

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  $\underline{\hspace{2cm}}$  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.**

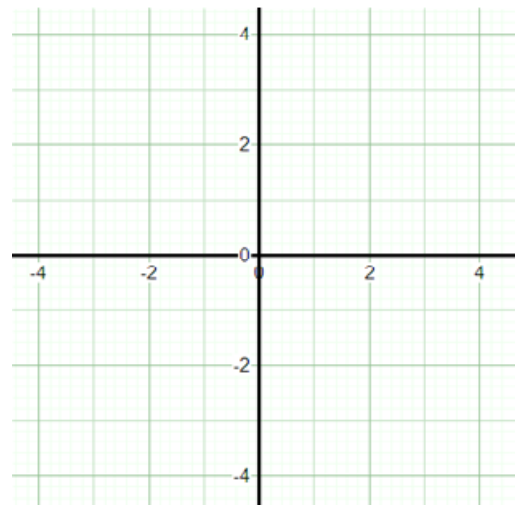
27. An analysis of a function  $f$  reveals the following facts.

- $f$  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.

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

e. 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.

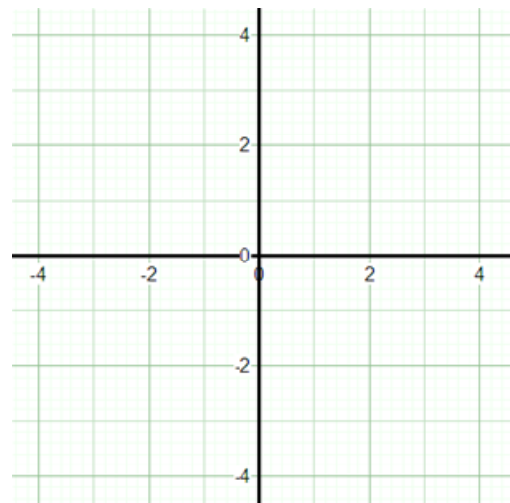
29. Consider the polynomial function  $f$  whose rule is  $f(x) = (x + 1)^5(x^2 - 2)^2$ .

- What is the degree of  $f$ ? \_\_\_\_\_
- What is the leading coefficient of  $f$ ? \_\_\_\_\_
- What is the constant term of  $f$ ? \_\_\_\_\_
- What are the zeros of  $f$ ? \_\_\_\_\_
- 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:

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