<div align="center">Polynomial Roots</div>

Complex number -   The degree of a polynomial -

The Fundamental Theorem of Algebra -

Give the degree of each function and give the number of complex roots. Write the function in generic factored form using factors in the form $(x + ?)$.

1) $y = x^3 + 2x^2 - 11x - 12$
Degree -
# of complex roots -
Factored form -

2) $y = x^2 - 7x - 6$

3) $y = x - 3$

4) $y = x^4 + 3x^3 - 8$

5) $y = 3v^2 - 5v$
Degree -
# of complex roots -
Factored form -

6) $y = 2a + 5$

7) $y = m^5 + 2$

8) $y = t^3 + t^2 - 20t$

Give the degree of each function and list the roots. How many x-intercepts does the function have. <u>Make a sketch of the function</u>. Use a calculator as needed.

9) $y = (x + 2)(x - 3)$
Degree -
Give all roots -
# of x-ints -

10) $y = (x - 8)(x - 1)$

11) $y = (x - 5)(5x + 4)$

12) $y = x(x - 4)$
Degree -
Give all roots -
# of x-ints -

13) $y = (-x + 1)(5x + 2)$

14) $y = (x + 6)(x + 6)$

15) $y = (-x + 3)(2x - 7)$
Degree -
Give all roots -
# of x-ints -

16) $y = (3x - 2)(3x - 2)$

17) $y = (3x + 7)x$

18) $y = (x - 2)(x - 2)$
Degree -
Give all roots -
# of x-ints -

19) $y = x(x - 1)$

20) $y = (-x - 2)(x - 2)$

21) $y = (x + 2i)(x - 2i)$
Degree -
Give all roots -
# of x-ints -

22) $y = (x - 3i)(x + 3i)$

23) $y = (x - i)(x + I)$

Give the degree of each function and list the roots. How many x-intercepts does the function have. <u>Make a sketch of the function</u>. Give the Y-Max and Y-Min that gave you a good picture of the graph.

24) $y = (x + 4)(x + 1)(x - 3)$
Degree -
List all roots -
# of x-ints -
Y-Max -
Y- Min -

25) $y = (x + 7)(x + 3)(x + 1)$

26) $y = (x + 2)(x + 3)(2x - 5)$

27) $y = x(x + 1)(x - 3)$
Degree -
List all roots -
# of x-ints -
Y-Max -
Y- Min -

28) $y = (x - 5)(x - 5)(x - 5)$

29) $y = (x - 3)(x + 1)(x - 3)$

30) $y = (x + 3)^2 (4x - 1)$
Degree -
List all roots -
# of x-ints -
Y-Max -
Y- Min -

31) $y = x(x + 4)(x - 1)$

32) $y = (x - 3)^3$

33) $y = (x + 2)(x + 2)(x + 2)$
Degree -
List all roots -
# of x-ints -
Y-Max -
Y- Min -

34) $y = (4x + 5)(x + 4)^2$

35) $y = x(x + 3)(x - 6)$

36) $y = (x + 5)(x + i)(x - i)$
Degree -
List all roots -
# of x-ints -
Y-Max -
Y- Min -

37) $y = (x - 4)(x + i)(x - i)$

38) $y = (x - 5)(x + 2i)(x - 2i)$

Give the degree of each function and list the roots. How many x-intercepts does the function have. <u>Make a sketch of the function</u>. Give the Y-Max and Y-Min that gave you a good picture of the graph.

39) $y = (x + 3)(x + 1)(x - 1)(x - 4)$
Degree -
Give all roots -
# of x-ints -
Y-Max -
Y- Min -

40) $y = x(2x + 7)(x + 8)(x - 2)$

41) $y = (x + 2)(x - 2)(x - 3)(x - 5)$

42) $y = (2x + 3)^2 (x - 2)^2$
Degree -
Give all roots -
# of x-ints -
Y-Max -
Y- Min -

43) $y = (x + 3)^2 (x - 1)(x - 4)$

44) $y = (x + 5)(x + 2)^2 (x - 2)$

45) $y = x^2(x + 3)(4x - 9)$
Degree -
Give all roots -
# of x-ints -
Y-Max -
Y- Min -

46) $y = (x + 1)(x + 1)(x - 4)(x - 4)$

47) $y = x(x + 4)(x + 4)(x - 2)$

48) $y = x(x + 3)(2x - 9)(2x - 9)$
Degree -
Give all roots -
# of x-ints -
Y-Max -
Y- Min -

49) $y = x^2(x + 8)(x + 2)$

50) $y = (x + 5)(x + 1)(3x - 2)^2$

51) $y = (x + 3i)(x - 3i)(x + 5)(x - 8)$
Degree -
Give all roots -
# of x-ints -
Y-Max -
Y- Min -

52) $y = (x + i)(x - i)(x - 6)(x - 9)$

53) $y = (x + 2i)(x - 2i)(x + 7)(x + 4)$

Based on what you have learned about multiplicity sketch a graph of each function. Check your graph on your calculator.

54) $y = (x + 4)(x + 4)$

55) $y = -(x - 2)(x - 2)$

56) $y = (x - 5)(x - 5)$

57) $y = (x - 1)(x - 4)(x - 4)$

58) $y = x(x - 3)(x - 3)$

59) $y = x(x + 6)^2$

60) $y = (x + 7)^2 (x + 2)$

61) $y = x(x + 3)^2$

62) $y = x(x - 1)(x - 1)$

63) $y = (x + 8)^2 (x + 1)^2$

64) $y = (x + 6)(x - 1)^2 (x - 4)$

65) $y = (x - 9)^2 (x - 3)(x - 1)$

66) $y = x^2(x - 3)(x - 6)$

67) $y = (x + 4)^2 (x - 1)^2$

68) $y = (x - 4)(x - 1)^2 (x + 4)$

69) $y = x(x + 5)(x - 2)^2$

70) $y = x(x + 5)^2 (x - 6)$

71) $y = x^2 (x - 3)^2$

Use a calculator to list the roots of each function and write the function in factored form.

72) $y = x^2 + 9$

73) $y = x^2 + 16$

74) $y = x^2 + 36$

75) $y = x^3 + 3x^2 + 4x + 12$

76) $y = x^3 - 5x^2 + 4x - 20$

77) $y = x^3 + 2x^2 + 9x + 18$

78) $y = x^3 + 2x^2 - 20x - 40$ 79) $y = x^3 - x^2 - 63x + 63$ 80) $y = x^3 + 2x^2 - 48x - 96$

81) $y = x^4 + 4x^3 - 11x^2 + 4x - 12$ 82) $y = x^4 + 6x^3 + 9x^2 + 24x + 20$ 83) $y = x^4 - 10x^3 + 25x^2 - 90x + 144$

84) $y = x^4 - 4x^3 - 23x^2 + 72x + 90$ 85) $y = x^4 + x^3 - 62x^2 - 50x + 600$ 86) $y = x^4 - 7x^3 - 36x^2 + 196x + 224$

Which choice is the correct set of roots for the polynomial?

87) $y = x^3 - x^2 - 46x - 80$

A. $x = 1, 3, 8$ B. $x = 2, 5, 8$

C. $x = -2, -5, 8$ D. $x = -2, -4, 5$

88) $y = x^3 - 10x^2 + 27x - 18$

A. $x = 2, 3(mlt = 2)$ B. $x = -1, -2, -9$

C. $x = 1, 3, 6$ D. $x = -1, -3, -6$

89) $y = x^3 + 8x^2 + 16x$

A. $x = 0, 4 \ (mlt = 2)$ B. $x = 1, 2, -2, 4$

C. $x = 0, -4 \ (mlt = 2)$ D. $x = 1, 2, 8$

90) $y = x^3 + 4x^2 + 4x + 16$

A. $x = 2, 2i, 4i$ B. $x = -4, 2i, -2i$

C. $x = 2i, -2i, 4$ D. $x = 2, 4i, -4i$

91) $y = x^3 - 2x^2 + 9x - 18$

A. $x = -3, 2i, -2i$ B. $x = 2, 3i, -3i$

C. $x = -2, 3i, -6i$ D. $x = -2, 3i, -3i$

92) $y = x^3 + 3x^2 - 5x - 15$

A. $-3, \sqrt{5}, -\sqrt{5}$ B. $-3, \sqrt{3}, -\sqrt{5}$

C. $-\sqrt{3}, \sqrt{3}, 5$ D. $3, \sqrt{5} \ (mlt = 2)$

93) $y = x^4 - 2x^3 - 13x^2 + 14x + 24$

A. $x = 1, 2, 3, 4$ B. $x = -1, -2, -3, -4$

C. $x = -4, -2, 1, 3$ D. $x = -3, -1, 2, 4$

94) $y = x^4 + x^3 - 27x^2 - 81x - 54$

A. $x = -1, -2, -4, -6$ B. $x = 1, 3, 4, 7$

C. $x = 1, 3(mlt = 2), 6$ D. $x = -1, -3(mlt = 2), 6$

95) $y = x^4 + 3x^3 + 25x^2 + 75x$

A. $x = 0, -3, 5i, -5i$ B. $x = 1, 3, 5, 25$

C. $x = 1, -25i, 25i, 5i$ D. $x = 0, 3, \sqrt{5}, -\sqrt{5}$

96) $y = x^4 + 3x^3 - 30x^2 - 36x + 216$

A. $x = -6, 3\sqrt{4}, -3\sqrt{4}, 2$ B. $x = -6, 3i, -3i, 4$

B. $x = -6, 2\sqrt{3}. -2\sqrt{3}, 3$ D. $x = -9, -3, 2, 4$

97) $y = x^4 - x^3 - 47x^2 + 45x + 90$

A. $x = -6, -1, 3, 5$ B. $x = 3\sqrt{5}, -3\sqrt{5}, -1, 2$

C. $x = 3i\sqrt{5}, -3\sqrt{5}, -1, 2$ D. $x = 5\sqrt{3}, -5\sqrt{3}, -1, 2$

98) $y = x^4 + 3x^3 + 25x^2 + 75x$

A. $2\sqrt{5}, -2\sqrt{5}, 1, 3$ B. $-4, 0, 3i, -3i$

C. $3i\sqrt{2}, -3i\sqrt{2}, -4, 0$ D. $-4, 0, 12, 18$

99) $y = x^5 + 5x^4 - 13x^3 - x^2 - 68x - 84$

A. x = -7, -2, -1, 2, 3 B. -7, -4i, 4i, 2, 3

C. x = -7, -2i, 2i, -1, 3   B. -7, -$\sqrt{2}$, $\sqrt{2}$, -1, 3

100) $y = x^4 - 2x^3 - 26x^2 + 34x + 105$

A. x = -5i, 5i, 3, 5   B. x = -5, -2$\sqrt{5}$, 2$\sqrt{5}$, 3

C. x = -3-$\sqrt{2}$, -3+$\sqrt{2}$, 3, 5   D. x = -9/2, -3/2, 3, 5

101) $y = x^5 + 2x^4 + x^3 + 18x^2 - 72x$

A. x = -4, -3i, 3i, 0, 2   B. x = -4, -2i, 2i, 9, 16

C. x = -4, i$\sqrt{3}$, -i$\sqrt{3}$, 0, 2   D. x = -4, 9i, -9i, 0, 2

Which choice is gives the function in the correct factored form?
102) $y = x^3 - x^2 - 46x - 80$

A. x = (x - 1)(x - 3)(x - 8)   B. x = (x - 2)(x - 5)(x - 8)

C. x = (x + 2), (x + 5)(x - 8)   D. x = (x + 2)(x + 4)(x - 5)

103) $y = x^3 - 10x^2 + 27x - 18$

A. x = (x - 2)(x - 3)(x - 3)   B.   x = (x + 1)(x + 2)(x + 9)

C. x = (x - 1)(x - 3)(x - 6)   D. x = (x + 1)(x + 3)(x + 6)

104) $y = x^4 + 3x^3 + 25x^2 + 75x$

A. x = x(x + 3)(x - 5i)(x + 5i)   B. x = (x - 1)(x - 3)(x - 5)(x - 25)

C. x = (x - 1)(x - 25i)(x + 25i)(x - 5)   D. x = x(x - 3)(x - $\sqrt{5}$)(x + $\sqrt{5}$)

105) $y = x^4 + 3x^3 - 30x^2 - 36x + 216$

A. x = (x + 6)(x - 3$\sqrt{4}$)(x + 3$\sqrt{4}$)(x - 2)   B. x = (x + 6)(x - 3i)(x - 3i)(x - 4)

B. x = (x + 6)(x + 2$\sqrt{3}$)(x - 2$\sqrt{3}$)(x - 3)   D. x = (x + 9)(x + 3)(x - 2)(x - 4)