MU ALPHA THETA - MAINE '95 THEORY OF EQUATIONS TOPIC TEST

Use the following polynomial for questions 1- 4: $x^3 - 6x^2 + 11x - 6 = 0$

1. Find the sum of the roots of the given polynomial.

a. -11 b. -6 c. 6 d. 11 e. not given

2. State the product of the roots of the given polynomials.

a. -11 b. -6 c. $\frac{11}{6}$ d. 11 e. not given

3. If one root of the given polynomial is one, then what are the other two roots.

a. 2 and 3 b. -2 and -3 c. 2 and -3 d. $2 \pm \sqrt{3}$ e. not given

4. If each of the roots are increased by four, then expanded to form a new polynomial, the numerical value of the coefficient of the linear term will be

a. -210 b. -5 c. 11 d. 107 e. not given

5. Using Descartes' Rule of Signs, at most, how many positive real roots could $x^4 - x^3 - x^2 + x - 1 = 0$ have?

a. 4 b. 3 c. 2 d. 1 e. not given

6. Again, refer back to question #5, and using Descartes' Rule of Signs, at most, how many negative real roots could this polynomial have?

a. 4 b. 3 c. 2 d. 1 e. not given

7. If x - 2 is a factor of $x^3 + kx^2 - 3x + 10$, another factor is

a. $x^2 + x - 5$ b. x - 5 c. $x^2 + x + 5$ d. $x^2 - x - 5$ e. not given

8. If $x^{21} - 3x^7 + 2$ is divided by x + 1, which of the following is the remainder?

a. -4 b. 0 c. 1 d. 4 e. not given

9. For $f(x) = (x-2)^{10}$ and g(x) = x - 1, The remainder when $f(x)$ is divided by g(x). is $\frac{a}{x-1}$, where a =

a. -2 b. -1 c. 1 d. 2 e. not given

10. Given $3x^2 = k - 4x$, one root is 5, find k.

a. -95 b. $\frac{-95}{3}$ c. $\frac{-19}{3}$ d. -19 e. not given

11. If one root of a quadratic equation with integral coefficients is 3 + i, where $i = \sqrt{-1}$, the equation of the quadratic is

a. $x^2 + 6x + 10 = 0$ b. $x^2 - 6x + 10 = 0$ c. $x^2 + 6x - 10 = 0$
d. $x^2 - 6x - 10 = 0$ e. not given

12. The sum of the roots of $3x - 7x^{-1} + 3 = 0$ is

a. $\frac{7}{3}$ b. 1 c. -1 d. $\frac{-7}{3}$ e. not given

13. If the roots of $x^2 - 8x + k = 0$ differ by 7, then the numerical value of k lies in which interval?

a. $0 < x < 1$ b. $1 < x < 2$ c. $2 < x < 3$ d. $3 < x < 4$ e. not given

14. Find the remainder when $x^7 - 5x^5 + 2x^4 + 4x^3 - 10x^2 - 4$ is divided by by the product of x + 1, x + 2, x - 2 , and x - 1.

a. -12 b. -4 c. 4 d. 7 e. not given

15. If p and q are the roots of the equation $x^2 - 12x + 6$, find the numerical value of $p^2q + q^2p$

a. 6 b. 12 c. 36 d. 72 e. not given

16. Find the smallest integral value of k so that the solutions to $x^2 - 2x - 1 = 2x^2 + kx + 8$ are not real.

a. -8 b. -7 c. -4 d. 3 e. not given

17. If the roots of the quadratic equation $2x^2 - tx + p = 0$ are 4t and t + 9, find the value of p.

a. -112 b. -84 c. -56 d. -42 e. not given

18. Given a polynomial $f(x)$ such that $f(4) = 4$ and $f(-2) = 0$, which of the following is a factor of $f(x)$?

a. x + 4 b. x - 4 c. x + 2 d. x - 2 e. not given

19. If r & s are roots of $x^2 - px + q = 0$, find the numerical value of $r^2 + s^2$ in terms of p and q.

a. $p^2 - 2q$ b. $2p^2q$ c. $p^2 + 2q$ d. $-2pq^2$ e. not given

20. If the polynomial $ax^4 + bx^2 + c$ has 5 as a zero, (root), what is the remainder when the polynomial is divided by (x - 5)?

a. 5c b. c c. -5 d. 5 e. not given

21. Calculate the sum of the reciprocals of the roots of the equation:
$$3x^4 + 4x^3 - 7x^2 + 34x - 51 = 0$$

a. $\frac{-3}{2}$ b. $\frac{-4}{3}$ c. $\frac{-2}{3}$ d. $\frac{-3}{2}$ e. not given

22. If $f(x) = x^2 + 4x - 5$ and g(x)=3x + 2, find the sum of all solutions to the equation $g(f(x)) - 2f(x) = 9$.

a. -6 b. -4 c. 0 d. 4 e. not given

23. A possible value of k so that one root of $x^2 - kx + 18 = 0$ is twice the other root is

a. -9 b. -5 c. 3 d. 7 e. not given

24. p and q are the roots of the quadratic equation: $3x^2 - 6x + 1 = 0$. Find $\log_3 p + \log_3 q$.

a. -3 b. -1 c. 0 d. 3 e. not given

25. If the polynomials $4x^3 + 8x - 5$ and $(p-1)x^3 + (q+4)x^2 + \left(\frac{r}{2}\right)x + 10s$ are equal, which of the following is (p, q, r, s)?

a. (5, -4, 16, -0.5) b. (5, 0, 16, -2) c. (5, -4, 16, -2) d. (5, -4, 4, -0.5)
e. not given

26. Suppose the roots of $ax^2+bx+c=0$ are r and s. Which one of the following has roots ar + b and as + b?

a. $x^2-bx-ac=0$ b. $x^2-bx+ac=0$ c. $x^2+3bx+ca+2b^2=0$
d. $x^2+3bx-ca+2b^2=0$ e. not given

27. Give the sum of the real roots of $3x^3+4x^2+4x+1=0$

a. $\frac{-4}{3}$ b. $\frac{-41}{3}$ c. $\frac{2}{3}$ d. $\frac{4}{3}$ e. not given

28. If the polynomial $ax^5+bx^4+cx^3+dx^2+ex+f$, where a, b, c, d, e, and f are all integers has the numbers 2, 2 + 2i, and $2+\sqrt{2}$ in its solution set, which of the following is the complete solution set?

a. $\{ 2, 2+2i, 2+\sqrt{2} \}$ b. $\{2, -2, 2-2i, 2-\sqrt{2} \}$
c. $\{2, 2+2i, 2-2i, 2+\sqrt{2}, 2-\sqrt{2} \}$ d. $\{ 2, -2, 2+2i, 2-2i, 2+\sqrt{2} \}$ e. not given

29. If r, s, and t are the roots of $P(x) = 2x^3-x^2-25x-12$, the ratio of (rs + rt + st) to (r + s + t) is

a. -25 to 2 b. -25 to 1 c. 6 to 1 d. 25 to 1 e. not given

30. Find k if the roots of the equation $x^3-26x^2+kx-216=0$ are in a geometric progression.

a. 141 b. 142 c. 152 d. 156 e. not given