider to set $a = 1$. (To quickly set a slider to a specific number, type the number into the field to the right of the slider, and then press Enter.)

Observe how the graph changes as you vary the values of r_1 and r_2.

> a. How does the graph change as the values of r_1 and r_2 are varied?
>
> **The position of the graph on the grid changes.**
>
> b. What features of the graph do the values of r_1 and r_2 relate to?
>
> **They relate to the values of the x-intercepts.**

2. Vary the r_1 and r_2 sliders to find a quadratic equation in factored form for each of the following pairs of x-intercepts.

Check each of your answers by turning on 'Show x-intercepts' and dragging the blue points to the given x-intercepts.

Write the equation you find beside each pair of x-intercepts.

> a. (2, 0) and (−1, 0)   Equation: $y = (\mathbf{x} - \mathbf{2})(\mathbf{x} + \mathbf{1})$
>
> b. (−3, 0) and (3, 0)   Equation: $y = (\mathbf{x} + \mathbf{3})(\mathbf{x} - \mathbf{3})$
>
> c. (−2, 0) and (1, 0)   Equation: $y = (\mathbf{x} + \mathbf{2})(\mathbf{x} - \mathbf{1})$

3. Set $a = 1$ and vary the values of r_1 and r_2 to find several parabolas that have <u>only one</u> x-intercept.

> a. What do you notice about r_1 and r_2 when the graph only has one x-intercept?
>
> **They are equal.**
>
> b. When there is only one x-intercept, what special point of the parabola does the x-intercept relate to?
>
> **The x-intercept relates to the vertex in this situation.**

c. What is the factored form for a quadratic equation with its vertex at the origin? Check your answer using the Gizmo. Write your equation below.

Equation: $y = (\mathbf{x} - \mathbf{0})(\mathbf{x} - \mathbf{0})$

Click on 'Show polynomial form' to get the simplified version of the equation. Write this equation below.

Simplified equation: $y = \mathbf{x}^2$

4. Vary the value of *a*.

    a. When you change the value of *a*, what effect does it have on the shape of the parabola?

    The parabola either gets wider or thinner.

    b. What does the parabola look like when *a* is positive? When *a* is negative?

    When *a* is positive, the graph opens upwards; when negative, downwards.

Part B—Extending Your Understanding

If you click on 'Show polynomial form', the function $y = a(x - r_1)(x - r_2)$ is expanded (i.e., process of multiplying terms together) and simplified so that you can see it written in …

standard form, $y = ax^2 + bx + c$.

'Factoring a quadratic equation algebraically means performing the reverse operation: changing the quadratic from standard form to factored form.

5. With 'Show polynomial form' turned on, set $a = 1$ and examine the standard form of the function as you change the values of r_1 and r_2.

    a. How do the values of r_1 and r_2 combine to get the value of *c* in the standard form $y = ax^2 + bx + c$? Provide an example using the gizmo.

    If you <u>MULTIPLY</u> r_1 and r_2 together, you will get the *c*-value in the equation.

    Example: For the equation, $y = x^2 + 4x + 3$, the x-intercepts are 1 and 3. By multiplying, $(1)(3) = 3$. This is the same value as *c* in the equation.

    b. How do the values of r_1 and r_2 combine to get the value of *b* in the standard form of the equation? Provide an example using the gizmo.

    If you <u>ADD</u> r_1 and r_2 together, you will get the *b*-value in the equation.

Example: For the equation, $y = x^2 + 4x + 3$, the x-intercepts are 1 and 3. By adding, $1 + 3 = 4$. This is the same value as b in the equation.

Part C—Assessment Questions

Using the gizmo where necessary, complete and submit the 5 assessment questions. These questions are located underneath the gizmo.