Your final exam will consist of two parts: Free Response and Multiple Choice

**Part I: Free Response: Five questions, 10 points each (50 points total), Calculator OK**

1. Given two functions, describe the transformations. (Unit 1 Transformations)

2. Use the **distance formula** to write an equation of the parabola below given vertex and focus. Start by sketching the graph, labeling the vertex, focus, directrix, and a point P (x,y) on the parabola. (Unit 2 Parabolas)

3. Solve a given quadratic function using two different methods. (Unit 3 Complex Numbers)

4. Given a polynomial equation that represents a real life scenario, graph the function and answer questions relating characteristics of the graph to the real life scenario. (Unit 4 Polynomials, specifically 2CP Poly App WS)

5. Complete a table, make a graph, and write an equation to represent a given situation. Answer questions related to the situation, particularly approach scenarios (Unit 5 Rational Functions, specifically 2CP Rational Functions App WS)

**Part II: Multiple Choice, 50 questions, 100 points, Calculator OK**

You will take this part in class during regularly scheduled final exams, Jan 15-17 2019.

These questions are taken straight from your You Cans, Quizzes, and Tests and modified to accommodate a multiple choice format (with different numbers, of course). To prepare for this portion of the final, you should review all test corrections, quizzes, and You Cans. Refer to previous homework assignments for additional practice.

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**Algebra 2 CP First Semester Final Practice**

**Unit 1**

1. Describe how the graphs of each of the following functions compare to the graph of the parent function $f$.

<table>
<thead>
<tr>
<th>Function</th>
<th>Transformations</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y = f(x) + k$</td>
<td></td>
</tr>
<tr>
<td>$y = f(x - h)$</td>
<td></td>
</tr>
<tr>
<td>$y = -f(x)$</td>
<td></td>
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<tr>
<td>$y = af(x)$</td>
<td></td>
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<tr>
<td>$y = f(ax)$</td>
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</tbody>
</table>
4. \( f(x) = (x + 3)^2 + 1 \)  
5. \( f(x) = 2|x| - 1 \)

Axis of Symmetry:  
Transformation(s):

Graph the function:

6. \( f(x) = -2(x + 2)^2 + 3 \)  
7. \( f(x) = \frac{1}{2}|x - 1| \)

Axis of Symmetry:  
Transformation(s):

Graph the function:
For 8-13, describe the transformation(s) and graph.

8.) \( f(x) = -3x^2 \)

9.) \( f(x) = |x + 3| - 3 \)

10.) \( f(x) = \frac{1}{2} |x - 2| \)

11.) \( f(x) = -(x - 1)^2 + 1 \)

12.) \( f(x) = 2|x| \)

13.) \( f(x) = 2x^2 - 3 \)

For 14-17, write a function \( g \) whose graph has the given transformations. Show all work.

14.) \( f(x) = 2x^2 + 4; \) translation down 12 units

15.) \( f(x) = (x + 3)^2 - 4; \) reflection over the vertex, translation 6 units right

16.) \( f(x) = \frac{3}{4} |x + 2| - 1; \) vertical stretch by a factor of 4

17.) \( f(x) = -|x - 3| - 1; \) reflected over the vertex, vertical shrink by \( \frac{1}{9} \)

For 18-20, give the information in the box. To find the equation, show any applicable work.

18.)

| Transformations: ____________________________ | Equation: ____________________________ |
| Domain: ____________________________ | Range: ____________________________ |
| Axis of symmetry: ____________________________ | Intervals of increasing: ____________________________ |
| Intervals of decreasing: ____________________________ | Maximum: ____________________________ |
| Minimum: ____________________________ |

19.)

| Transformations: ____________________________ | Equation: ____________________________ |
| Domain: ____________________________ | Range: ____________________________ |
| Axis of symmetry: ____________________________ | Intervals of increasing: ____________________________ |
| Intervals of decreasing: ____________________________ | Maximum: _________ Minimum: __________ |

20.)
20.) 

21.) The graph below shows the height \( h(t) \) in feet of a small rocket \( t \) seconds after it is launched. The path of the rocket is given by the equation: \( h(t) = -16t^2 + 128t \).

a.) What is the vertex? What does it represent in this context?

b.) Using your knowledge of transformations of functions, write the equation for the parabola in vertex form.

c.) What is the interval where the function is increasing? What does this represent in the context of this question?

d.) What is the interval where the function is decreasing? What does this represent in the context of this question?

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**Unit 2**

For 1-4, use the distance formula to come up with the equation of a parabola with the given characteristics.

1.) focus (0,-8) & directrix y=8  
2.) focus (5,0) & vertex (0,0)  
3.) directrix y=-3 & vertex (0,0)  
4.) directrix y=10 and focus (0, -10)

For 5-8, find the axis of symmetry, focus, directrix, and then graph, using 2 other points besides the vertex.

5.) \( y = -\frac{1}{16}x^2 \)  
6.) \( x = \frac{1}{24}y^2 \)  
7.) \( 36y = x^2 \)  
8.) \( 28x + y^2 = 0 \)

9.) Given the vertex of a parabola is (0,0) and the equation of the directrix is \( y = -3 \), find the equation for the parabola and sketch a graph labeling the vertex, directrix, and focus and two other points (1 point on each side of vertex).

10.) Given the vertex of a parabola is (0,0) and the focus is (-4,0), find the equation for the parabola and sketch a graph labeling the vertex, directrix, and focus and two other points (1 point on each side of vertex).

11.) Given the vertex of a parabola is (-3,4) and the focus is (-3,2), find the equation for the parabola and sketch a graph labeling the vertex, directrix, and focus and two other points (1 point on each side of vertex).

12.) Given the focus is (2,4) and the equation of the directrix is \( x = 4 \), find the equation for the parabola and sketch a graph labeling the vertex, directrix, and focus and two other points (1 point on each side of vertex).
13.) Using the graph below, find the vertex, focus, directrix, axis of symmetry, and equation.

14.) Using the graph below, find the vertex, focus, directrix, axis of symmetry, and equation.

15.) Using the graph below, find the vertex, focus, directrix, axis of symmetry, and equation.

16.) Using the graph below, find the vertex, focus, directrix, axis of symmetry, and equation.

17.) Given $y = -\frac{1}{8}x^2$, draw a graph showing the focus, vertex, directrix, and axis of symmetry and 2 other points labeled (1 point on each side of vertex). Label all parts of the graph.

18.) Given $x = -\frac{1}{12}y^2$, draw a graph showing the focus, vertex, directrix, and axis of symmetry and 2 other points labeled (1 point on each side of vertex). Label all parts of the graph.

19.) Given $x = -\frac{1}{4}(y + 1)^2 + 1$, draw a graph showing the focus, vertex, directrix, and axis of symmetry and 2 other points labeled (1 point on each side of vertex). Label all parts of the graph.

20.) Given $y = -\frac{1}{16}(x - 2)^2 - 1$, draw a graph showing the focus, vertex, directrix, and axis of symmetry and 2 other points labeled (1 point on each side of vertex). Label all parts of the graph.

21.) Use the distance formula to write the equation of the parabola below.
22.) Use the distance formula to write the equation of the parabola below.

![Image of a parabola with focus at (0, 12)]

23.) An archway in front of the Westlake auditorium is in the shape of a parabola. The top of the arch is the vertex (0,0). The school seal is at the focus, 5 feet below the vertex and the arch is 20 feet wide at the ground. Write an equation that represents a cross section of the arch. What is the height from the top of the arch to the ground?

24.) A parabolic microwave antenna is 16 feet in diameter. Write an equation that represents the cross section of the antenna with its vertex at (0,0) and its focus 10 feet to the right of the vertex. What is the depth of the antenna?

### Unit 3

**For 1-3, solve by factoring.**

1.) \( x^2 + 4x = 32 \)
2.) \( 2x^2 + 5x - 3 = 0 \)
3.) \( 4x^2 - 12x + 9 = 0 \)

**For 4-6, solve using square roots.**

4.) \( x^2 = -81 \)
5.) \( (x - 2)^2 + 27 = 0 \)
6.) \( 4x^2 - 31 = -111 \)

**For 7-9, solve by completing the square.**

7.) \( x^2 - 6x + 20 = 0 \)
8.) \( 3x^2 + 12x - 15 = 0 \)
9.) \( 3x(x + 3) = -20 \)

**For 10-19, simplify. Put all answers in standard form.**

10.) \( (3 + 8i) + (4 - 9i) \)
11.) \( (3 + 8i) - (4 - 9i) \)
12.) \( (3 + 8i)(4 - 9i) \)
13.) \( \frac{3 + 8i}{4 - 9i} \)
14.) \( (3 + 8i)^2 \)
15.) \( \sqrt{-25} - \sqrt{-100} + \sqrt{16} \)
16.) \( i^{727} \)
17.) \( (4 + 8i) - (2 + 4i^7) \)
18.) \( (3 - 2i^{12})(4 + 6i^9) \)
19.) \( \frac{12}{5i} \)

**Solve by factoring.**

20.) \( 2x^2 + 5x = 12 \)
21.) \( 2(x + 7)^2 + 56 = 0 \)
22.) \( x^2 - 3x + \frac{45}{2} = 0 \)

**Solve using square roots.**

23.) \( 6x^2 - 5x - 12 \)
24.) \( 6x^2 - 5x + 1 \)
25.) \( \frac{7 - 3i}{1 - 2i} \)
26.) \( \frac{7 - 3i}{1 - 2i} \)
27.) \( (7 - 3i)^2 \)
28.) \( i^{95} \)

**Solve by completing the square.**

29.) \( y = x^2 - 8x + 10 \)
30.) \( y = x^2 - 5x + 2 \)

**Simplify. Put all answers in standard form.**

29.) \( y = x^2 - 8x + 10 \)
30.) \( y = x^2 - 5x + 2 \)

**Convert from standard to vertex form. Then identify the vertex.**

31.) \( y = -x + 1 \)
32.) \( y = 2x^2 + 3x + 4 \)
33.) \( y = x^2 + 2x + 3 \)

**Solve the system by graphing. Sketch a graph and identify solution(s).**

31.) \( y = -x + 1 \)
32.) \( y = x^2 + 2x + 3 \)

### Unit 4

**For 1-2, divide by factoring first.**

1.) \( \frac{2x^2 - 5x - 12}{2x + 3} \)
2.) \( \frac{6x^2 - 5x + 1}{3x - 1} \)

**For 3-4, divide using long division.**

3.) \( (6x^3 - 8x + 5) ÷ (2x - 4) \)
4.) \( (x^3 + 9x^2 + 24x + 19) ÷ (x + 5) \)
For 5-6, divide using synthetic division.
5.) \((2x^3 - 3x^2 + 4x + 5) \div (x + 2)\)
6.) \((-2x^2 + x^3 - 4) \div (x - 3)\)

7.) For the following function: \(f(x) = -3x^6 + 2x^5 - x^3 + 4x^2 - 4\)
   a.) What is the maximum number of real zeros it could have? b.) Is the degree even or odd? c.) Is the leading coefficient positive or negative? Based on your answers from b.) and c.), sketch what the shape of the graph could be?

8.) Given the following graph:
   a.) Is the degree even or odd? b.) Is the leading coefficient positive or negative? c.) Describe the end behavior, d.) Domain/range? e.) Absolute min/max f.) Relative min/max, g.) Increasing/Decreasing, h.) \(f(x)>0\) & \(f(x)<0\). i.) Real zeros

Show all work on a separate piece of paper. Check your answers online along the way or when you are finished. For 9-14, no calculators allowed. For 15-20, calculators are allowed if needed.

9.) Prove the following polynomial identity: \((x^2 + 3)(x^2 - 3) = x^4 - 9\)

10.) Sketch the following polynomial, showing the zeros, x- and y-intercepts, end behavior, and general shape.
\(f(x) = x(x + 2)^2(x - 3)(x + 5)^2\)

11.) For the following polynomial, find: a.) domain and range, b.) absolute min and max, c.) relative min and max, d.) end behavior, e.) lowest possible degree of the polynomial, f.) positive or negative leading coefficient, g.) interval(s) where the function is increasing and decreasing, h.) interval(s) where \(f(x) > 0\) and \(f(x) < 0\), and i.) a possible polynomial equation for this graph (use the zeros).

12.) Given \(f(x) = x^3 - 5x^2 - 9x + 45\) show that \((x - 5)\) is a factor of \(f(x)\). Then factor \(f(x)\) completely.

13.) Find all complex solutions, real and imaginary, of \(0 = 4x^4 + 13x^2 - 12\).

14.) Divide \(f(x) = x^4 + 2x^2 - x + 5\) by \(x^2 - x + 1\) using long division.

15.) List all possible rational roots of the function \(f(x) = 2x^3 + 3x^2 + 6x - 12\)

16.) Find all zeros (real and imaginary) of a polynomial. (Hint: Use your graphing calculator to help you find a real, rational root, then go from there). \(f(x) = x^3 - 3x^2 + 4x - 12\)

17.) Find all real zeros of \(p(x) = 4x^3 + 5x^3 + 2x^2 - x - 6\) in your graphing calculator and tell how many complex zeros there are. Round to 4 decimal places.

18.) The beetle population of a small, remote island can be modeled by the equation \(f(t) = -0.004t^5 + 75t + 1500\) where \(t\) is the time in months since observations of the island began, and \(t=1\) represents January.
   a.) Use your calculator to sketch a graph of the function. Label any intercepts and maxima/minima.
   b.) During what months was the population increasing? Decreasing? (Use words, not interval notation)
   c.) During what month did the rabbits have the highest population?
   d.) What was the highest population?

19.) A farmer has 900 ft of fencing and wants to fence off a rectangular field that borders a straight river. He does not need a fence along the river. What are the dimensions of the field of largest area that he can fence? (see diagram)

<table>
<thead>
<tr>
<th>X=width</th>
<th>Length</th>
<th>Area</th>
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<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
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<tr>
<td>100</td>
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</tr>
<tr>
<td>200</td>
<td></td>
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<tr>
<td>300</td>
<td></td>
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</tr>
<tr>
<td>400</td>
<td></td>
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</tr>
<tr>
<td>500</td>
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</tbody>
</table>
Write equations to model the Length and Area as a function of x. Graph the equation on your calculator. Find the width that will allow the farmer to maximize its area. What is the maximum area?

Length = _______________ Area = _____________

A width of _______ gives a max area of__________.

Unit 5
For 1-3, tell whether x and y show direct variation, inverse variation, or neither. If they are direct or inverse, name the constant of variation (k).

1.) 7xy = 4  
2.) \( y = \frac{x}{12} \)
3.) y = 2x + 1

4.) If y varies inversely as x and \( y = 15 \) when \( x = 3 \), find \( y \) when \( x = 5 \).

5.) The time it takes you to get to campus varies inversely as your driving speed. Averaging 20 miles per hour in bad traffic, it takes you 1.5 hours to get to campus. How long would the trip take averaging 50 miles per hour?

6.) Simplify completely: \( \frac{2x^2-5x-3}{4x^2-8x-5} \)

7.) For what value(s) of \( x \) is the expression in number 6 undefined? (What can \( x \) not equal?)

8.) Simplify completely: \( \frac{24x^4y^3}{9x^2y^8} \div \frac{48x^5y^2}{27x^6y^6} \)
9.) Simplify completely: \( \frac{5x^2-25}{3y} \cdot \frac{y^2-9}{x^2+4x-5} \)
10.) Simplify completely: \( \frac{2}{y^2-6y+9} \)
11.) Simplify completely: \( \frac{4}{5x} - \frac{4}{6x} + \frac{3}{10x} \)
12.) Simplify completely: \( \frac{4}{x^2-x-12} \)
13.) Simplify completely: \( \frac{3x}{4x-2} \)

Given the graph below, answer the following questions:

14.) Domain (interval notation)
15.) Range (interval notation)
16.) Equation for Vertical Asymptote
17.) Equation for Horizontal Asymptote
18.) Increasing interval(s) (interval notation)
19.) Increasing interval(s) (interval notation)
20.) End behavior

21.) Graph \( f(x) = \frac{1}{x+3} + 2 \). Draw the asymptotes as dashed lines and label them with their equations.

22.) Graph \( f(x) = \frac{1}{x-1} + 3 \). Draw the asymptotes as dashed lines and label them with their equations.

23.) Graph \( f(x) = \frac{x+1}{x+4} \). Draw the asymptotes as dashed lines and label them with their equations.

24.) Solve: \( \frac{1}{x+2} = \frac{3}{x-1} \)
25.) Solve: \( \frac{7}{x+3} = \frac{2}{x-9} \)
26.) Solve: \( \frac{x}{x-3} = \frac{2}{x+3} \)

27.) Mr. Harris can solve the world’s most enjoyable math problem in 4 days. His evil twin brother can solve the same problem in 2 days. How long will it take them to solve the problem if they work together?