

NAME: _____ Score _____ /100

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SHOW ALL YOUR WORK IN A NEAT AND ORGANIZED FASHION

Course Average _____

No Decimals No mixed numbers No complex fractions No boxed or circled answers**Questions 1 – 20 are 2 pts each.**

1. T F The y-intercept of the graph of a quadratic function $f(x) = ax^2 + bx + c$ is $(0, c)$.
2. T F A term is a letter, a number, or a product of letters and numbers.
3. T F The degree of a polynomial is the degree of the leading term.
4. T F The sum of two polynomials is a polynomial.
5. T F The sum of two terms is a term.
6. T F If the multiplicity of a real zero is an odd number the graph intersects but does not cross the x-axis at that zero.
7. A quadratic function is a function whose rule may be written in the form $f(x) = \underline{\hspace{2cm}}$ where a, b, and c are real numbers and a is not zero.
8. The discriminant of a quadratic function $f(x) = ax^2 + bx + c$ is $\underline{\hspace{2cm}}$.
9. The numerical part of a term is called the $\underline{\hspace{2cm}}$ of the term.
10. If a polynomial contains a term which is strictly numerical, it is called the $\underline{\hspace{2cm}}$ term of the polynomial.
11. A $\underline{\hspace{2cm}}$ is a term or a sum of terms in which all variables have whole number exponents.
12. If a complex number is a zero of a polynomial function f, then its $\underline{\hspace{2cm}}$ is also a zero of the function f.
13. Division Algorithm: If a and b are natural numbers then there are unique natural numbers q and r such that $\underline{\hspace{2cm}}$ with $0 \leq r < b$.
14. If f is a polynomial function such that $f(a) < 0$ and $f(b) > 0$, then f has an $\underline{\hspace{2cm}}$ (a real zero) between a and b.
15. The graph of a polynomial function is a $\underline{\hspace{2cm}}$ $\underline{\hspace{2cm}}$ curve with no $\underline{\hspace{2cm}}$ corners.
16. 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 $\underline{\hspace{2cm}}$ term and the denominator q must be a divisor of the $\underline{\hspace{2cm}}$ coefficient.
17. If the remainder r in the division algorithm is 0, then we say that the polynomial p is $\underline{\hspace{2cm}}$ by the polynomial d.

If f is a polynomial function whose rule is given by

$$f(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$$

then the following statements are equivalent.

a. k is a real zero of the function f .

18. k is a _____ of the polynomial equation $a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0 = 0$.

19. _____ is a factor of the polynomial $a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$.

20. $(k, 0)$ is an _____ of the graph of the function f .

Questions 21 – 32 are each worth 5 pts.

21. Find the vertex of the graph of the function whose rule is $f(x) = x^2 + 5x + 6$. **Show the steps**

22. What are the x -intercepts of the graph of the function whose rule is $f(x) = (x + 3)(x - 5)(x - 2)$?

23. Consider the polynomial function whose rule is $f(x) = -43x^5 + 281x^3 - 97x^2 + 2x - 302$. Determine the end behavior of the graph of f by completing the following:

As $x \rightarrow +\infty$, $f(x) \rightarrow$ _____

As $x \rightarrow -\infty$, $f(x) \rightarrow$ _____

24. Consider the polynomial function whose rule is $f(x) = 5x^4 + 7x^2 - x + 9$. Determine the possible rational zeros of f by completing the following:

$p \in \{ \quad \quad \quad \}$

$q \in \{ \quad \quad \quad \}$

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

25. Which of the following are rules for polynomial functions? Identify your choices by placing an X in the box preceding the option.

- $f(x) = 2x - 4$

 $f(x) = 3x^{-5} - 8x^{\frac{1}{2}}$

 $f(x) = \frac{3x^2 + 2x^5 + 4x - 2}{2}$
- $f(x) = \frac{3x^4 - 2x^5 + 4x - 2}{2x^3 + 5}$

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

26. Use the Intermediate Value Theorem to prove that the graph of the function whose rule is $f(x) = x^5 - x^3 - 1$ has an x-intercept between 1 and 2. **Both calculations and words of explanation are required.**

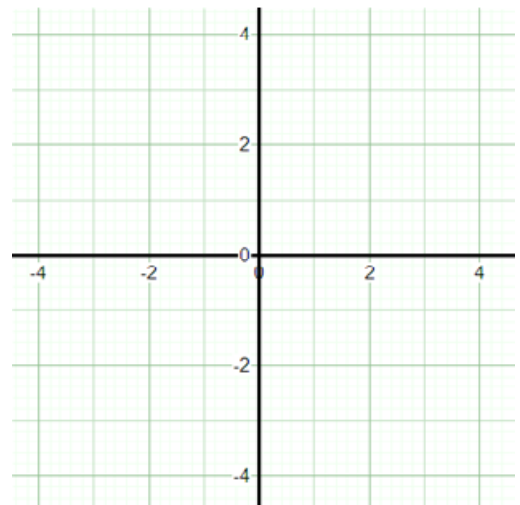
27. An analysis of a function f reveals the following facts.

- f is a polynomial function of degree 5.
- The real zeros of f are -1, 0, and 3.
- The multiplicity of -1 is 2.
- The multiplicity of 3 is 2.

e. As $x \rightarrow +\infty$, $f(x) \rightarrow -\infty$

As $x \rightarrow -\infty$, $f(x) \rightarrow +\infty$

Sketch the graph of f .



28. Circle **all** the words which can be used to correctly complete the sentences.

- $f(x) = 7$ is the rule for a (constant linear quadratic identity polynomial) function.
- $f(x) = x^2 + 2x + 1$ is the rule for a (constant linear quadratic identity polynomial) function.
- $f(x) = x^5 + 5x + 6$ is the rule for a (constant linear quadratic identity polynomial) function.
- $f(x) = x + 4$ is the rule for a (constant linear quadratic identity polynomial) function.
- $f(x) = x$ is the rule for a (constant linear quadratic identity polynomial) function.

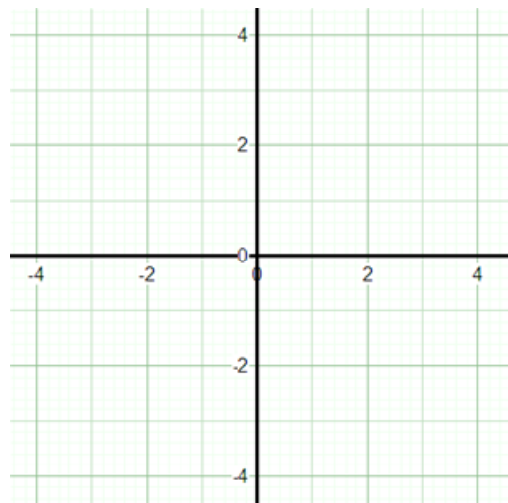
29. Consider the polynomial function f whose rule is $f(x) = (x + 1)^5(x^2 - 2)^2$.

- a. What is the degree of f ? _____
- b. What is the leading coefficient of f ? _____
- c. What is the constant term of f ? _____
- d. What are the zeros of f ? _____
- e. How many times does the graph of f cross the x -axis? _____

30. Consider the function whose rule is $f(x) = x^3 + x^2 - 4x - 4$. The zeros of f are -2 , -1 , and 2 . Sketch the graph of f .

As $x \rightarrow +\infty$, $f(x) \rightarrow$ _____

As $x \rightarrow -\infty$, $f(x) \rightarrow$ _____



31. Consider the function whose rule is $f(x) = x^3 + x^2 - 4x - 4$. The zeros of f are -2 , -1 , and 2 .

Factor the polynomial $x^3 + x^2 - 4x - 4$

32. Perform the indicated long division:

$$3x^2 + 1 \overline{) 18x^4 + 9x^3 + 3x^2}$$