Pre-Calculus: 1.1 – 1.2
Functions and Their Properties

(Solving equations algebraically and graphically, matching graphs, tables, and equations, and finding the domain, range, VA, HA, etc.).

Name: _____

Date: _____ Hour: ___

SCORE: _____/106

Percent Correct: ____%

Be sure to SHOW ALL WORK. Answer questions completely. Be sure to write answers in spaces provided. If work or answers are in another location, please make note of that. Short answer or multiple choice problems are worth 2 points each. Other problems will be worth 4 points each based on our department 4 point rubric. There are 106 points possible.

8/4	Correct, complete, with appropriate work or explanations.
6/3	Correct strategy, minor errors, appropriate work or explanations.
4/2	Starts with appropriate strategy, some understanding, some errors.
2/1	Attempted appropriate strategy, minimal understanding.
0	Little or no understanding evident – OR – no work shown.

I. **Select the appropriate graph and equation for each table of values.** (2 points per answer. 16 total)

1. Equation _____ Graph _____

x	0	1	2	4
y	-1.67	-3.5	-9	13

2. Equation _____ Graph _____

x	0	1	2	4
y	-1.67	-2.5	-5	5

3. Equation _____ Graph _____

x	-3	-2	-1	0
y	1	1.414	1.732	2

4. Equation _____ Graph _____

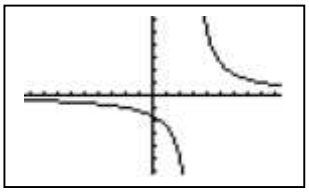
x	-2	-1	0	1
y	8	5	4	5

Equations:

a. $a(x) = \sqrt{x+4}$ b. $b(x)\frac{5}{x-3}$ c. $c(x) = \frac{2x+5}{x-3}$ d. $d(x) = x^2 + 4$

Graphs:

e.



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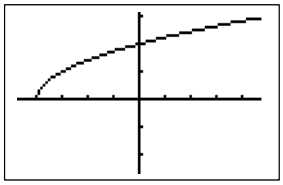
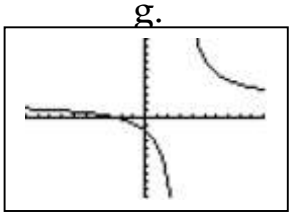


g.



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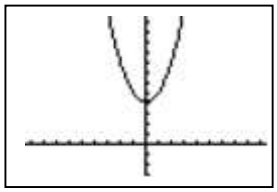


II. **Solve each equation algebraically.** (4 points each)

5. $3x^2 + 3x = 36$

6. $x^2 - 5x + 3 = 0$

III. Complete the table below. Fill in every box. (1 point per sketch and 2 points per box. 78 points total.)

	Equations	Sketch the Graph	Domain	Range	Vertical Asymptote	Horizontal Asymptote	Max./Min. (x, y)	Hole Yes or no? Where?
7.	$y = \frac{2x}{x-5}$							
8.	$y = \sqrt{2-x} - 3$							
9.	$x = -3$							
10.	$y = \frac{x-4}{x^2-x-12}$							
11.	$y = x^2 + 7x + 12$							
12.	$y = -\lvert x-1 \rvert + 4$							

13. In what type of equation would we expect to find a HORIZONTAL ASYMPTOTE? Explain and give an example to support your answer. (4 points)

14. **EXTRA CREDIT:** Give an example of a function that fits the criteria below. There may be more than one possible solution. (Pick **ONLY** 2. 2 points each)
    1. Domain: $(-\infty, \infty)$
       Range: $(-\infty, -3)$

    2. Domain: $(-3, \infty)$
       Range: $(2, \infty)$

    3. Vertical Asymptote: $x = -1$
       Horizontal Asymptote: $y = 0$
       Hole: $x = 4$

Pre-Calculus: 1.3 – 1.5

Graph Transformations and Combining Functions.

(Transforming images and parent functions as well as combining functions using the five different properties.)

Name: _____

Date: _____ Hour: ___

SCORE: _____ / 64

Percent Correct: ____%

Be sure to SHOW ALL WORK. Answer questions completely. Be sure to write answers in spaces provided. If work or answers are in another location, please make note of that. There are **64** points possible.

16/8/4	Correct, complete, with appropriate work or explanations.
12/6/3	Correct strategy, minor errors, appropriate work or explanations.
8/4/2	Starts with appropriate strategy, some understanding, some errors.
4/2/1	Attempted appropriate strategy, minimal understanding.
0	Little or no understanding evident – OR – no work shown.

1. Find $(f+g)(x)$ and $(f-g)(x)$ given that $f(x)=3x+2$ and $g(x)=x^2-7$. **(4 points)**

a) $(f+g)(x)=$ _____ **b)** $(f-g)(x)=$ _____

2. Find $(f*g)(-2)$ and $(\frac{f}{g})(3)$ given that $f(x)=\sqrt{x+6}$ and $g(x)=x^2-1$. **(4 points)**

a) $(f*g)(x)=$ _____ **b)** $\left(\frac{f}{g}\right)(x)=$ _____

3. Find $(f\circ g)(x)$ and $(g\circ f)(x)$ with $f(x) = 3x + 5$ and $g(x) = x^2 - 4$ **(4 points each)**

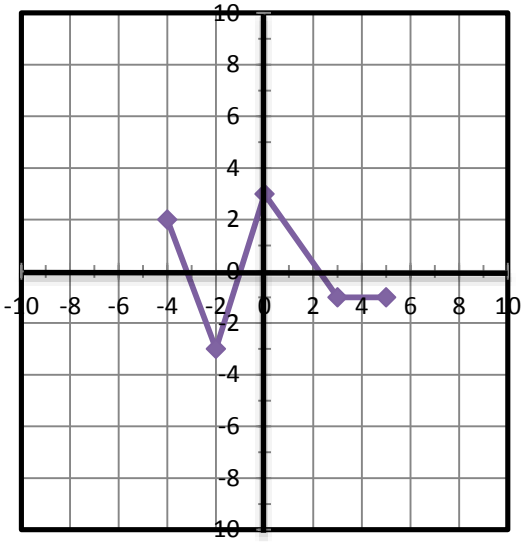
A. $(f\circ g)(x)$

B. $(g\circ f)(x)$

a) $(f\circ g)(x) =$ _____

b) $(g\circ f)(x) =$ _____

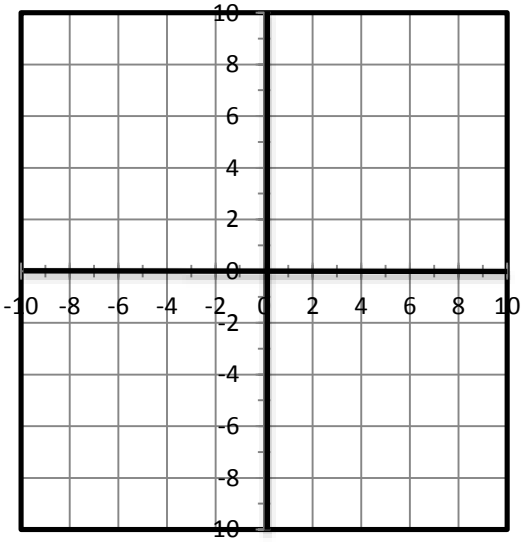
4. Perform the appropriate graph transformations and **draw the new graph**. **(16 points each)**



$$y = 3f(-x + 5) - 1$$

x	y	→	x	y	→	x	y	→	x	y	→	x	y

5. Perform the appropriate graph transformations and **draw the new graph**.**(16 points each)**



$$f(x) = -|2x - 4| + 3$$

Parent Function: _____

x	y	→	x	y	→	x	y	→	x	y	→	x	y
-2													
-1													
0													
1													
2													

6. Find the inverse of the function: $f(x) = \frac{3x-5}{x+4}$. **(8 points each)**

$f^{-1}(x) =$ _____

7. State the transformations occurring in each function below. **(4 Points each)**

A. $f(x) = 5\sqrt{-x+3} - 2$

1. ___ = _____
2. ___ = _____
3. ___ = _____
4. ___ = _____

B. $f(x) = -\left(\frac{1}{2}x - 4\right)^3 + 7$

1. ___ = _____
2. ___ = _____
3. ___ = _____
4. ___ = _____

8. **<u>Extra Credit:</u>** What are the ten parent functions? (½ point each)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Pre-Calculus: 2.1 – 2.4
Polynomial, Power and Monomial Functions, Graph Behavior and Division

Name: _____

Date: _____ Hour: ___

SCORE: ____ / 72

Percent Correct: ____%

Be sure to SHOW ALL WORK. Answer questions completely. Be sure to write answers in spaces provided. If work or answers are in another location, please make note of that.
There are **72** points possible.

16/8/4	Correct, complete, with appropriate work or explanations.
12/6/3	Correct strategy, minor errors, appropriate work or explanations.
8/4/2	Starts with appropriate strategy, some understanding, some errors.
4/2/1	Attempted appropriate strategy, minimal understanding.
0	Little or no understanding evident – OR – no work shown.

1. Using the Rational Zero Theorem, find all of the zeros for the polynomial function. **(12 points)**

$$f(x) = x^4 + 9x^3 + 14x^2 - 54x - 120$$

Zeros: _____

2. State the end behavior for the following functions: **(6 points)**
   i. $f(x) = -5x^3 + 4x^2 - 8$ _____ and _____
   ii. $f(x) = -3x^6 - x^4 + 7x^2 + 2$ _____ and _____
   iii. $f(x) = 2x^5 - 5x + 9$ _____ and _____

3. Find the vertex and axis of symmetry for the following quadratic function. **(4 points)**

$$f(x) = -2x^2 - 12x + 4$$

Vertex: _____

Axis of Symmetry: _____

4. Divide $f(x) = -4x^4 + x^3 + 2x^2 + 3x - 1$ by $d(x) = x - 1$. **(4 points)**

Fraction Form:

_____

5. Determine whether the following are polynomial, power or monomial functions. If so, state by underlying the correct term and filling in the blank appropriately.**(8 points)**

A. $f(x) = 4x^3$

Circle **all** that apply:
Polynomial Power Monomial

Degree/Power: _____

Leading Coefficient/C.O.V.: _____

B. $f(x) = -3x^5 + 2x^3 - 5$

Circle **all** that apply:
Polynomial Power Monomial

Degree/Power: _____

Leading Coefficient/C.O.V.: _____

6. Find the quadratic equation that has a **vertex** of $(-4, 13)$ and **point** $(-6, 1)$. **(4 points)**

Final Equation: _____

7. State the degree and zeros of the polynomial function. State the multiplicity of each zero and what the behavior of the graph is at that zero (crosses/kisses). **(10 points)**

$$f(x) = (x + 5)^4(x - 2)(x - 6)^3$$

Degree: _____

Zeros	Multiplicity	Crosses/Kisses
$x =$		
$x =$		
$x =$		

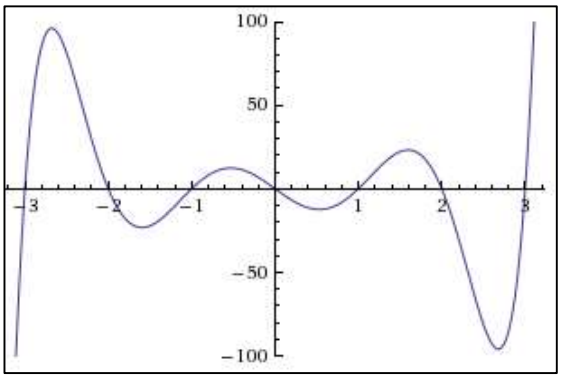
8. Write the statements below as a power function equation. **(4 points)**

m varies directly with the fourth root of t.	
g is inversely proportional to the cube of f.	

9. Write a sentence that expresses the relationship in the **power** formula, using the language of variation or proportion. **(4 points)**

$y = -5x^{-3}$	
$V = \frac{4}{3}\pi r^3$ $(V = Volume\ and\ r = radius)$	

10. Given the graph, state the following: **(4 points)**



i. Number of Zeros: _____

ii. Number of Extrema: _____

11. Using long division, divide $f(x) = 3x^4 + 2x^3 + 10x^2 + 4x - 5$ by $d(x) = x^2 + 2$. **(8 points)**

Polynomial Form:

_____

12. Write the equation for the linear equation with the **points** $(-3,5)$ and $(-4,8)$. **(4 points)**

Final Equation: _____

Pre-Calculus: 2.5 – 2.6

Complex Numbers and the Fundamental Theorem of Algebra

Name: _____

Date: _____ Hour: ___

SCORE: _____ / 88

Percent Correct: ____%

Be sure to SHOW ALL WORK. Answer questions completely. Be sure to write answers in spaces provided. If work or answers are in another location, please make note of that.
There are **88** points possible.

16/8/4	Correct, complete, with appropriate work or explanations.
12/6/3	Correct strategy, minor errors, appropriate work or explanations.
8/4/2	Starts with appropriate strategy, some understanding, some errors.
4/2/1	Attempted appropriate strategy, minimal understanding.
0	Little or no understanding evident – OR – no work shown.

1. Perform the indicated operation and write the result in standard form. **(16 points)**

A. $(3-2i)+(-2+5i)$

Solution: _____

B. $(5-7i)-(3-2i)$

Solution: _____

C. $(1+2i)(3-2i)$

Solution: _____

D. i^{123}

Solution: _____

2. Write the expression in bi where b is a real number. **(4 points)**

A. $\sqrt{-81}$

Solution: _____

B. $\sqrt{-625}$

Solution: _____

3. Write the following expressions in standard form. **(12 points)**

A. $\frac{(2i)(3-4i)}{3+i}$

Solution: _____

A. $(1+3i)^3$

Solution: _____

4. Find the product of the complex number and its conjugate given that $f(x)=2-9i$. **(4 points)**

Solution: _____

5. Write in standard form a polynomial function that would have with real coefficients and zeros: $5, -1$ and $4 + i$. **(Multiply out)** **(12 points)**

Standard Form: _____

6. Write in standard form a polynomial function that would have with real coefficients and zeros with their multiplicities: **(Multiply out)** **(12 points)**

Zero	Multiplicity
-4	2
$3i$	1

Standard Form: _____

7. Find all of the zeros and write a linear factorization of the function. **(12 points)**

$$f(x) = x^4 + 3x^3 - x^2 + 2x - 40$$

Linear Factorization: _____

8. Given the zero $5 + 3i$, find all of the zeros and write a linear factorization of the function. **(8 points)**

$$f(x) = x^3 - 6x^2 - 6x + 136.$$

Linear Factorization: _____

Conceptual Questions: **(8 Points)**

1. Is it possible to get a 5th degree polynomial with real coefficients and zeros of $3 - 5i$ and $4 - i$? **Explain.**

2. Up to what exponent of i do you need to know in order to solve i^n when n is a positive constant? Why? **Provide an example.**

3. If you have an x^4 polynomial, what do you do if you can only find one zero in the table?

4. When given a polynomial function, how can we determine the number of zeros without actually solving for them? **Explain.**

Form A – Part 2

Pre-Calculus: 2.7 – 2.8

Rational Functions and Solving Inequalities in One Variable

Name: _____

Date: _____ Hour: ___

SCORE: ____ /**80**

Percent Correct: ____%

Be sure to SHOW ALL WORK. Answer questions completely. Be sure to write answers in spaces provided. If work or answers are in another location, please make note of that. There are **80** points possible.

16/8/4	Correct, complete, with appropriate work or explanations.
12/6/3	Correct strategy, minor errors, appropriate work or explanations.
8/4/2	Starts with appropriate strategy, some understanding, some errors.
4/2/1	Attempted appropriate strategy, minimal understanding.
0	Little or no understanding evident – OR – no work shown.

1. Describe how the graphs of the given function can be obtained by transforming the graph of the rational function $f(x) = \frac{1}{x}$. **(8 points)**

$$f(x) = \frac{-8x + 3}{x - 2}$$

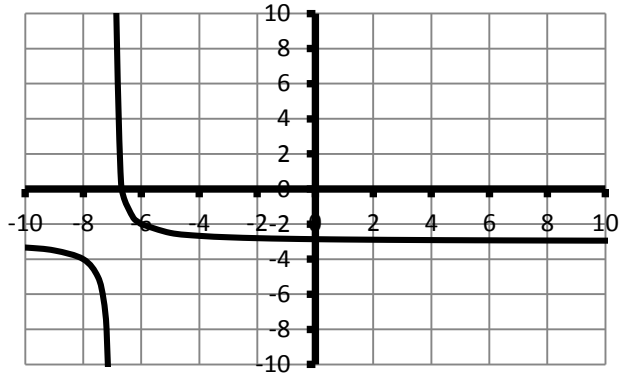
H – _____

S – _____

R – _____

V – _____

2. Evaluate the limit based on the graph $f(x)$ shown. **(8 points)**



$\lim_{x \to -7^+} f(x) =$ _____

$\lim_{x \to -7^-} f(x) =$ _____

$\lim_{x \to \infty} f(x) =$ _____

$\lim_{x \to -\infty} f(x) =$ _____

3. Solve the following equation algebraically. **(12 points)**

$$\frac{1}{x-4} + \frac{x}{x-2} = \frac{2}{x^2 - 6x + 8}$$

Solution: _____

4. For the given functions, find the indicated values. **(12 points)**

A. $f(x) = \frac{4x+3}{x^2-16}$

X-Intercepts: _____ Y-Intercept: _____

B. $f(x) = \frac{x^2-5x-36}{x+3}$

VA: _____ HA: _____ Slant A.: _____

For the following problems you are **REQUIRED** to make a sign chart for full credit.

5. Determine the x values that cause the polynomial functions to be **(a)** zero, **(b)** positive, and **(c)** negative. **(8 points)**

$f(x) = (x-7)(3x+4)(x^2+6)$ ⟷

(a):_____ **(b)**:_____ **(c)**:_____

6. Determine the x values that cause the polynomial function to be **(a)** zero, **(b)** undefined, **(c)** positive, and **(d)** negative. **(12 points)**

A. $f(x) = \frac{(3x-6)(x+9)}{x-7}$ ⟷

(a):_____ **(b)**:_____ **(c)**:_____ **(d)**:_____

7. Solve the polynomial inequality. **(12 points)**

A. $2x^3 - 25x^2 + 33x + 270 > 0$ ⟷

Solution: _____

B. $\frac{\sqrt{x-8}}{x^2+17x+30} \leq 0$

Solution: _____

8. Answer the following questions in <u>complete</u> sentences. **(8 points)**
   A. When is a polynomial function undefined? (HINT: There are two cases).
      I.

      II.

   B. How do we find horizontal asymptotes? (**Give an example of each!**)