Chapter 5
Polynomials, Polynomial Functions, and Factoring

1. Textbook #73 page 310 The common cold is caused by a rhinovirus. After x days of invasion by the viral particles, the number of particles in our bodies, f(x), in billions, can be modeled by the polynomial function $f(x) = -0.75x^4 + 3x^3 + 5$. Use the leading coefficient test to determine the graph's end behavior to the right. What does this mean about the number of viral particles in our bodies over time?

2. If $f(x) = x^2 - 3x + 7$, find each of the following and simplify:

a) $f(a+2)$ b) $f(a+h) - f(a)$

3. Simplify: $(y^n + 2)(y^n - 2) - (y^n - 3)^2$ (A: $6y^n - 13$)

4. Factor each polynomials completely:

a) $2y^7(3x-1)^5 - 7y^6(3x-1)^4$

b) $ax + ay + az - bx - by - bz + cx + cy + cz$

c) $x^n y^n + 3x^n + y^n + 3$

d) $x^{4n} + x^{2n} + x^{3n}$

e) $3x^{3m}y^m - 6x^{2m}y^{2m}$

f) $15x^3 - 25x^2 + 10x$

g) $24x^2 + 3xy - 27y^2$

h) $4x^3y^5 + 24x^2y^5 - 64xy^5$

5. Factor by introducing an appropriate substitution.

a) $2x^4 - x^2 - 3$

b) $2x^6 + 11x^3 + 15$

c) $3(x-2)^2 - 5(x-2) - 2$

d) $9x^{2n} + x^n - 8$

e) $a^{2n+2} - a^{n+2} - 6a^2$

6. Factor completely.

a) $x^2 - 0.5x + 0.06$

b) $x^2 - \frac{6}{25} + \frac{1}{5}x$

c) $0.04x^2 + 0.12x + 0.09$

d) $8x^4 - \frac{x}{8}$

e) $acx^2 - bcx + adx - bd$

f) $x^5 - x^3 + 27x^2 - 27$

7. If $(fg)(x) = 3x^2 - 22x + 39$, find *f* and *g*.

8. Textbook # 105 page 345 A diver jumps directly upward from a board that is 32 feet high. The function $f(t) = -16t^2 + 16t + 32$ describes the diver's height above the water, *f(t)*, in feet, after *t* seconds.

a) Find and interpret *f(1)*. b) Find and interpret *f(2)*.

9. Factor completely:

a) $4a^3c^2 - 16ax^2y^2$

b) $8x^2 + 8y^2$

c) $1 - 81x^4$

d) $x^3 - 6x^2 - x + 6$

e) $16x^2 - 40xy + 25y^2$

f) $x^2 - 8xy + 64y^2$

g) $x^2 - 6x + 9 - y^2$

h) $25x^2 - 20x + 4 - 81y^2$

i) $125x^3 - 8$

j) $216x - x^4$

k) $x^9 + 1$

l) $x^3 + (x+y)^3$

10. Solve each equation by factoring.

a) $x^2 - 4x = 45$ (A: -5,-9)

b) $x^2 = 8x$ (A: 0,8)

c) $(x-3)(x+8) = -30$ (A: -3, -2)

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

f) $x^3 + 4x^2 - 25x - 100 = 0$ (A: -5, -4, 5)

g) $3x^4 - 48x^2 = 0$ (A: -4, 0, 4)

d) $\frac{x^2}{4}-\frac{5x}{2}+6=0$ (A: 4, 6)

h) $x(x+1)^3-42(x+1)^2=0$ (A: -7, -1, 6)

i) $-7x\left[x(3x-2)-8\right](25x^2-40x+16)=0$ (A: -5/3, -3/2, 0, 4).

j) $\left|x^2+2x-36\right|=12$ (A: -8, -6, 4, 6)

11. Find all numbers satisfying the given conditions:

a) If 5 is subtracted from 3 times the number, the result is the square of 1 less than the number. (A: 2, 3)

b) The product of the number decreased by 1 and increased by 4 is 24. (A:-7, 4)

12. Textbook # 67, 68 page 373 The function $f(x)=-\frac{1}{4}x^2+3x+17$ models the number of people , f(x), in millions, receiving food stamps x years after 1990.

a) In which year did 25 million people receive food stamps? (A: 1994 and 1998)

b) How many people received food stamps in 1996? (A: 26 million)

13. a) Write a quadratic equation in standard form whose solutions are -3 and 7.

b) Write a quadratic equation in standard form with integer coefficients whose solutions are -1/2 and 3/5.

Polynomial Equations and Their Applications

1. James Bond stands on top of a 240-foot building and throws a film canister upward to a fellow agent in a helicopter 16 feet above the building. The height of the film above the ground *t* seconds later is given by the formula $h=-16t^2+32t+240$ where *h* is in feet.

a) Calculate $h(0)$ and $h(1)$. What is their meaning in this context?

b) How long will it take the film canister to reach the agent in the helicopter? (A: 1 sec)

c) If the agent misses the canister, when will it pass James Bond on the way down? (A: 2 sec)

d) How long will it take to hit the ground? (A: 5 sec)

2. Textbook # 72 page 373. A rectangular parking lot has a length that is 3 yards greater than the width. The area of the parking lot is 180 square yards. Find the length and width. (A: 15 yd ;12 yd)

3. Textbook #78 page 374 As part of a landscaping project, you put in a flower bed measuring 20 feet by 30 feet. To finish off the project, you are putting in a uniform border of pine bark around the outside of the rectangular garden. You have enough pine bark to cover 336 square feet. How wide should the border be? (A: 3 ft)

4. The size of a rectangular computer monitor screen is given by the length of its diagonal. If the length of the screen should be 3 inches greater than its width, what are the dimensions of a 15-inch monitor? (A: 9in by 12 in)

5. Textbook #83 page 374

A tree is supported by a wire anchored in the ground 15 feet from its base. The wire is 4 feet longer than the height that it reaches on the tree. Find the length of the wire. (A: 30 1/8 ft)

6. The height , *h*, of a baseball *t* seconds after being hit is given by $h=-16t^2+64t+4$. When will the baseball reach a height of 64? (A: 3/2, 5/2 sec)

7. Textbook #80 page 374

A machine produces open boxes using square sheets of metal. The machine cuts equal-sized squares measuring 3 inches on a side from the corners and then shapes the metal into an open box by turning up the sides. If each box must have a volume of 75 cubic inches, find the length and width of the open box. (A: 5 in)

8. A car traveling at 50 feet per second (about 34 mi per hour) can stop in 2.5 seconds after applying the brakes hard. The distance the car travels in feet, *t* seconds after applying the brakes is $d=50t-10t^2$. How long does it take the car to travel 40ft? (A: 1 second)