Chap 6 Review

Day 1

1. $f(x) = 22x^9 - 9x^5 + 25x^3 + 16x^2 - x$

Deg: 9
Lead Coeff: 22
# of terms: 5

2. $(x-2)^2(3x^3 - 2x^2 + 1)$

$(x^2 - 4x + 4)(3x^3 - 2x^2 + 1)$

$3x^5 - 2x^4 + x^2$

$-12x^4 + 8x^3 - 4x$

$+12x^3 - 8x^2 + 4$

$\boxed{3x^5 - 14x^4 + 20x^3 - 7x^2 - 4x + 4}$

3. $(2x-1)^4$ (1 3 3 1; 1 4 6 4 1)

$(2x)^4 + 4(2x)^3(-1) + 6(2x)^2(-1)^2 + 4(2x)(-1)^3 + (-1)^4$

$\boxed{16x^4 - 32x^3 + 24x^2 - 8x + 1}$

4. $\boxed{x^2 - 4x + 3 + \frac{3}{2x-1}}$

$2x - 1 \,\big)\, 2x^3 - 9x^2 + 10x$

$-2x^3 + x^2$

$-8x^2 + 10x$

$+8x^2 - 4x$

$6x$

$-6x + 3$

3

5. $-2 \,|\, 2 \quad 0 \quad 0 \quad 0 \quad -1$

$-4 \quad 8 \quad -16 \quad 32$

$2 \quad -4 \quad 8 \quad -16 \quad |\, 31$

$= \boxed{2x^3 - 4x^2 + 8x - 16 + \frac{31}{x+2}}$

6. $\frac{4x^4}{2x} - \frac{3x^3}{2x} + \frac{10x}{2x} = \boxed{2x^3 - \frac{3}{2}x^2 + 5}$

7. $2 \,|\, -2 \quad 0 \quad 7 \quad 0 \quad -3 \quad -9$

$-4 \quad -8 \quad -2 \quad -4 \quad -14$

$-2 \quad -4 \quad -1 \quad -2 \quad -7 \,|\, -23$

$\boxed{P(2) = -23}$

8 – 11 → See graphs

12. $f(-x) - 5$

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

$= 3 - 2x - x^2 - 5$

$= \boxed{-2 - 2x - x^2}$

13. $-f(x-3) + 2$

$= -\left(3 + 2(x-3) - (x-3)^2\right) + 2$

$= -(3 + 2x - 6 - x^2 + 6x - 9) + 2$

$= -(-x^2 + 8x - 12) + 2$

$= x^2 - 8x + 12 + 2$

$= \boxed{x^2 - 8x + 14}$

Day 2

1. $x = -2, \quad x = 5 \pm \sqrt{3}$

$x + 2 = 0$

$(x-5)^2 = (\pm\sqrt{3})^2$

$x^2 - 10x + 25 = 3$

$x^2 - 10x + 22 = 0$

$y = (x+2)(x^2 - 10x + 22)$

$y = x^3 - 10x^2 + 22x$

$+2x^2 - 20x + 44$

$\boxed{y = x^3 - 8x^2 + 2x + 44}$

2. $x = 2 \pm i$, $x = 3 \pm \sqrt{2}$

$(x-2)^2 = (\pm i)^2$

$x^2 - 4x + 4 = -1$ $\quad (x-3)^2 = (\pm\sqrt{2})^2$

$x^2 - 4x + 5 = 0$ $\quad x^2 - 6x + 9 = 2$

$x^2 - 6x + 7 = 0$

$(x^2 - 4x + 5)(x^2 - 6x + 7) = 0$

$$y = x^4 - 6x^3 + 7x^2$$
$$-4x^3 + 24x^2 - 28x$$
$$+5x^2 - 30x + 35$$

$$\boxed{y = x^4 - 10x^3 + 36x^2 - 58x + 35}$$

3.

-2	3	11	2	-16
		-6	-10	16
	3	5	-8	0

$(x+2)(3x^2 + 5x - 8) = 0$

$(x+2)(3x+8)(x-1) = 0$

$$\boxed{x = -2, -8/3, 1}$$

4. $f(x) = x(4x^4 + 5x^2 - 9)$

$= x(4x^2+9)(x^2-1)$

$= x(x-1)(x+1)(4x^2+9) = 0$

$4x^2 + 9 = 0$

$4x^2 = -9$

$x^2 = -9/4$

$x = \pm \frac{3}{2} i$

$$\boxed{x = 0, 1, -1, \pm \frac{3}{2} i}$$

5. $f(x) = -3x^2(x-10) + 5(x-10)$

$= (x-10)(-3x^2+5) = 0$

$-3x^2 = -5$

$x^2 = 5/3$

$x = \pm\sqrt{5/3}$

$x = \pm \frac{\sqrt{15}}{3}$

$$\boxed{x = 10, \pm \frac{\sqrt{15}}{3}}$$

6.

	x^5					
2	1	-5	-1	41	-72	36
		2	-6	-14	54	-36
	1	-3	-7	27	-18	0

2	1	-3	-7	27	-18
		2	-2	-18	18
	1 (x^3)	-1	-9	9	0

$= (x-2)^2(x^3 - x^2 - 9x + 9)$

$= (x-2)^2(x^2(x-1) - 9(x-1))$

$= (x-2)^2(x-1)(x^2-9)$

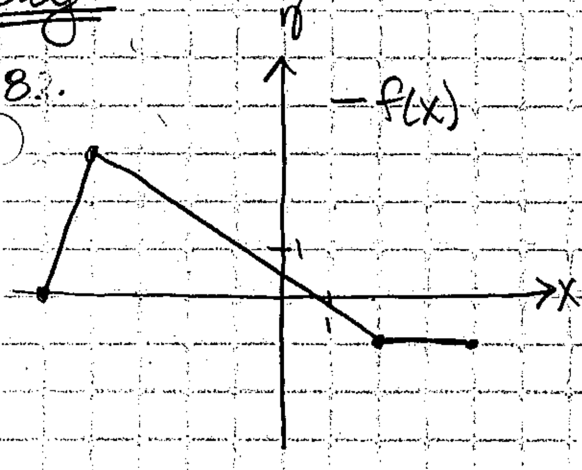
$= (x-2)^2(x-1)(x-3)(x+3)$

$$\boxed{x = 2, 1, 3, -3}$$

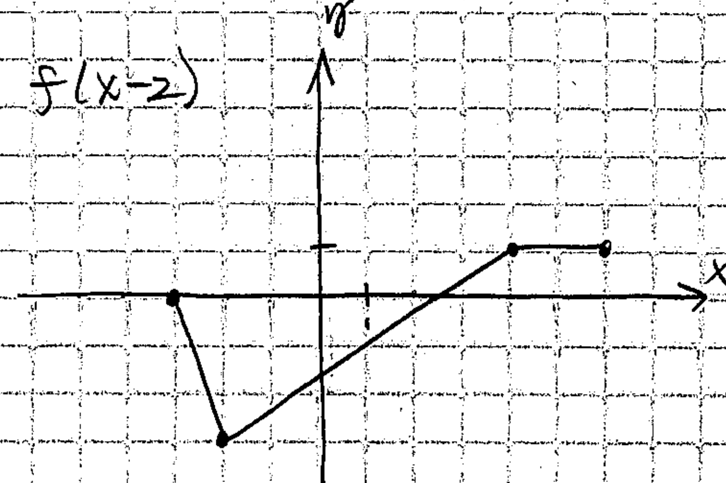
7-8 → See graphs.

Day 1

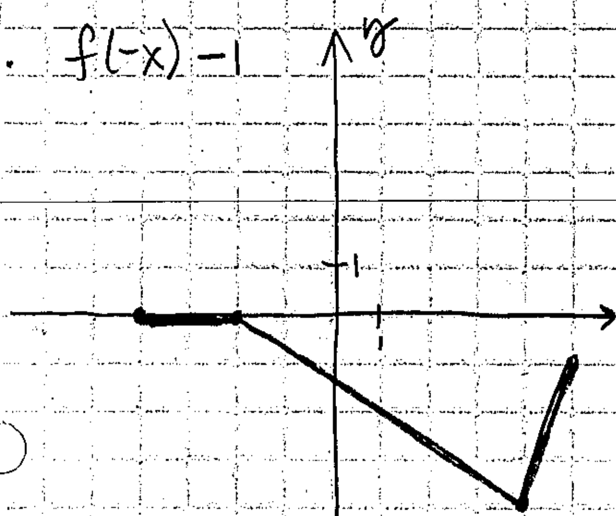
8. $-f(x)$



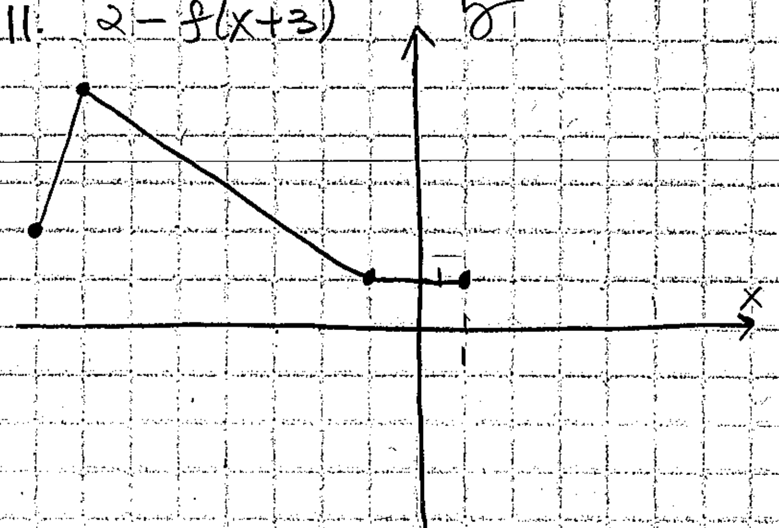
9. $f(x-2)$



10. $f(-x)-1$



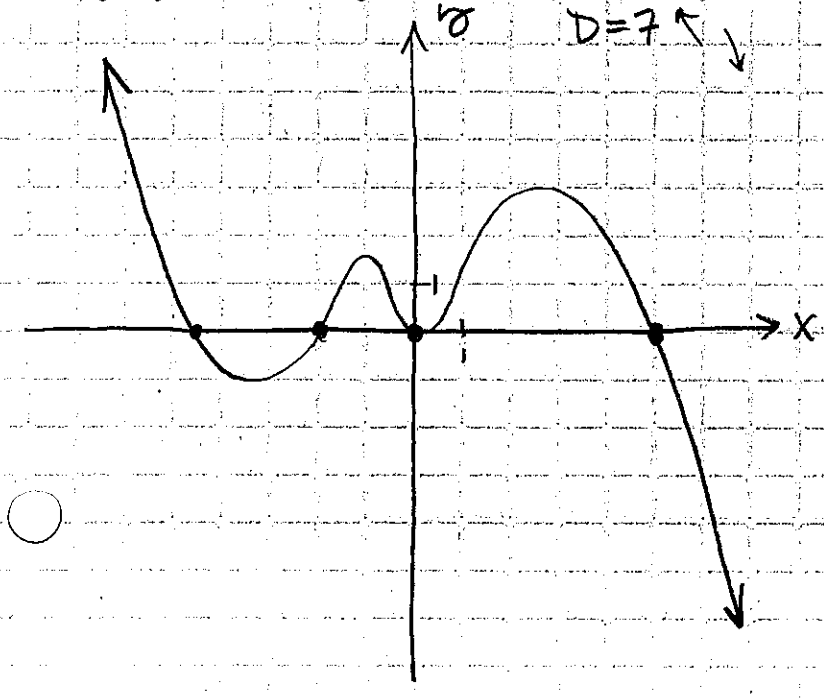
11. $2-f(x+3)$



Day 2

7. $f(x) = -12x^2(x+2)(x-5)^3(2x+9)$

D=7 ↖ ↘



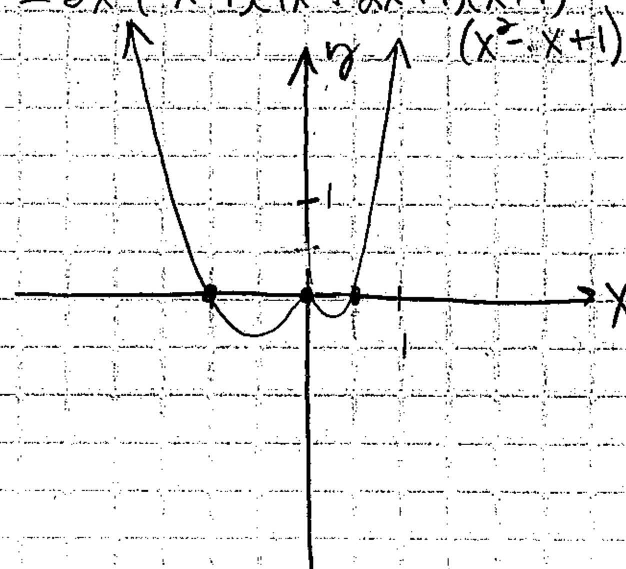
Deg=8 ↖ ↗

8. $f(x) = 16x^8 + 14x^5 - 2x^2$

$= 2x^2(8x^6+7x^3-1)$

$= 2x^2(8x^3-1)(x^3+1)$

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



18. Let x represent time. The time increases by a constant amount of 1. The bacteria populations are the y-values.

First differences:	68	140	263	434
Second differences:	72	123	171	
Third differences:	51	48		

The third differences are relatively close, a cubic function should be a good model.
$f(x) = 8.25x^3 - 13.18x^2 + 49.58x - 0.6$

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1. monomial
2. synthetic division
3. multiplicity
4. end behavior

LESSON 6-1

5. Standard form: $-3x^3 + 4x^2 + 6x + 7$
Leading coefficient: -3
Degree: 3
Terms: 4
Name: cubic polynomial with 4 terms

6. Standard form: $-x^5 + 2x^4 + 5x^3 + 8x$
Leading coefficient: -1
Degree: 5
Terms: 4
Name: quintic polynomial with 4 terms

7. Standard form: $9x^2 - 11x + 1$
Leading coefficient: 9
Degree: 2
Terms: 3
Name: quadratic trinomial

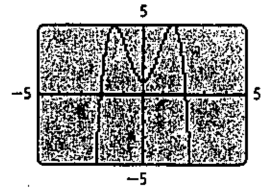
8. Standard form: $x^4 - 6x^2$
Leading coefficient: 1
Degree: 4
Terms: 2
Name: quartic binomial

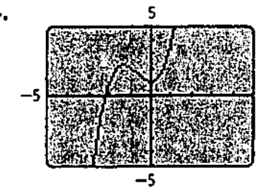
9. $(8x^3 - 4x^2 - 3x + 1) - (1 - 5x^2 + x)$
$= (8x^3 - 4x^2 - 3x + 1) + (5x^2 - x - 1)$
$= (8x^3) + (-4x^2 + 5x^2) + (-3x - x) + (1 - 1)$
$= 8x^3 + x^2 - 4x$

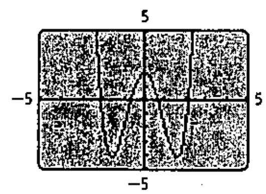
10. $(6x^2 + 7x - 2) + (1 - 5x^3 + 3x)$
$= (6x^2 + 7x - 2) + (-5x^3 + 3x + 1)$
$= (-5x^3) + (6x^2) + (7x + 3x) + (-2 + 1)$
$= -5x^3 + 6x^2 + 10x - 1$

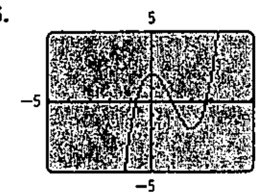
11. $(5x - 2x^2) - (4x^2 + 6x - 9)$
$= (-2x^2 + 5x) + (-4x^2 - 6x + 9)$
$= (-2x^2 - 4x^2) + (5x - 6x) + 9$
$= -6x^2 - x + 9$

12. $(x^4 - x^2 + 4) + (x^2 - x^3 - 5x^4 - 7)$
$= (x^4 - x^2 + 4) + (-5x^4 - x^3 + x^2 - 7)$
$= (x^4 - 5x^4) + (-x^3) + (-x^2 + x^2) + (4 - 7)$
$= -4x^4 - x^3 - 3$

13.

From left to right, it alternately increases and decreases, changing direction 3 times and crossing the x-axis 2 times. There appear to be 2 real zeros.

14.

From left to right, it increases, decreases slightly, and then increases again. It crosses the x-axis 1 time. There appears to be 1 real zero.

15.

From left to right, it alternately decreases and increases, changing direction 3 times. It crosses the x-axis 4 times. There appear to be 4 real zeros.

16.

From left to right, it increases, decreases, and then increases again. It crosses the x-axis 3 times. There appear to be 3 real zeros.

LESSON 6-2

17. $5x^2(3x - 2)$
$= 5x^2(3x) + 5x^2(-2)$
$= 15x^3 - 10x^2$

18. $-3t(2t^2 - 6t + 1)$
$= -3t(2t^2) - 3t(-6t) - 3t(1)$
$= -6t^3 + 18t^2 - 3t$

19. $ab^2(a^2 - a + ab)$
$= ab^2(a^2) + ab^2(-a) + ab^2(ab)$
$= a^3b^2 - a^2b^2 + a^2b^3$

20. $(x - 2)(x^2 - 2x - 3)$
$= x(x^2) + x(-2x) + x(-3) - 2(x^2) - 2(-2x) - 2(-3)$
$= x^3 - 2x^2 - 3x - 2x^2 + 4x + 6$
$= x^3 - 4x^2 + x + 6$

21. $(2x + 5)(x^3 - x^2 + 1)$
$= 2x(x^3) + 2x(-x^2) + 2x(1) + 5(x^3) + 5(-x^2) + 5(1)$
$= 2x^4 - 2x^3 + 2x + 5x^3 - 5x^2 + 5$
$= 2x^4 + 3x^3 - 5x^2 + 2x + 5$

22. $(x - 3)^3$
$= [1(x)^3(-3)^0] + [3(x)^2(-3)^1] + [3(x)^1(-3)^2]$
$+ [1(x)^0(-3)^3]$
$= x^3 - 9x^2 + 27x - 27$

23. $(x+4)(x^4-3x^2+x)$
$= x(x^4) + x(-3x^2) + x(x) + 4(x^4) + 4(-3x^2) + 4(x)$
$= x^5 - 3x^3 + x^2 + 4x^4 - 12x^2 + 4x$
$= x^5 + 4x^4 - 3x^3 - 11x^2 + 4x$

24. $(2x+1)^4$
$= \left[1(2x)^4(1)^0\right] + \left[4(2x)^3(1)^1\right] + \left[6(2x)^2(1)^2\right] + \left[4(2x)^1(1)^3\right] + \left[1(2x)^0(1)^4\right]$
$= 16x^4 + 32x^3 + 24x^2 + 8x + 1$

25. $V = \pi r^2 \cdot h$
$= \left(\pi(2x)^2\right)(x^2 - x - 3)$
$= 4\pi x^2(x^2 - x - 3)$
$= 4\pi x^2(x^2) + 4\pi x^2(-x) + 4\pi x^2(-3)$
$= 4\pi x^4 - 4\pi x^3 - 12\pi x^2$

LESSON 6-3

26.
$$\begin{array}{r}
x^2 - 7x + 16 \\
x+2\overline{)\,x^3 - 5x^2 + 2x - 7} \\
-(x^3 + 2x^2) \\
\hline
-7x^2 + 2x \\
-(-7x^2 - 14x) \\
\hline
16x - 7 \\
-(16x + 32) \\
\hline
-39
\end{array}$$

$$\frac{x^3 - 5x^2 + 2x - 7}{x+2} = x^2 - 7x + 16 - \frac{39}{x+2}$$

27.
$$\begin{array}{r}
4x^3 + 2x^2 + 4x + 1 \\
2x-1\overline{)\,8x^4 + 0x^3 + 6x^2 - 2x + 4} \\
-(8x^4 - 4x^3) \\
\hline
4x^3 + 6x^2 \\
-(4x^3 - 2x^2) \\
\hline
8x^2 - 2x \\
-(8x^2 - 4x) \\
\hline
2x + 4 \\
-(2x - 1) \\
\hline
5
\end{array}$$

$$\frac{8x^4 + 6x^2 - 2x + 4}{2x-1} = 4x^3 + 2x^2 + 4x + 1 + \frac{5}{2x-1}$$

28.
$$\begin{array}{r|rrrr}
3 & 1 & -4 & 3 & 2 \\
 & & 3 & -3 & 0 \\
\hline
 & 1 & -1 & 0 & \boxed{2}
\end{array}$$

$$\frac{x^3 - 4x^2 + 3x + 2}{x-3} = x^2 - x + \frac{2}{x-3}$$

29.
$$\begin{array}{r|rrrr}
2 & 1 & 0 & 2 & -1 \\
 & & 2 & 4 & 12 \\
\hline
 & 1 & 2 & 6 & \boxed{11}
\end{array}$$

$$\frac{x^3 + 2x - 1}{x-2} = x^2 + 2x + 6 + \frac{11}{x-2}$$

30. Number of ribbons $= \dfrac{\text{length of spool}}{\text{length of ribbon}} = \dfrac{x^3 + x^2}{x-1}$

$$\begin{array}{r|rrrr}
1 & 1 & 1 & 0 & 0 \\
 & & 1 & 2 & 2 \\
\hline
 & 1 & 2 & 2 & \boxed{2}
\end{array}$$

Yes. The number of strips of ribbons can be represented by $x^2 + 2x + 2$. Possible answer: with a remainder of 2 in.

LESSON 6-4

31.
$$\begin{array}{r|rrrr}
-3 & 1 & 2 & 0 & -5 \\
 & & -3 & 3 & -9 \\
\hline
 & 1 & -1 & 3 & \boxed{-14}
\end{array}$$

$x+3$ is not a factor of $P(x)$.

32.
$$\begin{array}{r|rrrrr}
1 & 4 & 0 & -5 & 3 & -2 \\
 & & 4 & 4 & -1 & 2 \\
\hline
 & 4 & 4 & -1 & 2 & \boxed{0}
\end{array}$$

$x-1$ is a factor of $P(x)$.

33.
$$\begin{array}{r|rrrr}
2 & 2 & -3 & 1 & -6 \\
 & & 4 & 2 & 6 \\
\hline
 & 2 & 1 & 3 & \boxed{0}
\end{array}$$

$x-2$ is a factor of $P(x)$.

34. $x^3 - x^2 - 16x + 16$
$= (x^3 - x^2) + (-16x + 16)$
$= x^2(x-1) - 16(x-1)$
$= (x-1)(x^2 - 16)$
$= (x-1)(x-4)(x+4)$

35. $4x^3 - 8x^2 - x + 2$
$= (4x^3 - 8x^2) + (-x + 2)$
$= 4x^2(x-2) - (x-2)$
$= (x-2)(4x^2 - 1)$
$= (x-2)(2x-1)(2x+1)$

36. $3x^3 + 81$
$= 3(x^3 + 27)$
$= 3(x^3 + 3^3)$
$= 3(x+3)(x^2 - x \cdot 3 + 3^2)$
$= 3(x+3)(x^2 - 3x + 9)$

37. $16x^3 - 2$
$= 2(8x^3 - 1)$
$= 2\left[(2x)^3 - 1^3\right]$
$= 2(2x-1)\left[(2x)^2 + 2x \cdot 1 + 1^2\right]$
$= 2(2x-1)(4x^2 + 2x + 1)$

LESSON 6-5

38. $x^3 - 5x^2 + 8x - 4 = 0$

Possible rational roots: $\pm1, \pm5$

$$\begin{array}{r|rrrr}
1 & 1 & -5 & 8 & -4 \\
 & & 1 & -4 & 4 \\
\hline
 & 1 & -4 & 4 & \boxed{0}
\end{array}$$

$(x-1)(x^2 - 4x + 4) = 0$
$(x-1)(x-2)(x-2) = 0$
The roots are 1 and 2.

39. $x^3 + 6x^2 + 9x + 2 = 0$

Possible rational roots: $\pm 1, \pm 2$

-2	1	6	9	2
		-2	-8	-2
	1	4	1	0

$(x+2)(x^2+4x+1) = 0$

Solve $x^2 + 4x + 1 = 0$

$x = \dfrac{-4 \pm \sqrt{16-4}}{2} = -2 \pm \sqrt{3}$

The fully factored equation is:

$(x+2)\left[x-\left(-2+\sqrt{3}\right)\right]\left[x-\left(-2-\sqrt{3}\right)\right] = 0$

The roots are -2 and $-2 \pm \sqrt{3}$.

40. $x^3 + 3x^2 + 3x + 1 = 0$

$(x+1)^3 = 0$

The roots are -1 with multiplicity 3.

41. $x^4 - 12x^2 + 27 = 0$

$(x^2-9)(x^2-3) = 0$

$(x+3)(x-3)(x^2-3) = 0$

Solve $x^2 - 3 = 0$

$x^2 = 3$

$x = \pm\sqrt{3}$

The fully factored equation is:

$(x+3)(x-3)(x+\sqrt{3})(x-\sqrt{3}) = 0$

The roots are -3, 3, and $\pm\sqrt{3}$.

42. $x^3 + x^2 - 2x - 2 = 0$

$x^2(x+1) - 2(x+1) = 0$

$(x+1)(x^2-2) = 0$

Solve $x^2 - 2 = 0$

$x^2 = 2$

$x = \pm\sqrt{2}$

The fully factored equation is:

$(x+1)(x+\sqrt{2})(x-\sqrt{2}) = 0$

The roots are -1, and $\pm\sqrt{2}$.

43. $x^3 - 5x^2 + 4 = 0$

Possible rational roots: $\pm 1, \pm 2, \pm 4$

1	1	-5	0	4
		1	-4	-4
	1	-4	-4	0

$(x-1)(x^2-4x-4) = 0$

Solve $x^2 - 4x - 4 = 0$

$x = \dfrac{4 \pm \sqrt{16+16}}{2} = 2 \pm 2\sqrt{2}$

The fully factored equation is:

$(x-1)\left[x-\left(2+2\sqrt{2}\right)\right]\left[x-\left(2-2\sqrt{2}\right)\right] = 0$

The roots are 1, and $2 \pm 2\sqrt{2}$.

44. Let x represent the width in meters.

Then the length is $2x$, and the height is $x + 4$.

$2x(x)(x+4) = 48$

$(2x^2)(x+4) = 48$

$2x^3 + 8x^2 = 48$

$2x^3 + 8x^2 - 48 = 0$

$2(x^3 + 4x^2 - 24) = 0$

Factors of -24: $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24$

$\frac{p}{q}$	1	4	0	-24
1	1	5	5	-19
2	1	6	12	0
3	1	7	21	39

$2(x-2)(x^2+6x+12) = 0$

Solve $x^2 + 6x + 12 = 0$

$x = \dfrac{-6 \pm \sqrt{36-48}}{2} = -3 \pm i\sqrt{3}$

The width must be positive and real, so the width should be 2 m.

LESSON 6-6

45. $P(x) = (x+3)(x-2)(x-4)$

$= (x^2+x-6)(x-4)$

$= x^3 - 3x^2 - 10x + 24$

46. $P(x) = \left(x+\frac{1}{2}\right)(x+2)(x-3)$

$= \left(x^2+\frac{5}{2}x+1\right)(x-3)$

$= x^3 - \frac{1}{2}x^2 - \frac{13}{2}x - 3$

47. $P(x) = (x-\sqrt{2})(x+\sqrt{2})(x+1)$

$= (x^2-2)(x+1)$

$= x^3 + x^2 - 2x - 2$

48. $P(x) = (x+3)(x-i)(x+i)$

$= (x+3)(x^2+1)$

$= x^3 + 3x^2 + x + 3$

49. $P(x) = (x-\sqrt{2})(x+\sqrt{2})(x-\sqrt{3})(x+\sqrt{3})$

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

$= x^4 - 5x^2 + 6$

50. $P(x) = \left[x-\left(1+\sqrt{3}\right)\right]\left[x-\left(1-\sqrt{3}\right)\right](x-2i)(x+2i)$

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

$= x^4 - 2x^3 + 2x^2 - 8x - 8$

51. $x^3 - x^2 + 4x - 4 = 0$

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

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

Solve $x^2 + 4 = 0$

$x^2 = -4$

$x = \pm 2i$

The fully factored equation is:

$(x-1)(x-2i)(x+2i) = 0$

The solutions are 1, $2i$, and $-2i$.

52. $x^4 - x^2 - 2 = 0$

$(x^2 + 1)(x^2 - 2) = 0$

Solve $x^2 + 1 = 0$ $\qquad$ $x^2 - 2 = 0$

$x^2 = -1$ $\qquad$ $x^2 = 2$

$x = \pm i$ $\qquad$ $x = \pm\sqrt{2}$

The fully factored equation is:

$(x - i)(x + i)(x - \sqrt{2})(x + \sqrt{2}) = 0$

The solutions are i, $-i$, $\sqrt{2}$, and $-\sqrt{2}$.

53. $x^4 - \frac{63}{4}x^2 - 4 = 0$

Possible rational roots: ±1, ±2, ±4

$$\begin{array}{r|rrrrr} 4 & 1 & 0 & -\frac{63}{4} & 0 & -4 \\ & & 4 & 16 & 1 & 4 \\ \hline & 1 & 4 & \frac{1}{4} & 1 & 0 \end{array}$$

$(x - 4)\left(x^3 + 4x^2 + \frac{1}{4}x + 1\right) = 0$

$(x - 4)(x + 4)\left(x^2 + \frac{1}{4}\right) = 0$

Solve $x^2 + \frac{1}{4} = 0$

$x^2 = -\frac{1}{4}$

$x = \pm\frac{1}{2}i$

The fully factored equation is:

$(x - 4)(x + 4)\left(x - \frac{1}{2}i\right)\left(x + \frac{1}{2}i\right) = 0$

The solutions are 4, -4, $\frac{1}{2}i$, and $-\frac{1}{2}i$.

54. $x^3 + 3x^2 - 5x - 15 = 0$

$(x + 3)(x^2 - 5) = 0$

Solve $x^2 - 5 = 0$

$x^2 = 5$

$x = \pm\sqrt{5}$

The fully factored equation is:

$(x + 3)(x - \sqrt{5})(x + \sqrt{5}) = 0$

The solutions are -3, $\sqrt{5}$, and $-\sqrt{5}$.

LESSON 6-7

55. Leading coefficient: -2; Degree: 3;
End behavior: $x \to -\infty$, $f(x) \to +\infty$
$x \to +\infty$, $f(x) \to -\infty$.

56. Leading coefficient: 1; Degree: 4;
End behavior: $x \to -\infty$, $f(x) \to +\infty$
$x \to +\infty$, $f(x) \to +\infty$.

57. Leading coefficient: -3; Degree: 6;
End behavior: $x \to -\infty$, $f(x) \to -\infty$
$x \to +\infty$, $f(x) \to -\infty$.

58. Leading coefficient: 7; Degree: 5;
End behavior: $x \to -\infty$, $f(x) \to -\infty$
$x \to +\infty$, $f(x) \to +\infty$.

59. $f(x) = x^3 - x^2 - 5x + 6$

Possible rational roots: ±1, ±2, ±3, ±6

$$\begin{array}{r|rrrr} 2 & 1 & -1 & -5 & 6 \\ & & 2 & 2 & -6 \\ \hline & 1 & 1 & -3 & 0 \end{array}$$

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

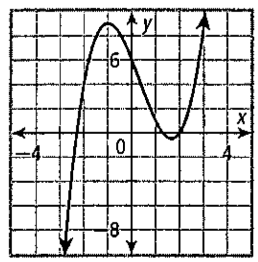
Solve $x^2 + x - 3 = 0$

$x = \frac{-1 \pm \sqrt{1 + 12}}{2} = \frac{-1 \pm \sqrt{13}}{2}$

The zeros are 2, ≈ 1.303, and ≈ -2.303

Plot other points: $f(0) = 6$, so the y-intercept is 6;
$f(-1) = 9$, and $f(1.5) = -0.375$.

The degree is odd and the leading coefficient is positive, so as $x \to -\infty$, $P(x) \to -\infty$,
and as $x \to +\infty$, $P(x) \to +\infty$.



60. $f(x) = x^4 - 10x^2 + 9$

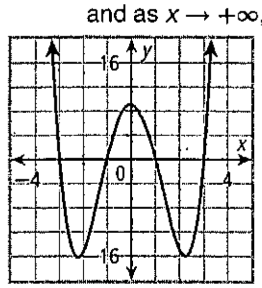
$= (x^2 - 1)(x^2 - 9)$

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

The zeros are 1, -1, 3, and -3.

Plot other points: $f(0) = 9$, so the y-intercept is 9;
$f(-2) = -15$, and $f(2) = -15$.

The degree is even and the leading coefficient is positive, so as $x \to -\infty$, $P(x) \to +\infty$,
and as $x \to +\infty$, $P(x) \to +\infty$.



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

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

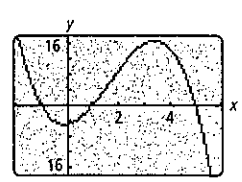
$= -(x - 5)(x^2 - 1)$

$= -(x - 5)(x - 1)(x + 1)$

The zeros are 5, 1, and -1.

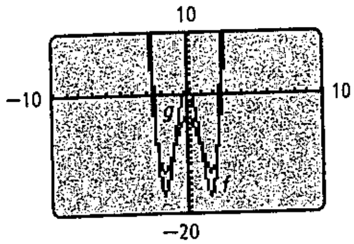
Plot other points: $f(0) = -5$, so the y-intercept is -5;
$f(3) = 16$

The degree is odd and the leading coefficient is negative, so as $x \to -\infty$, $P(x) \to +\infty$,
and as $x \to +\infty$, $P(x) \to -\infty$.

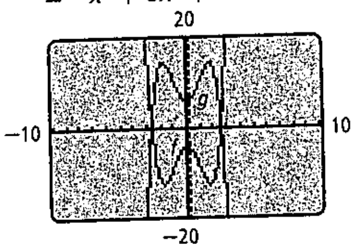


LESSON 6-8

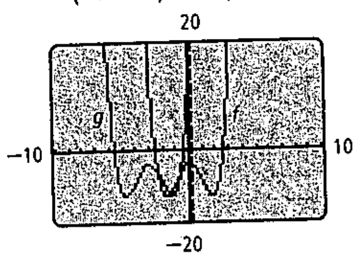
62. $g(x) = 2f(x) + 9$
$= 2(x^4 - 6x^2 - 4) + 9$
$= 2x^4 - 12x^2 - 8 + 9$
$= 2x^4 - 12x^2 + 1$



63. $g(x) = -(f(x) - 2)$
$= -(x^4 - 6x^2 - 4 - 2)$
$= -(x^4 - 6x^2 - 6)$
$= -x^4 + 6x^2 + 6$



64. $g(x) = f(-x - 3)$
$= (-x - 3)^4 - 6(-x - 3)^2 - 4$



LESSON 6-9

65. Let x represent the number of days. The days increase by a constant amount of 1. The attendances for the movie are the y-values.

First differences:	50	20	70	40
Second differences:	−30	50	−30	
Third differences:	80	−80		
Fourth differences:	−160			

The fourth differences are constant, a quartic will be the best model.

$f(x) \approx -6\frac{2}{3}x^4 + 80x^3 - 328\frac{1}{3}x^2 + 572x - 72$

66. Let x represent the number of years. The years increase by a constant amount of 1. The poulations are the y-values.

First differences:	783	702	1104	1989
Second differences:	−81	402	885	
Third differences:	483	483		

The third differences are constant, a cubic function should be a good model.

$f(x) \approx 80.5x^3 - 523.5x^2 + 1790x + 544$

CHAPTER TEST, PAGE 478

1. $(3x^2 - x + 1) + (x)$
$= (3x^2) + (-x + x) + (1)$
$= 3x^2 + 1$

2. $(6x^3 - 3x + 2) - (7x^3 + 3x + 7)$
$= (6x^3 - 3x + 2) + (-7x^3 - 3x - 7)$
$= (6x^3 - 7x^3) + (-3x - 3x) + (2 - 7)$
$= -x^3 - 6x - 5$

3. $(y^2 + 3y^2 + 2) + (y^4 + y^3 - y^2 + 5)$
$= (4y^2 + 2) + (y^4 + y^3 - y^2 + 5)$
$= (y^4) + (y^3) + (4y^2 - y^2) + (2 + 5)$
$= y^4 + y^3 + 3y^2 + 7$

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

5. $C(15) = \frac{1}{10}(15)^3 - (15)^2 + 25 = 137.50$
The cost of manufacturing 15 units is \$137.50.

6. $xy(2x^4y + x^2y^2 - 3xy^3)$
$= xy(2x^4y) + xy(x^2y^2) + xy(-3xy^3)$
$= 2x^5y^2 + x^3y^3 - 3x^2y^4$

7. $(t + 3)(2t^2 - t + 3)$
$= t(2t^2) + t(-t) + t(3) + 3(2t^2) + 3(-t) + 3(3)$
$= 2t^3 - t^2 + 3t + 6t^2 - 3t + 9$
$= 2t^3 + 5t^2 + 9$

8. $(x + 5)^3$
$= [1(x)^3(5)^0] + [3(x)^2(5)^1] + [3(x)^1(5)^2] + [1(x)^0(5)^3]$
$= x^3 + 15x^2 + 75x + 125$

9. $(2y + 3)^4$
$= [1(2y)^4(3)^0] + [4(2y)^3(3)^1] + [6(2y)^2(3)^2]$
$+ [4(2y)^1(3)^3] + [1(2y)^0(3)^4]$
$= 16y^4 + 96y^3 + 216y^2 + 216y + 81$

10.

2	5	−6	−8
		10	8
	5	4	0

$\frac{5x^2 - 6x - 8}{x - 2} = 5x + 4$

11.

$$\begin{array}{r} x^2 - 3x + 3 \\ 2x - 1\overline{)2x^3 - 7x^2 + 9x - 4} \\ \underline{-(2x^3 - x^2)} \\ -6x^2 + 9x \\ \underline{-(-6x^2 + 3x)} \\ 6x - 4 \\ \underline{-(6x - 3)} \\ -1 \end{array}$$

$\frac{2x^3 - 7x^2 + 9x - 4}{2x - 1} = x^2 - 3x + 3 - \frac{1}{2x - 1}$

12.

3	1	3	−1	2	−6
		3	18	51	159
	1	6	17	53	153