

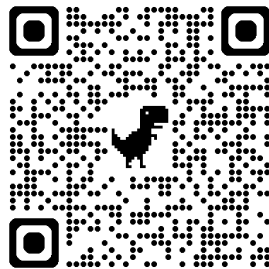
Name:

Common Core Algebra II

Unit 1

Polynomials and Factoring

Mr. Schlansky



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: $(x \quad)(x \quad)$

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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Algebra 2

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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Algebra 2

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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Algebra 2

Profit

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 $R(x) = x \bullet S(x)$. The company's profits, $R(x) - C(x)$, could be modeled by

- | | |
|--------------------------------------|---------------------------------------|
| 1) $0.18x^3 + 6.02x^2 + 91.4x + 180$ | 3) $-0.18x^3 - 6.02x^2 + 91.4x - 180$ |
| 2) $0.18x^3 - 5.98x^2 - 91.4x + 180$ | 4) $0.18x^3 + 5.98x^2 + 99.4x + 180$ |

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 $R(x) = x \bullet S(x)$. The company's profit, $P(x) = R(x) - C(x)$, could be modeled by

- | | |
|-------------------------------------|---------------------------------------|
| 1) $0.15x^3 + 0.02x^2 - 28x + 120$ | 3) $-0.15x^3 + 0.01x^2 - 2.01x - 120$ |
| 2) $-0.15x^3 - 0.02x^2 + 28x - 120$ | 4) $-0.15x^3 + 32x + 120$ |

4. A major car company analyzes its revenue, $R(x)$, and costs $C(x)$, in millions of dollars over a fifteen-year period. The company represents its revenue and costs as a function of time, in years, x , using the given functions.

$$R(x) = 550x^3 - 12,000x^2 + 83,000x + 7000$$

$$C(x) = 880x^3 - 21,000x^2 + 150,000x - 160,000$$

The company's profits can be represented as the difference between its revenue and costs. Write the profit function, $P(x)$, as a polynomial in standard form.

5. The profit function, $p(x)$, is found by subtracting the cost function, $c(x)$, from the revenue function, $r(x)$. Which function below represents the cost function given $p(x) = -15x^2 + 600x + 60$ and $r(x) = -0.4x^2 + 130x + 1200$?

1) $c(x) = -14.6x^2 + 470x - 1140$

3) $c(x) = 14.6x^2 - 470x + 1140$

2) $c(x) = -14.6x^2 + 730x - 1260$

4) $c(x) = 14.6x^2 + 730x - 1260$

6. The profit function, $p(x)$, for a company is the cost function, $c(x)$, subtracted from the revenue function, $r(x)$. The profit function for the Acme Corporation is $p(x) = -0.5x^2 + 250x - 300$ and the revenue function is $r(x) = -0.3x^2 + 150x$. The cost function for the Acme Corporation is

1) $c(x) = 0.2x^2 - 100x + 300$

3) $c(x) = -0.2x^2 + 100x - 300$

2) $c(x) = 0.2x^2 + 100x + 300$

4) $c(x) = -0.8x^2 + 400x - 300$

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Algebra II

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 $4g(x) - [f(x)g(x)]$

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

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

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

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

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

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

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

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

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

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

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

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

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Dividing Polynomials With Long Division

Divide each of the following polynomials

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

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

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

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

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

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

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

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

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

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

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Long Division with Quadratic Divisors

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

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

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

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

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

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

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

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

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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. $1000 - y^3$

8. $x^3 + 1$

9. $y^3 + 216$

10. $729 - x^3$

11. $x^4 - 125x$

12. $16 - 2x^3$

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

$$7. \frac{81-x^2}{x^2-7x-18}$$

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

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

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

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

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

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

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. $\frac{x^3 - 8}{x^3 - 2x^2 + 5x - 10}$

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

Solve the following equations for the given variable:

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

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