

NAME: _____ Score _____ /100
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SHOW ALL YOUR WORK IN A NEAT AND ORGANIZED FASHION

Questions 1 – 15 are each worth 2 points. Questions 16 – 25 are each worth 5 points. The last three questions combined are worth 20 points.

Circle T or F, whichever is correct.

1. T F Every function is a polynomial function.
2. T F To verify (prove) that two functions f and f^{-1} are inverses of each other it is necessary to show that both of the following are true:

$$f^{-1} \circ f(x) = x \text{ for all } x \text{ in the domain of } f \text{ and}$$

$$f \circ f^{-1}(x) = x \text{ for all } x \text{ in the domain of } f^{-1}$$
3. T F $f(x)$ is the rule for the function f .
4. T F If the multiplicity of a real zero is even the graph of the function crosses the x -axis at that zero.
5. T F If the graph of a function passes the horizontal line test, the function has an inverse.
6. T F The product of two functions is a real number.

Fill in each of the blanks to make the statements true.

7. The graph of a function is the set of all points whose coordinates are $(a, \underline{\hspace{2cm}})$ where a is an element of the domain.
8. If p and d are polynomials with real coefficients, then there are unique polynomials q and r with real coefficients such that $\underline{\hspace{2cm}}$ with $r = 0$ or the degree of r is less than the degree of d .
9. The composition of a function f with a function g is a $\underline{\hspace{2cm}}$ named $\underline{\hspace{2cm}}$ whose rule is $\underline{\hspace{2cm}}$
10. If f is a polynomial function such that $f(a) < 0$ and $f(b) > 0$, then f has an $\underline{\hspace{2cm}}$ between a and b .
11. If a horizontal line may be drawn so that it intersects the graph of a function in more than one point, then the function $\underline{\hspace{2cm}}$ have an inverse.
12. If $\frac{p}{q}$ is a rational zero of a polynomial function with integer coefficients, then the numerator p must be a divisor of the $\underline{\hspace{2cm}}$ and the denominator q must be a divisor of the $\underline{\hspace{2cm}}$
13. The degree of the function f whose rule is $f(x) = 3x^5 - 7x^3 + 2x + 7$ is $\underline{\hspace{2cm}}$
14. The graph of the function whose rule is $f(x) = -3x^2 + 2x - 98$ is a $\underline{\hspace{2cm}}$ which opens $\underline{\hspace{2cm}}$.
15. The slope of the line through the points $(-3, 2)$ and $(7, -5)$ is $\underline{\hspace{2cm}}$

**For Problems 16 – 25, Show all necessary work. NO WORK – NO CREDIT
Sentences are good**

16. What is the domain of the function whose rule is $f(x) = \frac{3x + 4}{x - 4}$?

17. The rule for a function f is given by the equation $f(x) = \frac{x - 3}{2x + 1}$ and the rule for a function g is given by the equation $g(x) = x - 2$. Determine the rule for the function $f \circ g$.

18. Suppose f and g are functions whose rules are $f(x) = x^2 - 3$ and $g(x) = \frac{x}{3}$. Calculate $f \circ g(2)$.

19. Find the inverse of the function whose rule is $f(x) = 5x + 3$.

20. Suppose f and g are functions whose rules are $f(x) = 3x + 2$ and $g(x) = \frac{1}{3}x - 2$.

Verify (prove) that f and g are **not** inverses of each other.

21. The rule for a function f is $f(x) = -3x^5 - 22x^4 + 6x^3 - 7x^2 + 8x - 5$. Complete the following statements about f .

- The graph of f “tries” to cross the x -axis _____ times.
- The graph of f can cross the x -axis no more than _____ times.
- The graph of f must cross the x -axis at least _____ times.

$\lim_{x \rightarrow \infty} f(x) = \underline{\hspace{2cm}}$

d.

$\lim_{x \rightarrow -\infty} f(x) = \underline{\hspace{2cm}}$

22. Perform the polynomial division. $x^2 - 2 \overline{) x^3 - 4x^2 - 7x + 1}$

23. What are the possible rational zeros of the function whose rule is $f(x) = 5x^3 + 2x^2 - 7x - 7$?

$p \in \{$

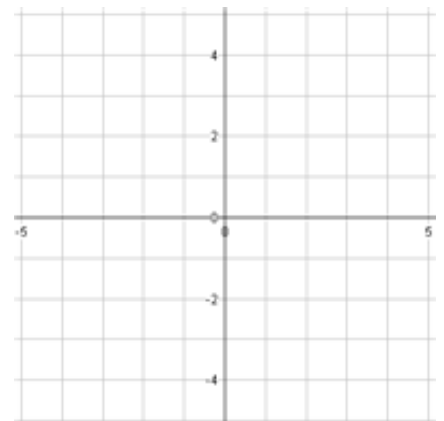
$q \in \{$

$\frac{p}{q} \in \{$

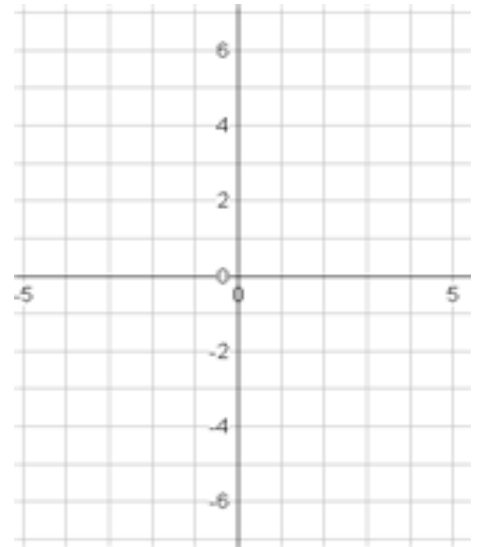
24. An analysis of a function f reveals the following facts.

- f is a polynomial function of degree 4.
- As $x \longrightarrow -\infty$, $f(x) \longrightarrow +\infty$
As $x \longrightarrow +\infty$, $f(x) \longrightarrow +\infty$
- The real zeros of f are -1 , 0 , and 3 .
- The multiplicity of 0 is 2 .

Sketch the graph of f .



25. Sketch the graph of the function whose rule is $f(x) = 2x^2 - 5x - 3$. Label the x and y intercepts and the vertex with their coordinates. Factoring helps. Label important points.

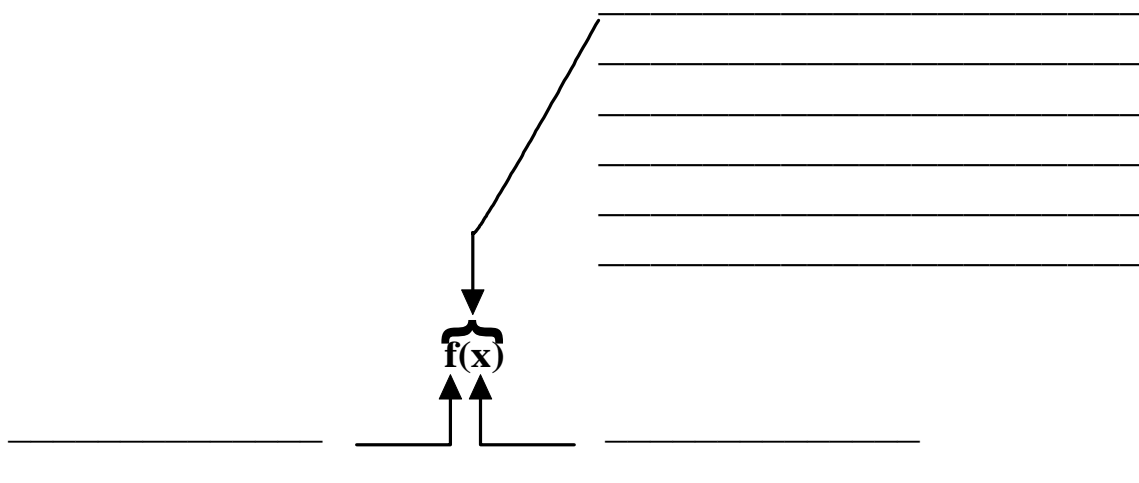


26. (6 points) Fill in the blanks

Definition: A _____ consists of three things

- A set called the _____
- A set called the _____
- A _____ which associates _____ element of the domain with a _____ element of the range.

27. (4 points)



28. (10 points) Rules for functions are given at the top of the page and graphs of functions are given below them. Match the graphs and the rules by writing the letter which identifies a graph in the blank preceding a rule for a function.

a. _____ $f(x) = \frac{1}{x}$

b. _____ $f(x) = -3x + 3$

c. _____ $f(x) = -x^2$

d. _____ $f(x) = 3x + 3$

e. _____ $f(x) = x^2$

f. _____ $f(x) = (x + 2)^2$

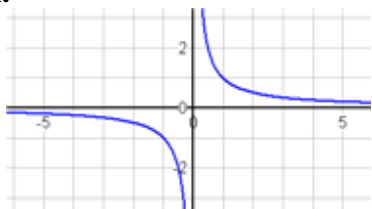

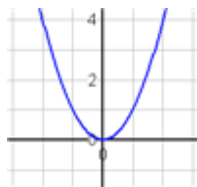
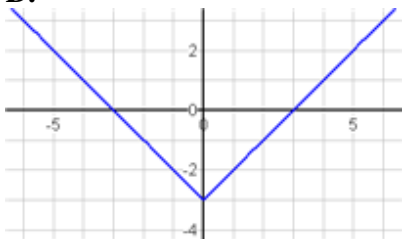

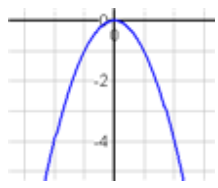

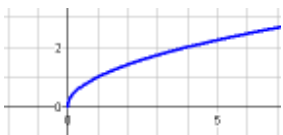
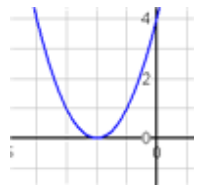


g. _____ $f(x) = |x| - 3$

h. _____ $f(x) = \sqrt{x}$

k. _____ $f(x) = x^3$

m. _____ $f(x) = -x^3$

The graphs are shown in blue.

<p>A.</p> 	<p>B.</p> 	<p>C.</p> 
<p>D.</p> 	<p>E.</p> 	<p>F.</p> 
<p>G.</p> 	<p>H.</p> 	<p>I.</p> 
<p>J.</p> 	<p>K.</p> 	<p>L.</p> 