Name: _____ **CP Calculus Summer Packet**

Complete this packet over the summer (DO NOT complete it all during the month of June . . . it will defeat the purpose of the packet). You will be tested on this information during the first week of school. If you have questions, you can e-mail me: kgrossi@umtsd.org, I will check my e-mail occasionally throughout the summer.

PART 1: POLYNOMIALS. You should be able to factor polynomials, simplify rational expressions, and divide polynomials.

Factor completely.

1. $x^2 - 8x + 12$

2. $x^2 + 7x - 30$

3. $3x^2 - 24x - 60$

4. $2x^2 - 5x - 12$

5. $6x^2 + 17x + 5$

6. $24x^2 + 2x - 12$

Simplify each rational expression. SHOW YOUR WORK.

7. $\frac{x^2 + 3x - 10}{2x^2 + 9x - 5}$

8. $\frac{x^2 + 10x + 16}{x^2 + 5x - 24}$

9. $\frac{3x^2 - 75}{x^2 + 8x + 15}$

DIVIDING FRACTIONS

$$\frac{x^4-6x^3+18x-1}{x-2}$$

Using Long division:

$$\begin{array}{r} x^3-4x^2-8x+2 \\ x-2\overline{)\,x^4-6x^3+0x^2+18x-1} \\ \underline{x^4-2x^3} \\ -4x^3+0x^2 \\ \underline{-4x^3+8x^2} \\ -8x^2+18x \\ \underline{-8x^2+16x} \\ 2x-1 \\ \underline{2x-4} \\ 3 \end{array}$$

Remainder

Final Answer: $x^3-4x^2-8x+2+\frac{3}{x-2}$

Using Generic Rectangles:

	x^3	$-4x^2$	$-8x$	$+2$	
x	x^4	$-4x^3$	$-8x^2$	$+2x$	3
-2	$-2x^3$	$+8x^2$	$+16x$	-4	
	x^4-6x^3	$+0x^2$	$+18x$	-1	

Remainder

Final Answer: $x^3-4x^2-8x+2+\frac{3}{x-2}$

Use generic rectangles to divide the polynomials.

10. $(x^4-x^3-4x^2+8x+8)\div(x+2)$

x	x^4			
$+2$				
	x^4	$-x^3$	$-4x^2$	$+8x$	$+8$

11. $(4x^3+4x^2-7x-6)\div(2x+3)$

$2x$	$4x^3$			
$+3$				
	$4x^3$	$+4x^2$	$-7x$	-6

Divide the following polynomial functions using generic rectangles AND using long division.

12. $\frac{2x^3+4x^2-6x+6}{2x+1}$

PART 2: DOMAIN AND RANGE. You should be able to identify the domain and range of a function both algebraically (without a calculator) and graphically.

DOMAIN: The domain of a function is the set of x-values that can be inputted into a function, so yield a y-value. To find the domain of a function, ask yourself what values CANNOT be used.

- The domain of all **polynomial functions** is ALL REAL NUMBERS, because you can raise any number to an whole number exponent and you can add, subtract, and multiply all numbers.
- You cannot take the **square root** of a negative number, so when dealing with a square root, you know that whatever is under the radical must be greater than or equal to zero.
- You are NEVER allowed to divide by zero, so we know that the denominator of a **rational function** cannot equal zero.
- You cannot take the log of a negative number, so we know that when we have a logarithmic function, whatever we take the log of must be greater than or equal to zero.

RANGE: The range is the resulting outputs or y-values. To find the range of a function, think about what the function looks like (general shape and starting point or shifts); also consider what is happening in the function and what that does to the problem (EX: when you square a positive or negative number, your answer always turns positive).

INTERVAL and SET NOTATION: When identifying your domain and range, you should write your answer in interval or set notation.

INTERVAL NOTATION: Interval notation uses parentheses () and brackets []. A parentheses indicates that the number next to it is NOT included while a bracket indicates that the number next to it IS part of the domain or range.

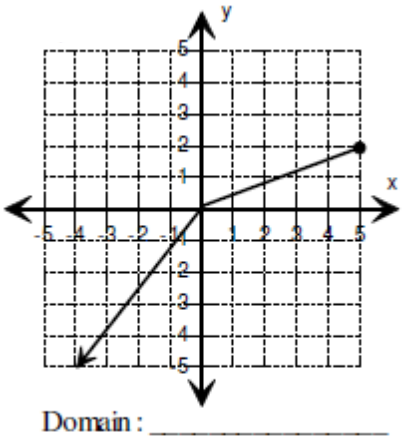
SET NOTATION: Set notation is good to use when your domain or range is a list of numbers or a set of numbers on an interval. For domain, it would look like: {x: x>5}. Range would look similar, except with y's instead of x's.

EX: The range is all numbers between 3 and 7 (including 3, but not including 7).

INTERVAL NOTATION: [3, 7) SET NOTATION: $\{y: 3 \leq y < 7\}$

Identify the domain and range of each function. When given an equation for the function, you MUST show algebraic work (not a sketch of the graph) to justify your answer.

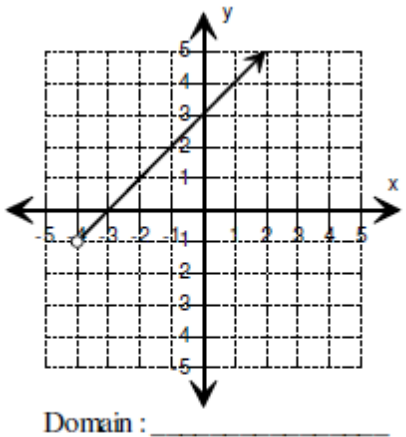
13.



Domain : _____

Range : _____

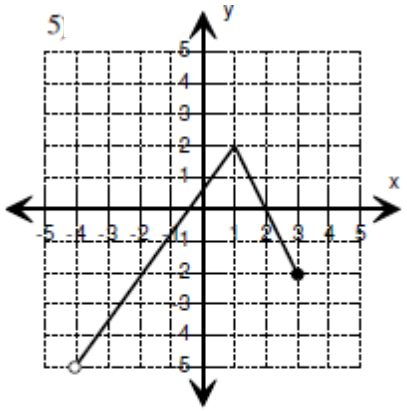
14.



Domain : _____

Range : _____

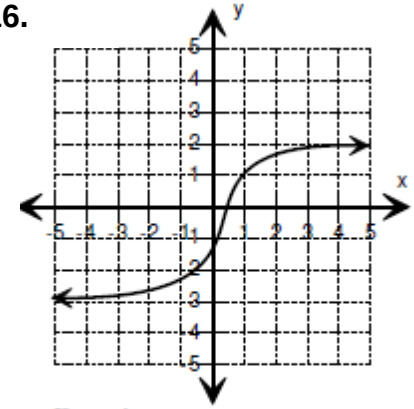
15.



Domain : _____

Range : _____

16.



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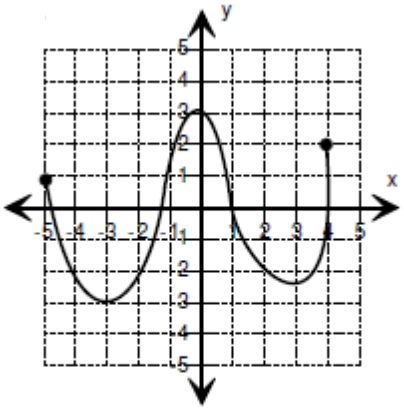
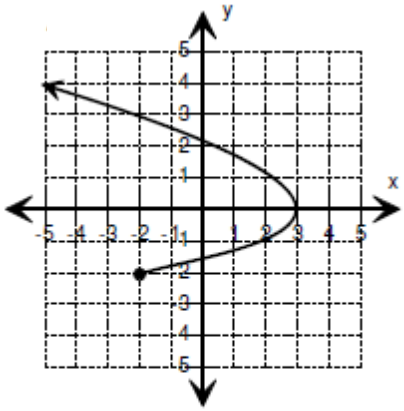
17.



Domain : _____

Range : _____

18.



Domain : _____

Range : _____

19. $f(x) = \sqrt{x+2} + 3$

Domain : _____

Range : _____

20. $f(x) = \frac{x+1}{x-2}$

Domain : _____

Range : _____

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

Domain : _____

Range : _____

22. $f(x) = -|x-5| + 6$

23. $f(x) = \frac{x}{\sqrt{2x+3}}$

24. $f(x) = 2x^2 + 4x - 6$

Domain : _____
Range : _____

Domain : _____
Range : _____

Domain : _____
Range : _____

PART 3: EVALUATING FUNCTIONS and COMPOSITE FUNCTIONS. You can use your calculator to evaluate a function, but you should be able to evaluate a function by hand as well.

EVALUATING FUNCTIONS: $f(x)$ is used to write a function in function notation (instead of y=). If $f(x) = 3x - 2$, then $f(5)$ means evaluate $f(x)$ for $x = 5$.

EX: $f(x) = 2x + 5$ $\quad$ $g(x) = \sqrt{x}$

Find $f(8)$. $\quad$ $f(8) = 2(8) + 5 = 16 + 5 = 21$

Find $f(g(x))$. $\quad$ $f(g(x)) = 2(\sqrt{x}) + 5 = 2\sqrt{x} + 5$

COMPOSITE FUNCTIONS: With composite functions, you combine two functions by taking the output of one function and making it the input of the other function.

EX: $f(x) = 2x + 5$ $\quad$ $g(x) = \sqrt{x}$

Find $f(g(9))$.

$$g(9) = \sqrt{9} = 3$$
$$f(g(9)) = 2(3) + 5 = 11$$

Evaluate each function. SHOW YOUR WORK.

$f(x) = 2x - 1$ $\quad$ $g(x) = x^2 - 4$ $\quad$ $h(x) = \frac{2x}{x+1}$

25. Find $f(-3)$.

26. Find $f(g(5))$.

27. Find $g(-4)$.

Evaluate each function. SHOW YOUR WORK.

$f(x) = 2x - 1$ $g(x) = x^2 - 4$ $h(x) = \frac{2x}{x+1}$

28. Find $h(f(x))$.

29. Find $g\big(f(x)\big)$.

30. Find $g(x + 3)$.

31. Find $f(x + 7)$.

32. Find $h(2a + b)$.

33. Find $g(x + \Delta x)$.

PART 4: EXPONENTS. In Algebra 1, you learned how to get rid of negative exponents. In Algebra 2, you learned about fractional exponents. Rewrite each expression using negative or fractional exponents.

34. $y = \frac{3}{x^5}$

35. $y = \frac{2}{3x}$

36. $y = \frac{4}{x^2} + 3x - \sqrt{x}$

37. $y = \sqrt{4x - 1}$

38. $y = \sqrt[5]{(x + 1)^3}$

39. $y = \left(\sqrt{x}\right)^3$ *Write with a single exponent.*