MPM 2D
Mr. Kempe

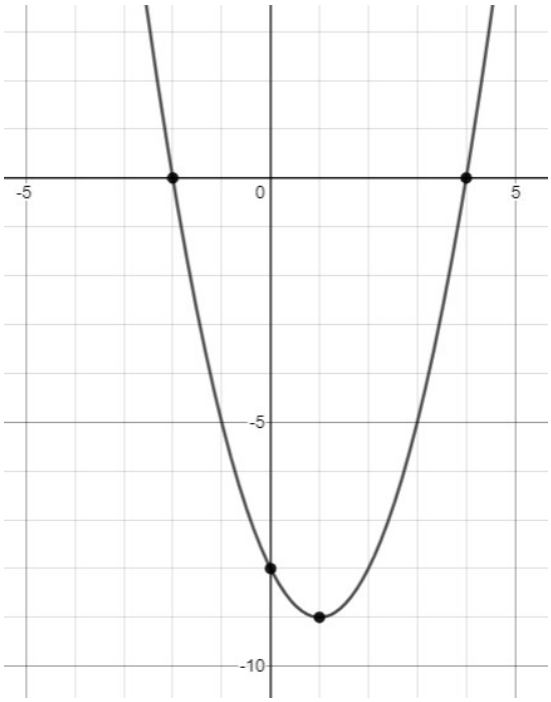
Name: _____
Date: _____

Test #3 – Quadratics Part 1

[40 marks]

Part A: Multiple Choice [K/U – 10 marks]

Questions 1 – 5 use the graph of the parabola, shown right.



1. What is the **y-intercept** of the parabola?
   a. 4 b. -2
   c. -8 d. -9

2. What are the **zeroes** of the parabola?
   a. -2 and 4 b. 0 and -8
   c. -1 and -9 d. 2 and -4

3. What is the equation of the **axis of symmetry**?
   a. $x = 1$ b. $x = -4$
   c. $x = -5$ d. $x = -1$

4. What are the coordinates of the **vertex**?
   a. (-2, 4) b. (0, -8)
   c. (1, -9) d. (-9, 1)

5. The standard form of a quadratic is $y = ax^2 + bx + c$. What do you know about the value of a for this parabola by looking at the graph?
   a. a is positive b. a is negative c. a is 0 d. There is nothing known

Questions 6 – 8 use the relation $y=(x-3)(x+2)$.

6. What is the **y-intercept** of this relation?
   a. 0 b. 2 c. -3 d. -6

7. What are the **zeroes** of this relation?
   a. 3 and 2 b. -3 and 2 c. 3 and -2 d. -3 and -2

8. Which of the following is the **standard form** of the relation?
   a. $y=x^2-5x+6$ b. $y=x^2-x-6$ c. $y=x^2+x-6$ d. $y=x^2-x+6$

9. Which of the following is a **perfect square trinomial**?
   a. x^2+5x+6 b. $x^2-10x+25$ c. $x^2+13x+36$ d. x^2+49

10. Which of the following is **not a difference of squares**?
    a. x^2-49 b. $4x^2-9$ c. $25x^2-1$ d. $36x^2-25x$

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Part B: Definition / Short Answer [C, 10 marks]

1. List four key features of parabolas can help you graph a quadratic relationship. [2 marks]

   Y-intercept, Zeroes, Axis of Symmetry, Vertex
   ("a" value is also acceptable)

2. Referring to question 1, define **two** of the features you listed. [2 marks]

   Y-intercept: where the parabola crosses the y-axis
   Zeroes: where the parabola crosses the x-axis (also called roots or x-intercepts)

3. Explain how to read the **zeroes** from the **factored form** of a quadratic relationship. [2 marks]

   Given the form $y = a(x - r)(x - s)$, the zeroes are *r* and *s*.
   (Explaining how the zeroes are the opposite sign of "what's in the brackets" is also acceptable.)

4. Explain how to find the vertex of a quadratic relationship if you know already know the **zeroes**. [2 marks]

   Go halfway between the zeroes to find the axis of symmetry; plug the axis into the original equation for *x* to find the *y*-co-ordinate of the vertex.

5. List the different types of factoring techniques we have learned, in *the order you should attempt them.* [2 marks]

   Common Factoring
   Special Cases (Perfect Square / Difference of Squares)
   Simple Trinomial
   Decomposition

   (Factoring by Grouping is optional for this list.)

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Part C: Problem Solving [ATIPS, 20 marks]

Complete any 5 of the following 6 problems. Each problem worth is 4 marks.

1. A quadratic relation has the equation $y=2(x+1)(x-2)$.

   Determine the *y*-intercept, zeroes, axis of symmetry, and vertex of this relation.

   Sketch the graph this relation and label the features.

   Y-intercept:

   $y=2(0+1)(0-2)$

   $y=2(1)(-2)$

   $y=-4$

   By inspection, the zeroes are **-1** and **2**.

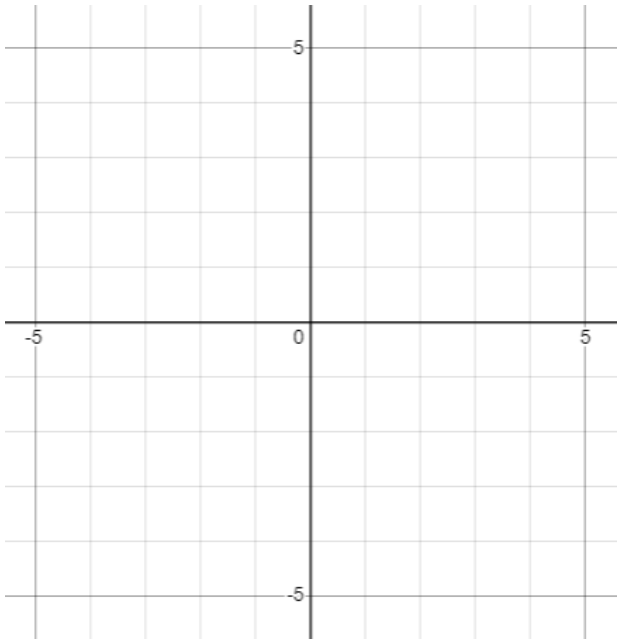
   The axis is $x=\frac{-1+2}{2}=\frac{1}{2}$

   $y=2\left(\frac{1}{2}+1\right)\left(\frac{1}{2}-2\right)$

   $y=2\left(\frac{3}{2}\right)\left(-\frac{3}{2}\right)$

   $y=-\frac{9}{2}=-4.5$

   The vertex is $\left(\frac{1}{2},-\frac{9}{2}\right)$ or (0.5, -4.5)



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2. A parabola has its vertex at (3,8). One of its zeroes is located at (1,0).

   a. What it the location of the other zero? [Hint: a rough sketch might help!]

   Solution 1
   The axis of symmetry is 3. Using the formula:

$$\frac{1+r}{2}=3$$
$$1+r=6$$
$$r=5$$

   The other zero is 5.

   Solution 2
   Noting that the axis is halfway between the zeroes, there is a distance of 2 between our zero (1) and the axis (3), so the other zero must be 2 more than 3, which is 5.

   b. Determine the equation of the relation in **factored form**.

$$y=a(x-1)(x-5)$$
$$8=a(3-1)(3-5)$$ Sub in the vertex to solve for a.
$$8=a(2)(-2)$$
$$8=-4a$$
$$-2=a$$

   Therefore the equation is $y = -2(x - 1)(x - 5)$.

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3. Expand and simplify.

a. $3x(x^2-4x+3)$

$=3x^3-12x^2+9x$

b. $(2x-5)(x+2)$

$=2x^2+4x-5x-10$
$=2x^2-x-10$

c. $(x-1)(x+1)-(x+9)(x-9)$
$=(x^2-x+x-1)-(x^2-9x+9x-81)$
$=(x^2-1)-(x^2-81)$
$=x^2-1-x^2+81$
$=80$

d. $(5x-3)^2$

$=(5x-3)(5x-3)$
$=25x^2-15x-15x+9$
$=25x^2-30x+9$

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4. Factor.

a. $x^2+8x+15$

Simple Trinomial
M: 15 A: 8 N: 3,5

= (x + 3)(x + 5)

b. $3x^2-8x+5$

Decomposition
M: (3)(5) = 15 A: -8 N: -3, -5

$=3x^2-3x-5x+5$
$=3x(x-1)-5(x-1)$
$=\mathbf{(x-1)(3x-5)}$

c. $28x^2-63$

Common factor
$=7(4x^2-9)$
Difference of Squares
$=7(2x-3)(2x+3)$

d. $x^3-8x^2-25x+200$

Factor by Grouping
$=x^2(x-8)-25(x-8)$
$=(x-8)(x^2-25)$
$=(x-8)(x-5)(x+5)$

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5. At a soccer game, a goalie kicks the ball down the field. The position of the ball is given by the relation $h=-\frac{1}{50}d(d-80)$, where h is the height above the ground and d is the distance from the goalie, both in meters.

   a. How far from the goalie does the ball land?

      The **zeroes** are 0 and 80, so the ball lands **80m away**.

   b. What is the maximum height of the ball above the ground during the kick?

      Halfway between the zeroes is **40**.

$$h=-\frac{1}{50}(40)(40-80)$$
$$h=-\frac{1}{50}(40)(-40)$$
$$h=\frac{1600}{50}=32$$

      The maximum height of the ball is 32m in the air.

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6. A hawk swoops down from a tree to catch a mouse. Its path can be modeled by the relation $h=3t^2-12t+12$ where t in the time in seconds, and h is the height in feet.

a. How high above the ground is the hawk 1s after is begins its descent?

$$h=3(1)^2-12(1)+12$$
$$h=3-12+12$$
$$h=3$$

The hawk is 3m above the ground.

b. How long does it take the hawk to reach the ground?

Find the zeroes!

$$h=3(t^2-4t+4)$$
$$h=3(t-2)^2$$

The zero occurs at 2, so the hawk reaches the ground in 2 seconds.