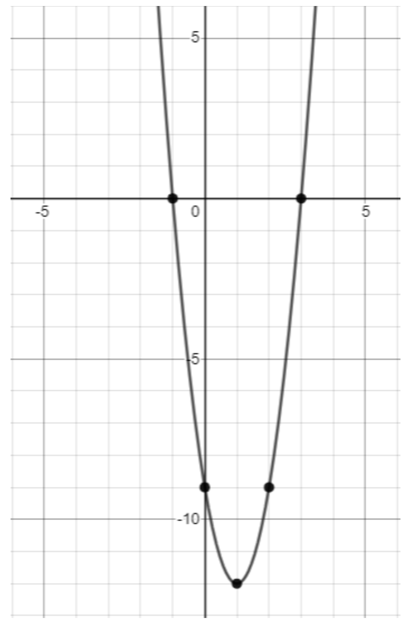
MPM 2D Exam Part 2 Name: ______________________
Mr. Kempe Tuesday, November 10th, 2020

Exam Part 2

(Quadratics. All of it.)
[40 marks]

Part A: Multiple Choice [10 marks]

Questions 1 – 5 deal with the parabola show right.



1. What is the *y*-intercept of this parabola?
   a. -1 b. 3 c. -9 d. -12
2. What is the equation of the axis of symmetry?
   a. $x = -1$ b. $x = 3$ c. $x = 1$ d. $x = -12$
3. What is the equation of this parabola in vertex form?
   a. $y=3(x-1)^2+12$ b. $y=3(x+1)^2+12$
   c. $y=3(x-1)^2-12$ d. $y=3(x+1)^2-12$
4. What is the equation of this parabola in factored form?
   a. $y=3(x-1)(x+3)$ b. $y=3(x+1)(x+3)$
   c. $y=3(x+1)(x-3)$ d. $y=3(x-1)(x-3)$
5. If you were to determine the **discriminant** of this quadratic relation, it would have to be…
   a. Negative b. Zero c. Positive d. Undefined
6. What direction does the parabola $y=-3x^2+2$ open?
   a. Left b. Right c. Up d. Down
7. Which of the following is the factored form of $y=x^2-5x-6$?
   a. $y = (x - 2)(x + 3)$ b. $y = (x + 2)(x - 3)$ c. $y = (x + 6)(x - 1)$ d. $y = (x - 6)(x + 1)$
8. Which of the following **cannot** be the number of solutions to a quadratic equation?
   a. 0 b. 1 c. 2 d. 3
9. A model rocket is launched from the roof of a building. The height of the rocket over time is modeled by a quadratic relation. To determine the height of the roof, you would find the:
   a. Zeroes b. Axis c. Vertex d. Y-intercept
10. The cost of producing a number of calculators is given by a quadratic relation. If you wanted determine the production level that gives the lowest possible cost, you would find the:
    a. Y-intercept b. Zeroes c. Axis d. Vertex

Bonus. What do you feed a baby parabola? **Quadratic Formula**

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Part B: Definition Matching [10 marks]

For each definition, write the letter corresponding to the appropriate word from the work bank in the space beside it. (An example has been done for you.) There are (a lot) more words that definitions, so be careful!

Word Match	Definition
W	$b^2 - 4ac$; used to determine the number of roots
H	The highest (or lowest) point on a parabola; where the parabola "turns around"
I	If $a > 0$, it is up; if $a < 0$, it is down
T	$y = a(x-h)^2 + k$
E	Where the parabola crosses the *x*-axis; also called roots or solutions
B	The name for a relationship whose graph is a parabola
O	Trinomials of the form $a^2 + 2ab + b^2$ or $a^2 - 2ab + b^2$
A	The highest exponent a polynomial has; for quadratics, it's always 2.
R	A method of factoring $ax^2 + bx + c$ that involves "splitting" the middle term
D	The name for the graph of a quadratic relationship
S	A process that takes standard form to vertex form by creating a perfect square

WORD BANK

A. Degree
B. Quadratic
C. Second Differences
D. Parabola
E. Zeroes
F. Y-intercept
G. Axis of Symmetry
H. Vertex
I. Direction of Opening
J. Step Pattern
K. Standard Form
L. Factored Form
M. Distributive Property
N. Common Factoring
O. Perfect Square Trinomial
P. Difference of Squares
Q. Simple Trinomial
R. Decomposition
S. Complete the Square
T. Vertex Form
U. Factor By Grouping
V. Quadratic Formula
~~W. Discriminant~~

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Part C: Problem Solving [20 marks]

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

1. Factor each expression as much as possible.

a. $x^2+12x-13$

$=(x-1)(x+13)$

b. $2x^2+9x+7$

$=2x^2+2x+7x+7$

$=2x(x+1)+7(x+1)$

$=(x+1)(2x+7)$

c. $4x^2-25$

Difference of Squares

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

d. $16x^2-56x+49$

Perfect Square Trinomial

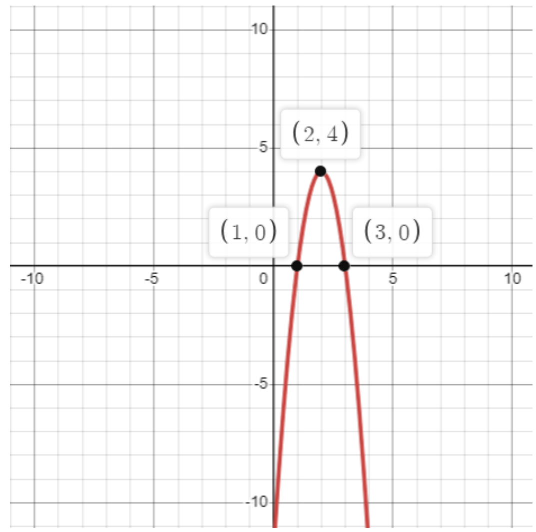
$=(4x-7)^2$

2. A quadratic relation has a vertex at (2, 4) and zeroes of 1 and 3. Determine the equation of this relationship in…
   a. Vertex Form.

$$y=a(x-h)^2+k$$
$$y=a(x-2)^2+4$$
$$0=a(1-2)^2+4$$
$$-4=a(1)$$
$$-4=a$$

$$\mathbf{y=-4(x-2)^2+4}$$

(You can use this grid if you want to, but it is not required for this question.)



   b. Factored Form.

   Given we found *a* above, we can fill in the equation directly.

$$y=a(x-s)(x-t)$$
$$\mathbf{y=-4(x-1)(x-3)}$$

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3. Sketch the graph of $y=3(x+1)(x+5)$ on the grid provided by finding the zeroes, axis of symmetry, vertex, and y-intercept. You must show all calculations for the key features to earn full marks.

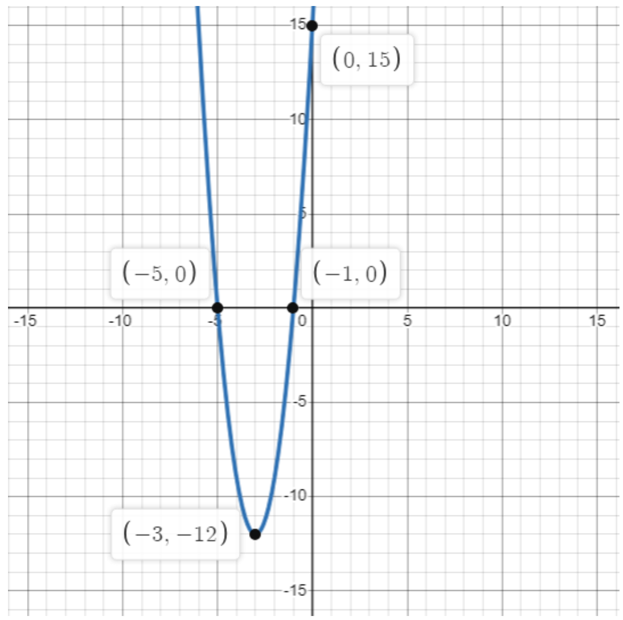
Zeros are -1 and -5.

Axis is $\frac{-1+(-5)}{2}=-3$

$$y=3(-3+1)(-3+5)$$
$$y=3(-2)(2)$$
$$y=-12$$

Vertex is (-3, -12).

Y-int is $y=3(0+1)(0+5)=\mathbf{15}$



4. Solve each quadratic equation. Round your answers to two decimal places, if necessary.

a. $-3(x-10)^2+3=0$

$$-3(x-10)^2+3=0$$
$$-3(x-10)^2=-3$$
$$(x-10)^2=\frac{-3}{-3}$$
$$(x-10)^2=1$$
$$x-10=\pm\sqrt{1}$$
$$x=10\pm1$$
$$x=11,9$$

b. $5x^2-15=3x^2+9x$

$$2x^2-9x-15=0$$
$$x=\frac{-(-9)\pm\sqrt{(-9)^2-4(2)(-15)}}{2(2)}$$
$$x=\frac{9\pm\sqrt{201}}{4}$$
$$x\approx\frac{9\pm14.18}{4}$$
$$x\approx5.79,-1.29$$

5. In Frisbee Golf, the objective is to land a Frisbee into a target like the one shown.

The path of a particular Frisbee throw can be modeled by the equation

$h = -0.005d^2 + 0.2d + 2$

where *h* is the height above the ground and *d* is the distance traveled along the ground, both in feet.

a. How high above the ground is the Frisbee when it is released?

h = $-0.005(0)^2 + 0.2(0) + 2$ = **2m**

b. Will the Frisbee reach a height of 4 feet above the ground?

$$h=-0.005d^2+0.2d+2$$
$$4=-0.005d^2+0.2d+2$$
$$0=-0.005d^2+0.2d-2$$

Check the discriminant:

$$b^2-4ac$$
$$=(0.2)^2-4(-0.005)(-2)$$
$$=0$$

Yes, the Frisbee peaks a 4 feet.

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6. The cost of extracting oil from a well can be modeled by the relation $C = 9x^2 - 144x + 608.50$, where C represents the cost per barrel, in dollars, for extracting x thousand barrels of oil.

   a. Determine the cost per barrel if 3500 barrels are extracted from the ground.

      3500 barrels = 3.5 thousand barrels

$$C = 9(3.5)^2 - 144(3.5) + 608.50$$
$$C = 214.75$$

      The cost per barrel is $214.75.

   b. What is the lowest possible cost-per-barrel?

      Lowest possible means find the ***vertex****. There are several ways to do this; complete the square is shown below.*

$$C = 9x^2 - 144x + 608.50$$
$$C = 9(x^2 - 16x) + 608.50$$
$$C = 9(x^2 - 16x + 64 - 64) + 608.50$$
$$C = 9(x^2 - 16x + 64) - 576 + 608.50$$
$$C = 9(x - 8)^2 + 32.5$$

      The lowest possible cost-per-barrel is $32.50, and this occurs at a production level of 8000 barrels.