Name:

Common Core Algebra II

Unit 1

Polynomials and Factoring

Mr. Schlansky

2026

Lesson 1: I can perform operations with monomials by following the rules for each operation
Multiplying: Add the exponents
Dividing: Subtract the exponents

Lesson 2: I can perform operations with polynomials by following the rules for each operation.
Operations with Polynomials
Adding: Combine like terms
Subtracting: Keep, change, change
Keep the first polynomial
Change subtraction to addition
Change EVERY sign in the second polynomial
*from comes first
Multiplication: Box Method. Don't forget to combine like terms
Division: Divide every term by the denominator
When squaring a binomial, write out the binomial twice and use box method!
*profit = revenue – cost, $p(x) = r(x) - c(x)$

Lesson 3: I can find profit using revenue – cost and distributing the negative. I can evaluate functions by substituting what's in the parenthesis in for x.
Profit = revenue – cost. Distribute the negative when subtracting.
To evaluate a function, substitute what's inside the parenthesis in for x and then perform operations with polynomials.

Lesson 4: I can perform operations with functions by substituting the functions into the expression and then performing that appropriate operations.
1) Substitute the functions into the given expressions
2) Perform the appropriate operations

Lesson 5: I can divide polynomials using synthetic division.
Synthetic Division
1) List the coefficients of dividend (what you are dividing into)
2) Negate the divisor (what you are dividing by) and put it outside
3) Bring the first coefficient down
4) Multiply/add (repeat this step until you make it all the way through)
5) Take the new coefficients and decrease all the powers by 1. The last number is the remainder which goes over the divisor.

*Put 0 as a placeholder if necessary.

Lesson 6: I can divide polynomials using long division.
Long Division
Divide (first term by first term)
Multiply (Distribute)
Subtract (Keep, change, change)
Bring Down (Next term from the dividend)
*Put the remainder over the divisor
*Put 0 as a placeholder if necessary

Lesson 7: I can perform long division using a quadratic divisor.
Same notes as lesson 6.

Lesson 8: I can factor using GCF, DOTS, Trinomials, and Completely using each of their procedures.
Greatest Common Factor: GCF( )
Difference of Two Squares: $(\sqrt{\ }_1 + \sqrt{\ }_2)(\sqrt{\ }_1 - \sqrt{\ }_2)$
Trinomials: (x)(x)
1) First sign comes down
2) The two signs must multiply for the last sign
3) Find two numbers that multiply to the last number and add/subtract to the middle number
***Factor further if possible**

Lesson 9: I can factor tricky trinomials (trinomials with a leading coefficient) using the bridge method.
Bridge Method: (Trinomial with a leading coefficient bigger than 1)
1) Build a bridge between the first and last numbers (Multiply)
2) Factor Trinomial Normally
3) Pay the toll (Divide by the leading coefficient)
    -If 1 divides nicely: divide them and put the denominator in front of the variable inside the parenthesis for the other factor
    -If they both reduce: reduce both of them and then put the denominator in front of the variable for each factor

Lesson 10:
I can factor by grouping using its procedure.
Grouping: (4 Terms or More)
1) Look for a pattern in the exponents to determine the groups. **You cannot have two terms with the same exponent in the same group.**
2) Factor out the GCF in each group
*You should be left with the same factor. If signs are reversed, factor out a negative
3) Combine coefficients and keep like term.
***Factor further if possible**

Lesson 11: I can factor complex trinomials using substitution
Substitution Trinomials
1) Replace binomial with y
2) Factor normally
3) Substitute back
4) Combine like terms OR factor further

Lesson 12: I can factor using sum and difference of two cubes using their formulas.
Sum and Difference of Two Cubes
SOAP for signs (Same, Opposite, Always Positive)
$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

Lesson 13: I can reduce rational expressions by factoring and canceling common factors.
Reducing Rational Expressions
1) Factor both the top and bottom polynomials (Two separate factoring problems).
2) Cancel common factors.
***If the same **factor is written backwards with a minus sign, they cancel to negative one.**

Lesson 14: I can solve polynomial equations by factoring.
Polynomial Equations
1) Bring everything to one side. Keep the leading coefficient positive.
2) Factor (Refer to above section)
3) Set each factor equal to zero

Lesson 15: I can prepare for my polynomials/factoring exam by practicing!

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Operations with Monomials

1. $(4x^3)(2x^5)$

2. $(3x^4)(7x^8)$

3. $(2x^5)(5x^2)$

4. $(6x)(5x^5)$

5. $(9x^3)(6x^2)$

6. $(-2x^2y^3)(3x^5y)$

7. $\frac{12x^8}{4x^3}$

8. $\frac{24x^9}{3x^2}$

9. $\frac{48x^8y^9}{4xy^8}$

10. $\frac{21x^6}{7x^4}$

11. $\frac{18x^8}{3x^4}$

12. $\frac{45x^6y^9}{9x^5y^4}$

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Operations with Polynomials

1. Express $(x^2 - 5x - 2) + (-6x^2 - 7x - 3)$ in simplest terms.

2. Express $(3x^2 - 8x + 1) + (2x^2 - 3x + 5)$ in simplest terms.

3. Express $(-2x^2 + 5x - 7) - (7x^2 - 3x + 2)$ in simplest terms.

4. Express $(7x^2 + 2x + 1) - (2x^2 - 3x - 5)$ in simplest terms.

5. What is the result when $5m^2 + 3m - 1$ is subtracted from $7m^2 - 5m + 1$?

6. What is the result when $7xy + 5y - 2x$ is subtracted from $9xy - 5y + 3x$?

Express the following in simplest terms

7. $\frac{12x^3 - 6x^2 + 2x}{2x}$

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

9. $-3x(x-4) - 2x(x+3)$

10. $-3x^2y(5xy^2 + xy)$

11. $(x-4)(x+6)$

12. $(2x-3)(3x+1)$

13. $(x^2 + 2x - 4)(x+3)$

14. $(2x^2 + 3x - 2)(x-2)$

15. $(3x^2 + x - 5)(x - 4)$

16. $(2y^2 - 3y - 1)(y + 7)$

17. $(4x^2 + 2x + 3)(x - 2)$

18. $(-5x^2 - 4x + 1)(2x + 5)$

19. $(m + 7)^2$

20. $(y - 4)^2$

21. $(x - 9)^2$

22. $(z + 2)^2$

23. $(2x - 3)^2$

24. $(4x + 2)^2$

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Applications of Operations with Polynomials

1. Mr. Schlansky's tutoring revenue can be represented by $r(x) = 25x^2 - 90x + 14$ and his costs can be represented by $c(x) = 12x^2 + 21x + 10$. If his profit can be determined using $p(x) = r(x) - c(x)$, write a polynomial function what would represent $p(x)$.

2. Stone Manufacturing has developed a cost model, $C(x) = 0.18x^3 + 0.02x^2 + 4x + 180$, where x is the number of sprockets sold, in thousands. The sales price can be modeled by $S(x) = 95.4 - 6x$ and the company's revenue by $R(x) = x \bullet S(x)$. Express the company's profits, $R(x) - C(x)$.

3. A manufacturing company has developed a cost model, $C(x) = 0.15x^3 + 0.01x^2 + 2x + 120$, where x is the number of items sold, in thousands. The sales price can be modeled by $S(x) = 30 - 0.01x$. Therefore, revenue is modeled by $R(x) = x \bullet S(x)$. Express the company's profit, $P(x) = R(x) - C(x)$.

4. If $f(x) = 2x^2 + 3x - 4$, evaluate $f(x + 2)$

5. If $f(x) = 3x^2 - 5x + 1$, evaluate $f(x - 3)$

6. If $f(x) = -2x^2 - 8x - 3$, evaluate $f(x + 1)$

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Performing Operations with Functions

Express each of the following in polynomial standard form

1. Given $f(x) = 3x^2 - 5x + 1$ and $g(x) = x + 1$.
Express $[g(x)]^2 - 2f(x)$

2. Given $p(x) = x^2 + 2x - 3$ and $g(x) = 2x - 3$.
Express $[p(x)][g(x)] - 3p(x)$

3. Given $f(x) = 2x^2 + 4x - 2$ and $g(x) = x - 2$.
Express $f(x) - [g(x)]^3$

4. For $c(x) = 3x^2 - 4x + 7$ and $d(x) = x - 2$, determine $c(x) \bullet d(x) - [d(x)]^3$ as a polynomial in standard form.

5. Given $f(x) = 5x^2 + 3x - 12$ and $g(x) = 2x - 1$.
Express $4g(x) - f(x + 1)$

6. Given $m(x) = 2x^2 + 2x - 7$ and $n(x) = x - 5$.
Express $3n(x) - m(x - 2)$

7. Given $f(x) = x^2 - 2x + 3$ and $g(x) = 4x + 1$.
Express $2f(x - 1) - [f(x)][g(x)]$

8. Given $f(x) = 2x^2 - 3x + 1$ and $g(x) = x - 3$.
Express $[g(x)]^3 - f(x - 3)$

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Dividing Polynomials With Synthetic Division

Divide each of the following polynomials using synthetic division

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

2. $\frac{x^2+7x+5}{x+1}$

3. $\frac{x^2-10x-21}{x+2}$

4. $\frac{-x^2-8x+33}{x+10}$

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

6. $\frac{-3x^2+10x-6}{x+1}$

7. $\frac{5x^4+17x^3+10x^2-5}{x+3}$

8. $\frac{2x^4-3x^3-4x^2-5}{x-2}$

9. $\dfrac{2x^3 - x - 2}{x - 2}$

10. $\dfrac{2x^3 - 3x^2 - 2x + 5}{x - 3}$

11. $\dfrac{x^3 + 5x^2 - 1}{x + 2}$

12. $\dfrac{x^4 - 32x^2 + 21x - 12}{x + 6}$

13. $\dfrac{2x^3 + 5x^2 - 31x - 84}{x + 3}$

14. $\dfrac{4x^3 + 12x^2 - 5}{x + 5}$

15. $\dfrac{2x^3 - 10x + 3}{x + 3}$

16. $\dfrac{5x^3 - 60}{x - 2}$

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Dividing Polynomials With Long Division

Divide each of the following polynomials

1. $\dfrac{6x^3+19x^2+11x-6}{3x-1}$

2. $\dfrac{15x^3+29x^2-23x-21}{5x+3}$

3. $\dfrac{2x^3-3x^2+2x+5}{x-5}$

4. $\dfrac{9x^2-2}{3x+1}$

5. $\frac{2x^3 - x - 2}{x - 4}$

6. $\frac{4x^3 + 10x^2 + 10x - 1}{2x - 3}$

7. $\frac{4x^3 + 5x + 10}{2x + 3}$

8. $\frac{4x^4 + 10x^3 - 2x^2 + x + 2}{2x + 1}$

9. $\frac{6x^4 - 8x^3 - 12x^2 + 13x + 7}{3x - 4}$

10. $\frac{6x^2 + 7x - 1}{2x + 5}$

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Long Division with Quadratic Divisors

1. $\frac{3x^3+x^2+2x+5}{x^2+2x+1}$

2. $\frac{20x^3-9x^2-56x+52}{5x^2+4x-9}$

3. $\frac{x^4-2x^3+3x^2-4x+5}{x^2-2}$

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

5. $\frac{3x^4+4x^3-5x^2+14x-}{x^2+2x-2}$

6. $\frac{3x^4-19x^3-29x^2-x+8}{x^2-8x+3}$

7. $\frac{-12x^4+2x^3+16x-5}{x^2+2x-1}$

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

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Factoring Using GCF, DOTS, Trinomials

Factor each expression

1. $4x + 8$

2. $12x + 18$

3. $x^2 - 7x$

4. $2x^2 - 4xy$

5. $5x^2y - 20x$

6. $ax^2 + 5ax - a$

7. $x^2 - 64$

8. $y^2 - 36$

9. $x^2 - 25$

10. $9 - k^2$

11. $4t^2 - 25$

12. $36 - 25x^2$

13. $9x^2 - 16y^4$

14. $100y^4 - 49t^6$

15. $x^2 + 4x - 12$

16. $y^2 + 3y + 2$

17. $m^2 - 8m + 15$

18. $x^2 - 8x - 20$

19. $y^2 + 5y - 14$

20. $x^2 + x - 12$

21. $x^2 - 3x - 10$

22. $x^2 - 7x + 12$

23. $x^2 + 2xy + y^2$

24. $k^2 - 2kx + x^2$

25. $x^4 + 4x^2 - 12$

26. $x^4 - 6x^2 + 9$

27. $2x^2 - 50$

28. $2x^2 - 8x - 10$

29. $3x^2 + 9x - 12$

30. $6x^2 - 54$

31. $2x^2 + 14x + 24$

32. $5x^2 - 500$

33. $ax^2 - 2ax - 8a$

34. $yx^2 - 64y$

35. $2x^3 - 2x^2 - 12x$

36. $x^4 + 6x^2 - 7$

37. $3x^2 - 147$

38. $-2x^3 + 4x^2 + 198x$

39. $12x^2 - 75$

40. $x^4 - 81$

41. $x^4 - 8x^2 - 9$

42. $x^4 + x^2 - 2$

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Factoring Tricky Trinomials

Factor all of the following polynomials

1. $2y^2 - 5y - 7$

2. $2x^2 + 15x - 8$

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

4. $6x^2 + 13x + 5$

5. $3y^2 + 4y + 1$

6. $12y^2 - 5y - 2$

7. $12x^2 + 7x + 1$

8. $2x^2 + 13x + 6$

9. $2x^2 + 7x - 4$

10. $6x^2 - 11x - 10$

11. $2x^2 - 9x - 18$

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

13. $4y^2 + 9y + 2$

14. $5x^2 + 3x - 2$

15. $6x^2 + x - 12$

16. $8x^2 + 7x - 1$

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Factoring by Grouping

Factor the following polynomials

1. $x^3 - 5x^2 + 2x - 10$

2. $x^3 + 3x^2 + 4x + 12$

3. $x^3 + 7x^2 + x + 7$

4. $x^3 - 8x^2 + 2x - 16$

5. $x^3 + 12x^2 - 2x - 24$

6. $x^3 + 6x^2 - 3x - 18$

7. $x^3 + 5x^2 - x - 5$

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

9. $8x^3 + 2x^2 + 12x + 3$

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

11. $x^3 + 3x^2 - 9x - 27$

12. $x^3 + 10x^2 - 9x - 90$

13. $8x^3 + 12x^2 - 2x - 3$

14. $27x^3 + 36x^2 - 12x - 16$

15. $9x^3 + 18x^2 - x - 2$

16. $x^3y^2 + 4x^2y^2 - 4x - 16$

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Factoring By Grouping II

Factor the following polynomials

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

2. $3x^3 + x^2 - 12x^2 - 4x - 63x - 21$

3. $t^4 - 3t^3 - 18t^2 - t^2 + 3t + 18$

4. $x^3 - 2x^2 - 8x^2 + 16x + 15x - 30$

5. $w^3 + 2w^2 - 3w + w^2 + 2w - 3$

6. $2x^3 - 5x^2 - 3x + 14x^2 - 35x - 21$

7. $k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48$?

8. $a^4 + 2a^3 - 3a^2 - a^3 - 2a^2 + 3a - 6a^2 - 12a + 18$

9. $2a^4 + 14a^3 + 20a^2 - 9a^3 - 63a^2 - 90a + 4a^2 + 28a + 40$

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Factoring Trinomials with Substitution

Factor the following expressions completely

1. $(x^2+5x)^2-2(x^2+5x)-24$

2. $(x-4)^2-3(x-4)-10$

3. $(x^2-2x)^2-11(x^2-2x)+24$

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

5. $(x^2-3x)^2-14(x^2-3x)+40$

6. $(x+8)^2+6(x+8)+5$

7. $(x^2+3x)^2-8(x^2+3x)-20$

8. $(x^2-7x)^2-2(x^2-7x)-48$

9. $2(x+2)^2-3(x+2)-5$

10. $\left(4x^2+5x\right)^2-5\left(4x^2+5x\right)-6$

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Sum and Difference of Two Cubes

Factor the following polynomials

1. $x^3 - 8$

2. $x^3 + 8$

3. $y^3 - 125$

4. $z^3 + 64$

5. $a^3 - 27$

6. $b^3 - 216$

7. $1000x^{12} - 27y^3$

8. $343x^{15} + 1$

9. $8 - 1331x^{24}$

10. $729x^3 + y^6$

11. $64x^{18} - 125y^9$

12. $27y^9 + 8x^{12}$

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Reducing Rational Expressions

Reduce the rational expression to simplest terms (*Hint: Factor then cancel)*

1. $\frac{6x+12}{9x+18}$

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

3. $\frac{2x+6}{x^2-9}$

4. $\frac{10-5x}{x^2+2x-8}$

5. $\frac{6x+18}{6x+12}$

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

7. $\frac{81-x^2}{x^2-7x-1}$

8. $\frac{2x^2+x-6}{9-4x^2}$

9. $\frac{x^2+3x+2}{x^3+2x^2+8x+16}$

10. $\frac{3x^2+7x-6}{4-9x^2}$

11. $\frac{x^3+8}{2x^2-4x+8}$

12. $\frac{2x^4+4x^3-6x^2}{4x^3-36x}$

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Solving Polynomial Equations by Factoring

1. $y^2 - 5y - 6 = 0$

2. $x^2 + 4x = 0$

3. $a^2 - 8a = 20$

4. $3x^2 = 48$

5. $x^2 - 6x = -8$

6. $3x^2 + 3x - 6 = 0$

7. $n^2 = 3n + 18$

8. $2x^2 + 3x = 5$

9. $x^2 - 6x = 2x + 20$

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

11. $4(x^2 + 2x) = 8x + 64$

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

13. $x^3 - 6x^2 - 4x + 24 = 0$

14. $x^3 - 7x^2 = x - 7$

15. $x^3 + 5x^2 = 4x + 20$

16. $9x - 36 = x^3 - 4x^2$

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Polynomials/Factoring Review Sheet

1. Stone Manufacturing has developed a cost model, $C(x) = 0.18x^3 + 0.02x^2 + 4x + 180$, where x is the number of sprockets sold, in thousands. The sales price can be modeled by $S(x) = 95.4 - 6x$ and the company's revenue by $R(x) = x \bullet S(x)$. Express the company's profits, $R(x) - C(x)$.

2. A manufacturing company has developed a cost model, $C(x) = 0.15x^3 + 0.01x^2 + 2x + 120$, where x is the number of items sold, in thousands. The sales price can be modeled by $S(x) = 30 - 0.01x$. Therefore, revenue is modeled by $R(x) = x \bullet S(x)$. Express the company's profit, $P(x) = R(x) - C(x)$

3. Given $f(x) = 3x^2 - 5x + 1$ and $g(x) = x + 1$.
Express $[g(x)]^2 - 2f(x)$

4. Given $p(x) = x^2 + 2x - 3$ and $g(x) = 2x - 3$.
Express $[p(x)][g(x)] - 3p(x)$

Divide the following polynomials using synthetic division

5. $\frac{2x^3 - x - 2}{x - 4}$

6. $\frac{2x^4 - 3x^3 - 4x^2 - 5}{x - 2}$

Divide the following polynomials using long division

7. $\frac{4x^3 + 5x + 10}{2x + 3}$

8. $\frac{4x^4 + 10x^3 - 2x^2 + x + 2}{2x + 1}$

9. $\frac{3x^4+4x^3-5x^2+14x-17}{x^2+2x-2}$

10. $\frac{3x^4-19x^3-29x^2-x+8}{x^2-8x+3}$

Factor the follow expressions completely

11. $2x^2 - 50$

12. $4x^2 - 36$

13. $2x^2 - 16x - 40$

14. $3x^2 + 12x - 36$

15. $2y^2 - 5y - 7$

16. $6x^2 + x - 12$

17. $x^3 + 3x^2 - 9x - 27$

18. $x^3 + 5x^2 - x - 5$

19. $(x + 7)^2 - 7(x + 7) + 12$

20. $(x^2 - 2x)^2 - 11(x^2 - 2x) + 24$

21. $y^3 - 125$

22. $z^3 + 64$

Express the following in simplest terms

23. $\frac{2x+6}{x^2-9}$

24. $\frac{10-5x}{x^2+2x-8}$

Solve the following equations for the given variable:

25. $n^2 + 6n = 3n + 18$

26. $x^3 + 10x^2 = 9x + 90$