Algebra 2 Name_____ ID: 1

Polynomials

Divide.

1) $(7n^3 + 12n^2 + 8n + 4) \div (n + 1)$

2) $(6b^3 - 53b^2 - 10b + 1) \div (b - 9)$

3) $(x^3 + x^2 - 35x + 41) \div (x + 7)$

4) $(x^3 - 13x^2 + 48x - 74) \div (x - 8)$

5) $(r^3 + 2r^2 - 69r - 52) \div (r + 9)$

6) $(2x^3 + 2x^2 - 10x + 14) \div (x - 1)$

7) $(p^3 + 5p^2 - 30p - 44) \div (p + 8)$

8) $(4n^3 - 13n^2 + 14n + 3) \div (n - 1)$

9) $(b^3 + 2b^2 - 71b - 77) \div (b - 8)$

10) $(4x^3 - 3x^2 + 2x + 8) \div (x + 1)$

Describe the end behavior of each function.

11) $f(x) = 2x^2 - 8x + 9$

12) $f(x) = -x^5 + 3x^3 - x - 1$

13) $f(x) = x^3 - 3x^2 + 4$

14) $f(x) = x^2 + 2x + 1$

15) $f(x) = -x^2 + 4x - 1$

16) $f(x) = -x^2 - 2x - 2$

17) $f(x) = -x^5 + 2x^3$

18) $f(x) = -x^4 + 3x^2 + 3x - 4$

19) $f(x) = x^4 - x^3 - 2x^2$

20) $f(x) = -x^4 + x^3 + 3x^2 + 1$

Find all roots.

21) $x^4 - x^3 + 2x^2 - 2x = 0$

22) $x^4 - 16x^2 + 63 = 0$

23) $x^4 - 9x^2 + 8 = 0$

24) $x^3 + 3x^2 - 2x - 6 = 0$

25) $x^4 + 2x^2 - 8 = 0$

Find all zeros.

26) $f(x) = x^4 - 10x^2 + 21$

27) $f(x) = x^4 + 12x^2 + 35$

28) $f(x) = x^4 - 9x^2 + 20$

29) $f(x) = x^3 - 8$

30) $f(x) = x^4 - x^2 - 30$

31) $f(x) = x^6 - 64$

32) $f(x) = 2x^3 - 6x^2 + 5x - 15$

Evaluate each function at the given value.

33) $f(n) = 4n^3 + 16n^2 + 12n - 11$ at $n = -3$

34) $f(a) = 5a^4 - 21a^3 - 2a^2 + 18a + 24$ at $a = 4$

35) $f(x) = 6x^3 + 26x^2 - 17x + 22$ at $x = -5$

36) $f(a) = -4a^4 - 16a^3 - 11a^2 + 5a + 2$ at $a = -3$

37) $f(a) = 4a^4 - 14a^3 - 13a^2 + 15a + 13$ at $a = 4$

38) $f(a) = -5a^3 + 23a^2 + 13a - 23$ at $a = 5$

39) $f(n) = 6n^4 - 14n^3 - 17n^2 + 9n + 9$ at $n = 3$

40) $f(x) = x^4 - 2x^3 - 3x^2 + 5x - 6$ at $x = 2$

41) $f(x) = x^3 + x^2 - 3x + 3$ at $x = 2$

42) $f(m) = m^3 + 2m^2 - 9m + 2$ at $m = 2$

Factor each.

43) $x^6 + 126x^3 + 125 = 0$

44) $x^6 - 64 = 0$

45) $x^8 - 17x^4 + 16 = 0$

46) $x^6 + 63x^3 - 64 = 0$

47) $x^7 - x = 0$

48) $x^8 - 25x^4 + 144 = 0$

49) $x^8 - 5x^4 + 4 = 0$

50) $x^6 + 5x^4 + 6x^2 = 0$

51) $x^8 - 10x^4 + 9 = 0$

52) $x^6 - 1 = 0$

53) $16x^8 - 25x^4 + 9 = 0$

54) $16x^6 - 48x^4 - x^2 + 3 = 0$

55) $3x^6 + x^4 - 3x^2 - 1 = 0$

56) $3x^6 + x^4 - 12x^2 - 4 = 0$

57) $2x^3 - 11x^2 + 15x = 0$

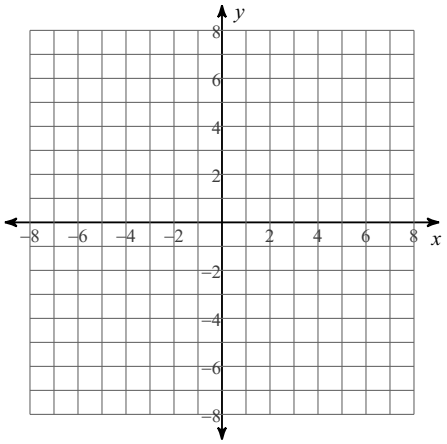
58) $2x^3 + 7x^2 + 3x = 0$

59) $3x^3 - 4x^2 + x = 0$

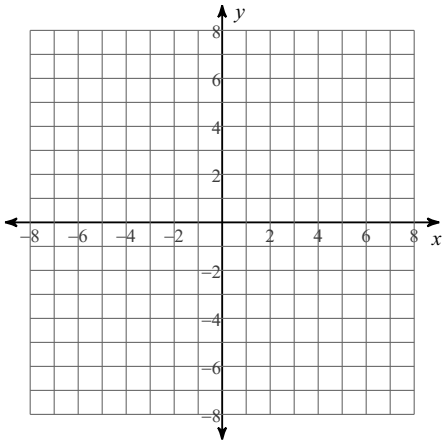
60) $3x^3 + 10x^2 + 3x = 0$

Sketch the graph of each function.

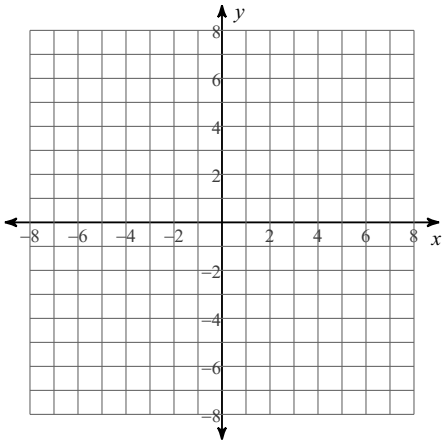
61) $f(x) = -x^3 + 4x^2 - 6$



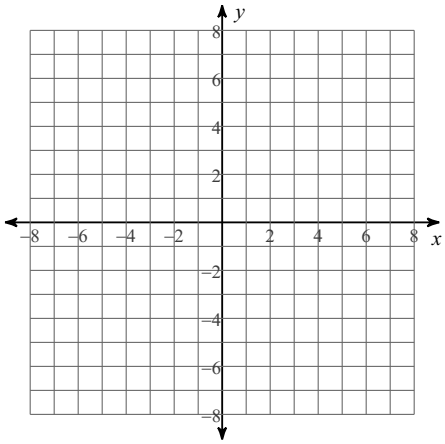
62) $f(x) = x^4 - 2x^2 + 4$



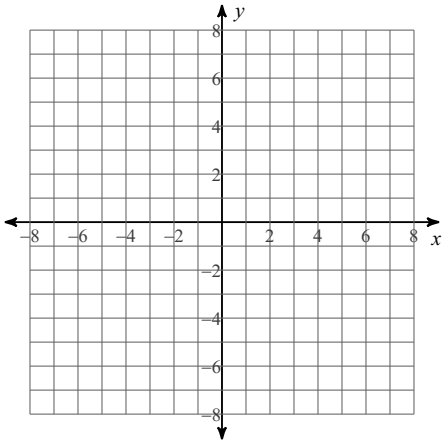
63) $f(x) = x^4 - 3x^2 + x + 2$



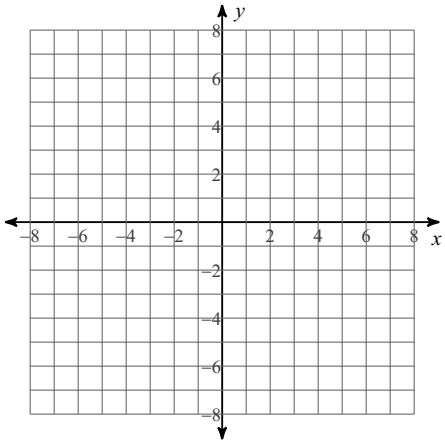
64) $f(x) = -x^3 + 2x^2 + 3$



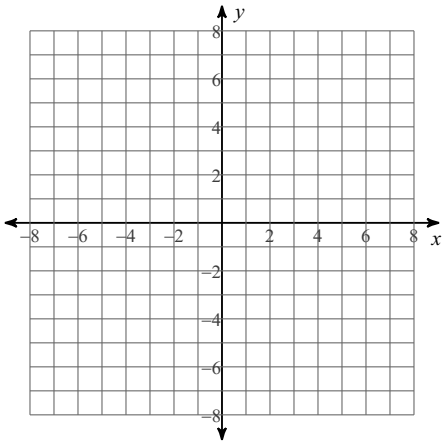
65) $f(x) = x^3 - 3x^2 - 3$



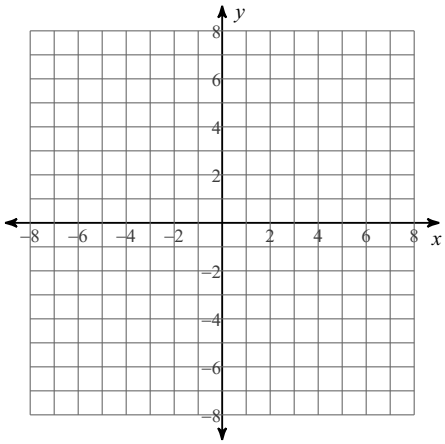
66) $f(x) = x^4 - 2x^2 - x + 1$



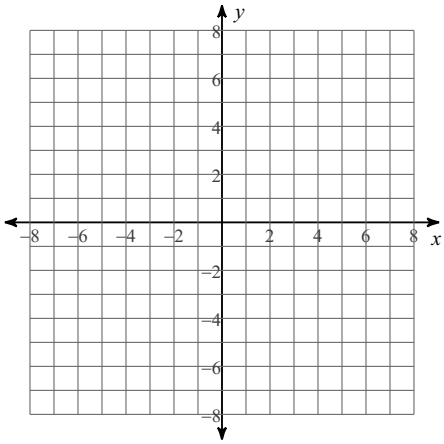
67) $f(x) = x^4 - 4x^2 - 3x + 3$



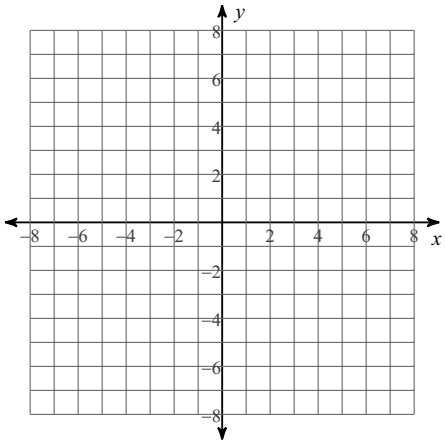
68) $f(x) = -x^3 + x^2 + 2$



69) $f(x) = -x^3 + 4x^2 - 3$



70) $f(x) = x^3 - 4x^2 + 3$



Name each polynomial by degree and number of terms.

71) $-2x^2 + 5x^4 - 10x - 8$

72) $-8n^4 - 4n$

73) $2r^4$

74) $-n + 4$

75) $-3n - 3n^3 + 10n^2$

76) $-5p^2 - 2 - 2p$

77) $6n^5$

78) $-5 - 9n^3 + 4n - 3n^2$

79) $-9x^3 - 2x$

80) $6v^2 + 7v + 4 + 9v^3$

State the possible rational zeros for each function. Then find all zeros.

81) $f(x) = x^3 - 11x^2 + 36x - 30$

82) $f(x) = 5x^3 + x^2 - 5x - 1$

83) $f(x) = x^3 + 5x^2 - 22x - 6$

84) $f(x) = x^3 + 7x^2 - 9x - 18$

85) $f(x) = x^3 - 23x - 10$

86) $f(x) = 5x^3 + 19x^2 - 29x + 5$

87) $f(x) = 9x^3 + 21x^2 + 3x - 1$

88) $f(x) = x^3 - 5x^2 - 6x + 24$

89) $f(x) = 3x^3 + x^2 - 3x - 1$

90) $f(x) = 2x^3 + 7x^2 - 11x + 20$

Write a polynomial function of least degree with integral coefficients that has the given zeros.

91) $-4,\ \ -3,\ \ \frac{4}{5}$

92) $2,\ \ -4,\ \ 0$

93) $\frac{1}{2},\ \ -\frac{1}{4},\ \ -\frac{4}{5}$

94) $\frac{1}{5},\ \ -\frac{3}{4},\ \ \frac{1}{4}$

95) $-3 - 2i,\ \ 3 + \sqrt{10},\ \ 3 - \sqrt{10}$

96) $3i,\ \ \sqrt{10}$

97) $-i,\ \ -2 + \sqrt{7}$

98) $-3i,\ \ 1 + \sqrt{2},\ \ 1 - \sqrt{2}$

99) $0,\ 4,\ 2$

100) $-2,\ 3,\ \frac{3}{5}$

101) $-\frac{3}{4},\ 2i$

102) $4,\ \frac{5}{4},\ -1$

103) $-3,\ \frac{1}{5},\ \sqrt{5}$

104) $4,\ \sqrt{3}$

105) $-1,\ -\frac{5}{3},\ -5$

106) $3,\ -3-3i$

Answers to Polynomials (ID: 1)

1) $7n^2 + 5n + 3 + \frac{1}{n+1}$ 2) $6b^2 + b - 1 - \frac{8}{b-9}$ 3) $x^2 - 6x + 7 - \frac{8}{x+7}$ 4) $x^2 - 5x + 8 - \frac{10}{x-8}$

5) $r^2 - 7r - 6 + \frac{2}{r+9}$ 6) $2x^2 + 4x - 6 + \frac{8}{x-1}$ 7) $p^2 - 3p - 6 + \frac{4}{p+8}$ 8) $4n^2 - 9n + 5 + \frac{8}{n-1}$

9) $b^2 + 10b + 9 - \frac{5}{b-8}$ 10) $4x^2 - 7x + 9 - \frac{1}{x+1}$ 11) $f(x) \to +\infty$ as $x \to -\infty$
$f(x) \to +\infty$ as $x \to +\infty$

12) $f(x) \to +\infty$ as $x \to -\infty$
$f(x) \to -\infty$ as $x \to +\infty$

13) $f(x) \to -\infty$ as $x \to -\infty$
$f(x) \to +\infty$ as $x \to +\infty$

14) $f(x) \to +\infty$ as $x \to -\infty$
$f(x) \to +\infty$ as $x \to +\infty$

15) $f(x) \to -\infty$ as $x \to -\infty$
$f(x) \to -\infty$ as $x \to +\infty$

16) $f(x) \to -\infty$ as $x \to -\infty$
$f(x) \to -\infty$ as $x \to +\infty$

17) $f(x) \to +\infty$ as $x \to -\infty$
$f(x) \to -\infty$ as $x \to +\infty$

18) $f(x) \to -\infty$ as $x \to -\infty$
$f(x) \to -\infty$ as $x \to +\infty$

19) $f(x) \to +\infty$ as $x \to -\infty$
$f(x) \to +\infty$ as $x \to +\infty$

20) $f(x) \to -\infty$ as $x \to -\infty$
$f(x) \to -\infty$ as $x \to +\infty$

21) $\{0, 1, i\sqrt{2}, -i\sqrt{2}\}$ 22) $\{\sqrt{7}, -\sqrt{7}, 3, -3\}$ 23) $\{2\sqrt{2}, -2\sqrt{2}, 1, -1\}$

24) $\{-3, \sqrt{2}, -\sqrt{2}\}$ 25) $\{2i, -2i, \sqrt{2}, -\sqrt{2}\}$ 26) $\{\sqrt{3}, -\sqrt{3}, \sqrt{7}, -\sqrt{7}\}$

27) $\{i\sqrt{5}, -i\sqrt{5}, i\sqrt{7}, -i\sqrt{7}\}$ 28) $\{2, -2, \sqrt{5}, -\sqrt{5}\}$ 29) $\{2, -1 + i\sqrt{3}, -1 - i\sqrt{3}\}$

30) $\{\sqrt{6}, -\sqrt{6}, i\sqrt{5}, -i\sqrt{5}\}$ 31) $\{2, -1 + i\sqrt{3}, -1 - i\sqrt{3}, -2, 1 + i\sqrt{3}, 1 - i\sqrt{3}\}$

32) $\left\{3, \frac{i\sqrt{10}}{2}, -\frac{i\sqrt{10}}{2}\right\}$ 33) -11 34) 0 35) 7

36) -4 37) -7 38) -8 39) -9

40) -8 41) 9 42) 0

43) $(x+1)(x^2 - x + 1)(x+5)(x^2 - 5x + 25) = 0$ 44) $(x-2)(x^2 + 2x + 4)(x+2)(x^2 - 2x + 4) = 0$

45) $(x-1)(x+1)(x^2+1)(x-2)(x+2)(x^2+4) = 0$ 46) $(x-1)(x^2 + x + 1)(x+4)(x^2 - 4x + 16) = 0$

47) $x(x-1)(x^2 + x + 1)(x+1)(x^2 - x + 1) = 0$ 48) $(x-2)(x+2)(x^2+4)(x^2-3)(x^2+3) = 0$

49) $(x-1)(x+1)(x^2+1)(x^2-2)(x^2+2) = 0$ 50) $x^2(x^2+2)(x^2+3) = 0$

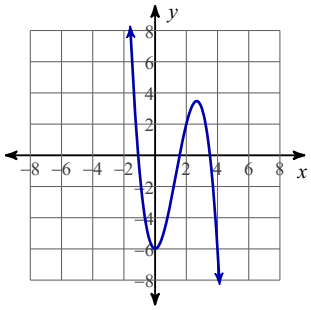
51) $(x-1)(x+1)(x^2+1)(x^2-3)(x^2+3) = 0$ 52) $(x-1)(x^2 + x + 1)(x+1)(x^2 - x + 1) = 0$

53) $(x-1)(x+1)(x^2+1)(4x^2-3)(4x^2+3) = 0$ 54) $(x^2-3)(2x-1)(2x+1)(4x^2+1) = 0$

55) $(3x^2+1)(x-1)(x+1)(x^2+1) = 0$ 56) $(3x^2+1)(x^2-2)(x^2+2) = 0$

57) $x(2x-5)(x-3) = 0$ 58) $x(2x+1)(x+3) = 0$ 59) $x(3x-1)(x-1) = 0$ 60) $x(3x+1)(x+3) = 0$

61)



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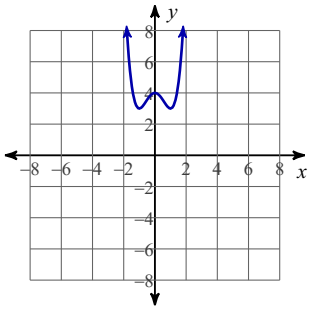

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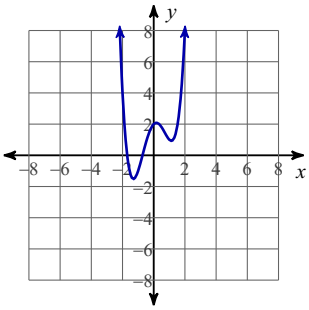

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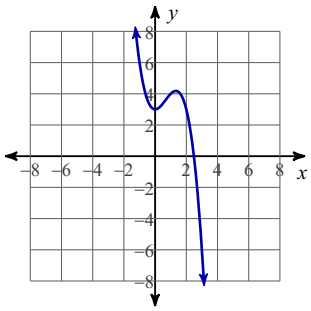

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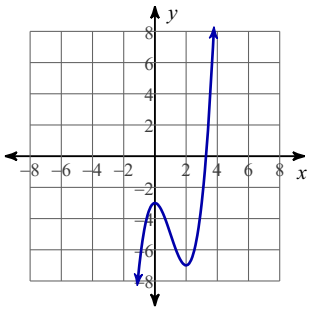

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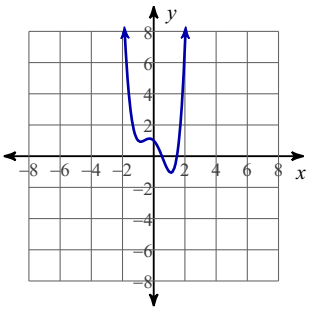

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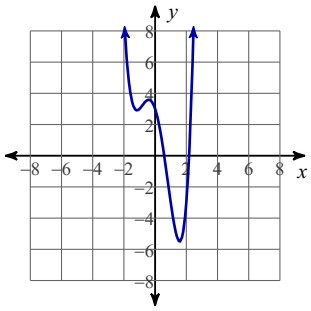

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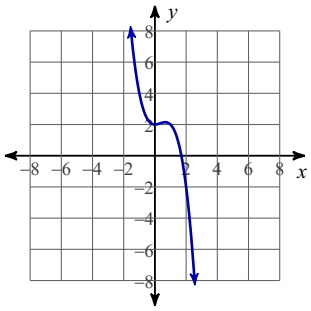

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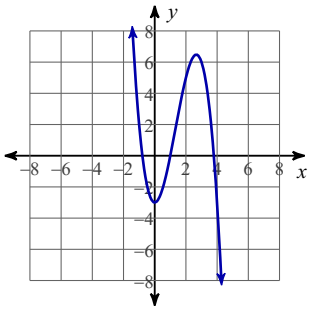

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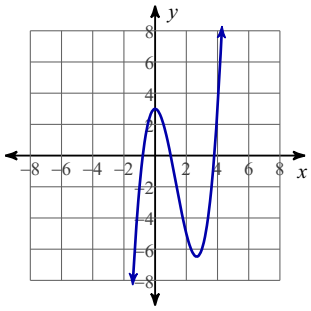

71) quartic polynomial with four terms

72) quartic binomial

73) quartic monomial

74) linear binomial

75) cubic trinomial

76) quadratic trinomial

77) quintic monomial

78) cubic polynomial with four terms

79) cubic binomial

80) cubic polynomial with four terms

81) Possible rational zeros:
$\pm 1, \pm 2, \pm 3, \pm 5, \pm 6, \pm 10, \pm 15, \pm 30$
Zeros: $\left\{5,\ 3+\sqrt{3},\ 3-\sqrt{3}\right\}$

82) Possible rational zeros: $\pm 1, \pm \frac{1}{5}$
Zeros: $\left\{-1,\ 1,\ -\frac{1}{5}\right\}$

83) Possible rational zeros: $\pm 1, \pm 2, \pm 3, \pm 6$
Zeros: $\left\{3,\ -4+\sqrt{14},\ -4-\sqrt{14}\right\}$

84) Possible rational zeros:
$\pm 1, \pm 2, \pm 3, \pm 6, \pm 9, \pm 18$
Zeros: $\left\{2,\ \frac{-9+3\sqrt{5}}{2},\ \frac{-9-3\sqrt{5}}{2}\right\}$

85) Possible rational zeros: $\pm 1, \pm 2, \pm 5, \pm 10$
Zeros: $\left\{5,\ \frac{-5+\sqrt{17}}{2},\ \frac{-5-\sqrt{17}}{2}\right\}$

86) Possible rational zeros: $\pm 1, \pm 5, \pm \frac{1}{5}$
Zeros: $\left\{\frac{1}{5},\ -5,\ 1\right\}$

87) Possible rational zeros: $\pm 1, \pm \frac{1}{3}, \pm \frac{1}{9}$
Zeros: $\left\{-\frac{1}{3},\ \frac{-3+2\sqrt{3}}{3},\ \frac{-3-2\sqrt{3}}{3}\right\}$

88) Possible rational zeros:
$\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24$
Zeros: $\left\{2,\ \frac{3+\sqrt{57}}{2},\ \frac{3-\sqrt{57}}{2}\right\}$

89) Possible rational zeros: $\pm 1, \pm \frac{1}{3}$
Zeros: $\left\{1,\ -1,\ -\frac{1}{3}\right\}$

90) Possible rational zeros:
$\pm 1, \pm 2, \pm 4, \pm 5, \pm 10, \pm 20, \pm \frac{1}{2}, \pm \frac{5}{2}$
Zeros: $\left\{-5,\ \frac{3+i\sqrt{23}}{4},\ \frac{3-i\sqrt{23}}{4}\right\}$

91) $f(x) = 5x^3 + 31x^2 + 32x - 48$

92) $f(x) = x^3 + 2x^2 - 8x$

93) $f(x) = 40x^3 + 22x^2 - 13x - 4$

94) $f(x) = 80x^3 + 24x^2 - 23x + 3$

95) $f(x) = x^4 - 24x^2 - 84x - 13$

96) $f(x) = x^4 - x^2 - 90$

97) $f(x) = x^4 + 4x^3 - 2x^2 + 4x - 3$

98) $f(x) = x^4 - 2x^3 + 8x^2 - 18x - 9$

99) $f(x) = x^3 - 6x^2 + 8x$

100) $f(x) = 5x^3 - 8x^2 - 27x + 18$

101) $f(x) = 4x^3 + 3x^2 + 16x + 12$

102) $f(x) = 4x^3 - 17x^2 - x + 20$

103) $f(x) = 5x^4 + 14x^3 - 28x^2 - 70x + 15$

104) $f(x) = x^3 - 4x^2 - 3x + 12$

105) $f(x) = 3x^3 + 23x^2 + 45x + 25$

106) $f(x) = x^3 + 3x^2 - 54$