P.5: Factoring Polynomials

I. Common Factors
   a. Students will learn about factoring out the GCF
   b. Examples Include:
      i. $18x^3 + 27x^2$ $9x^2(2x+3)$
      ii. $x^2(x+3) + 5(x+3)$ $(x^2+5)(x+3)$
      iii. $10x^3 - 4x^2$ $2x^2(5x-2)$
      iv. $2x(x-7) + 3(x-7)$ $(2x+3)(x-7)$

II. Factoring by Grouping
   a. Students will be able to factor polynomials with four terms using grouping then factoring the GCF
   b. Examples Include:
      i. $x^3 + 4x^2 + 3x + 12$ $(x^2+3)(x+4)$
      ii. $x^3 + 5x^2 - 2x - 10$ $(x^2-2)(x+5)$
      iii. $x^3 + 6x^2 + 2x + 12$ $(x^2+2)(x+6)$
      iv. $x^3 - x^2 - 5x + 5$ $(x^2-5)(x-1)$

III. Factoring Trinomials
   a. Students will be able to factor GCF and then factor the remaining part either using the special products or trial and error.
   b. Examples Include:
      i. $x^2 + 6x + 8$
      $(x+4)(x+2)$
      ii. $x^2 + 13x + 40$
      $(x+8)(x+5)$
      iii. $x^2 + 3x - 18$
      $(x-3)(x+6)$
      iv. $x^2 - 5x - 14$
      $(x-7)(x+2)$
      v. $8x^2 - 10x - 3$
      $(4x+1)(2x-3)$
      vi. $6x^2 + 19x - 7$
      $(2x+7)(3x-1)$
      vii. $3x^2 - 13xy + 4y^2$
      $(3x-y)(x-4y)$
      viii. $2x^2 - 7xy + 3y^2$
      $(2x-y)(x-3y)$
      ix. $x^2 - 4$
      $(x+2)(x-2)$
      x. $81x^2 - 49$
      $(9x+7)(9x-7)$
      xi. $x^2 - 81$
      $(x-9)(x+9)$
      xii. $36x^2 - 25$
      $(6x-5)(6x+5)$
      xiii. $x^4 - 81$
      $(x^2-9)(x^2+9)$
      xiv. $81x^4 - 16$
      $(9x^2-4)(9x^2+4)$

IV. Factoring Sums/Difference of Two Cubes
   a. Students will be able to use the sum/difference of two cubes formula to factor.
   b. Examples Include:
      i. $x^3 + 8$ $(x+2)(x^2-2x+4)$
      ii. $64x^3 - 125$ $(4x-5)(16x^2+20x+25)$
      iii. $x^3 + 1$ $(x+1)(x^2-x+1)$
      iv. $125x^3 - 8$ $(5x-2)(25x^2+10x+4)$

Practice:

Factor. (Hint: Use GCF)

1. $18x + 27$
2. $16x - 24$
3. $4x^2 - 8x$
4. $3x^2 + 6x$
5. $x(x + 5) + 3(x + 5)$
6. $x(2x + 1) + 4(x + 5)$
7. $x^2(x - 3) + 12(x - 3)$
8. $x^2(2x + 5) + 17(2x + 5)$

Factor. (Hint: Use grouping)

9. $x^3 - 2x^2 + 5x - 10$
10. $x^3 - 3x^2 + 4x - 12$
11. $x^3 - x^2 + 2x - 2$
12. $3x^3 - 2x^2 - 6x + 4$

Factor, if prime state so.

13. $x^2 + 5x + 6$
14. $x^2 + 8x + 15$
15. $x^2 - 2x - 15$
16. $x^2 - 4x - 5$
17. $x^2 - 8x + 15$
18. $2x^2 + 5x - 3$
19. $6x^2 - 11x + 4$
20. $6x^2 - 17x + 12$
21. $8x^2 + 33x + 4$
22. $6x^2 - 7xy - 5y^2$
23. $6x^2 - 5xy + 6y^2$
24. $2x^2 + 3xy + y^2$

Factor. (Hint: Difference of Two Squares)

25. $x^2 - 100$
26. $36x^2 - 49$
27. $x^2 - 144$
28. $9x^2 - 25y^2$
29. $36x^2 - 49y^2$
30. $81x^4 - 1$

Factor. (Hint: Sum/Difference of Two Cubes)

31. $x^3 + 27$
32. $x^3 - 64$
33. $8x^3 - 1$
34. $64x^3 + 27$

Challenge Plus:

Factor completely.

35. $10x^2(x + 1) - 7x(x + 1) - 6(x + 1)$
36. $6x^4 + 35x^2 - 6$
37. $x^7 + x$
38. $x^4 - 5x^2y + 4y^2$
39. $(x - y)^4 - 4(x - y)^2$

Practice:

1. $9(2x+3)$
2. $8(2x-3)$
3. $4x(x-2)$
4. $3x(x+2)$
5. $(x+5)(x+3)$
6. $(2x+2)(x+4)$
7. $(x-3)(x+4)$
8. $(2x+5)(x^2+17)$
9. $(x-2)(x^2+5)$
10. $(x-3)(x^2+4)$
11. $(x-1)(x^2+2)$
12. $(3x-2)(x^2-2)$
13. $(x+3)(x+2)$
14. $(x+3)(x+5)$
15. $(x-5)(x+3)$
16. $(x-5)(x+1)$
17. $(x-3)(x-5)$
18. $(2x-3)(x-1)$
19. $(2x-1)(3x-4)$
20. $(3x-4)(2x-3)$
21. $(8x-1)(x-4)$
22. $(3x-5y)(2x+y)$
23. $(3x+2y)(2x-3y)$
24. $(2x+y)(x+y)$
25. $(x+10)(x-10)$
26. $(6x+7)(6x-7)$
27. $(x+12)(x-12)$
28. $(3x+5y)(3x-5y)$
29. $(6x+7y)(6x-7y)$
30. $(9x^2+1)(9x^2-1)$
31. $(x+3)(x^2-3x+9)$
32. $(x-4)(x^2+4x+6)$
33. $(2x-1)(4x^2+2x+1)$
34. $(4x+3)(16x^2-12x+9)$

Challenge Plus:

35. $(x+1)(5x+6)(2x-1)$
36. $(6x^2-1)(x^2+6)$
37. $x(x^2+1)$
38. $(x^2-4y)(x^2-y)$
39. $(x-y)^2(x-y+2)(x-y-2)$