ALGEBRA 2 CP
MIDTERM REVIEW
Add or subtract the following polynomials. (Distribute if necessary, and then combine like terms)

1. \((2x - 2y) + (5x + 2y)\)  
2. \((5x - 7) - (7x - 6)\)  
3. \((-3x^3 + 12x^2 - 7x) - (9x^2 + 2x - 7)\)

Multiply the following polynomials. Use distribution or FOIL

4. \(-5x^2y^4(7x^5y + 3x^2y^3 - x^6y^4)\)  
5. \((x + 2)(x - 3)\)  
6. \((4x + 5y)(2x - 7y)\)

7. \((x + 3)^2\)  
8. \((x - 4)(x^2 - 4x + 1)\)  
9. \(2(x - 3)(x - 4)\)

True or false?

10. \((a + b)^3 = a^3 + b^3\)  
11. \((a - b)(a^2 + ab + b^2) = a^3 - b^3\)  
12. \((a + b)(a^2 - ab + b^2) = a^3 + b^3\)

Factor the following polynomials. Look for the greatest common factor, difference of squares, trinomials, and sum/difference of cubes

13. \(x^2 - 3x - 10\)  
14. \(2y^2 - 50\)  
15. \(3x^2 - 18x - 24\)
16. $4a^2 + a - 3$  
17. $x^3 + 3x^2 - 70x$  
18. $m^3 - 1$

19. $27r^4y^9 + 18r^5y^6 - 72r^3y^3$  
20. $81x^4 - 16$  
21. $45x^2 - 80y^2$

22. $8a^3 - 27$  
23. $c^2 + 6c - 7$  
24. $6x^2 - 3x - 18$

**Solve by factoring**

25. $x^2 - 2x = 15$  
26. $4c^2 = 20c$  
27. $3x^2 + 4x - 15 = 0$

**Simplify**

28. $(7 - 8i) + (-12 - 4i)$  
29. $(10 - 4i) - (7 - 3i)$  
30. $(-3 + 5i) + (18 - 7i)$
Simplify
31. $(2 + i) (3 - 5i)$  
32. $(7 - 6i) (2 - 3i)$  
33. $(3 + 4i) (3 - 4i)$

34. $\frac{8 - 6i}{3i}$

35. $\frac{3i}{4 + 2i}$

Fill in the blanks to complete the square.
36. $x^2 - 14x + \underline{\hspace{2cm}} = (x \underline{\hspace{2cm}} \underline{\hspace{2cm}})^2$

37. $x^2 + 9x + \underline{\hspace{2cm}} = (x \underline{\hspace{2cm}} \underline{\hspace{2cm}})^2$

38. $m^2 - \frac{2}{3}m + \underline{\hspace{2cm}} = (m \underline{\hspace{2cm}} \underline{\hspace{2cm}})^2$

Solve by completing the square
39. $x^2 - 2x = 15$

40. $4x^2 - 8x - 12 = 0$

41. $x^2 - 7x + 5 = 0$

Write each quadratic function in vertex form. Identify the vertex, axis of symmetry and direction of opening.
42. $y = x^2 + 10x + 20$

43. $y = 2x^2 + 16x + 29$
Use FOIL to write a quadratic equation with the following roots.

44. 3 and 5
45. -4i and 2
46. \(-\frac{2}{5}\) and \(\frac{2}{7}\)

Find the value of the discriminant and determine the nature of the roots.
Choices: 2 real roots, 1 real root, 2 complex roots

47. \(4x^2 + 16x + 15 = 0\)
48. \(x^2 = -10x - 25\)
49. \(x^2 + 4x + 53 = 0\)

Disc = __________
Disc = __________
Disc = __________
Nature of roots _________
Nature of roots _________
Nature of roots _________

Solve using the quadratic formula

50. \(3x^2 - 5x + 9 = 0\)
51. \(x^2 = 4x - 15\)

Find the Axis of Symmetry and Vertex for the graph of each function using \(x = -\frac{b}{2a}\).

52. \(y = -x^2 + 8x + 3\)
53. \(f(x) = 2x^2 + 2x + 5\)
Define a variable, write an equation and solve.
54. A sports team sells about 100 coupon books for $30 each during its annual fund-raiser. They estimate that for each $0.50 decrease in the price, they will sell about 10 more coupon books. How much should they charge for each book in order to maximize the income from their sales? What is the maximum monthly income the team can expect to make from these items?

55. The sum of two numbers is -1, and their product is -6. Write a quadratic equation to find the two numbers, then solve.

56. A rectangular picture frame measures 8 cm by 4 cm. You want to triple the frame’s area by adding the same distance $x$ to the length and the width. Write and solve an equation to find the value of $x$. What are the new dimensions of the picture frame?
CHAPTER 5 – POLYNOMIALS

Simplify. Answer all questions using positive exponents!

1. \( x^{10} \cdot x^{10} \)
2. \( \frac{x^{15}}{x^{10}} \)
3. \( (y^4)^4 \)

4. \( (2a^2b^3)^4 \)
5. \( 4j(2j^{-2}k^2)(3j^3k^{-7}) \)
6. \( (3a^0b^2)(2a^{-3}b^2)^2 \)

7. \( 2^{-3} \)
8. \( \frac{1}{5^2} \)
9. \( (m^2n^4)^{-2} \)

10. \( \frac{3(a^2b)^4}{(3ab)^3} \)
11. \( \frac{4^{-2}x^{-5}y^{-1}}{6y^{-2}x^{-3}} \)
12. \( \frac{1}{x^0 + y^0} \)

Divide the following polynomials using synthetic division

13. \( (2x^3 - 5x + 40) \div (x + 3) \)
14. \( (x^2 - 4x + 7) \div (x - 2) \)

Divide the following polynomials using Long Division

15. \( (6x^3 + x^2 + x) \div (2x + 1) \)
16. \( (4x^2 - 2x + 6) \div (2x - 3) \)
Use direct substitution to find $f(2)$ and $f(-1)$ for each function.

17. $f(x) = x^3 - 3x^2 + x - 2$
18. $f(x) = x^5 - 7x^3 - 4x + 10$

Find $p(-1)$ and $p(2)$ for each function using synthetic substitution.

19. $p(x) = 2x^2 - 4x + 1$
20. $p(x) = -2x^3 + 5x + 3$

Given a polynomial and one of its factors, find the remaining factors of the polynomial.

21. $x^3 + 3x^2 - 6x - 8; x - 2$
22. $4x^3 - 12x^2 - x + 3; x - 3$

Solve each equation. State the number and types of roots.

23. $-9x - 15 = 0$
24. $x^5 = 81x$
25. $x^4 - 5x^2 + 4 = 0$

Use Descarte’s Rule of Signs. State the possible number of positive real zeros, negative real zeros, and imaginary zeros of each function.

26. $f(x) = 4x^3 - 2x^2 + x + 3$
27. $f(x) = 2x^4 - 6x^3 + 6x^2 + 24x - 40$

List all the possible rational zeros of each function.

28. $p(x) = 2x^4 - 5x^3 + 8x^2 + 3x - 5$
29. $g(x) = x^4 - 7x^3 + 3x^2 + x - 20$
Find all of the zeros of each function.

30. \(g(x) = x^3 - 3x^2 - 4x + 12\)  
31. \(f(x) = 3x^3 - 9x^2 - 10x - 8\)

Find the zeros, relative minimum(s) and relative maximum(s) and graph the following. Your answer must be exact!

32. \(f(x) = 2x^3 - 3x^2 + 2\)

33. \(f(x) = 0.5x^4 - 4x^2 + 4\)

Describe the end behavior for each of the following by completing the statement:

\[\text{as } x \to -\infty, \ f(x) \to \ldots \quad \text{and} \quad \text{as } x \to \infty, \ f(x) \to \ldots\]

34. \(f(x) = -x^3 - 4x^2 + 5\)

35. \(g(x) = 4x^4 - 3x^3 + x^2 + 1\)

Graph the following polynomials, be sure to include the relative maxima and minima.

36. \(f(x) = x^3 - 4x^2 + 5\)

37. \(g(x) = x^4 - x^3 - 4x^2 + 1\)
38. The weight \( w \), in pounds, of a patient during a 7-week illness is modeled by the cubic equation:
\[ w(n) = 0.1n^3 - 0.6n^2 + 110, \]
where \( n \) is the number of weeks since the patient became ill.

a. Graph the equation, and describe the turning points of the graph and its end behavior.

b. What trends in the patient’s weight does the graph suggest? Is it reasonable to assume the trend will continue indefinitely?

39. The rainfall \( r \), in inches per month, during a 7-month period is modeled by the equation:
\[ r(m) = 0.01m^3 - 0.18m^2 + 0.67m + 3.23, \]
where \( m \) is the number of months after March 1.

a. Graph the equation, and describe the turning points of the graph and its end behavior.

b. What trends in the amount of rainfall received by the town does the graph suggest?
CHAPTER 6 – RATIONAL EXPONENTS AND RADICAL FUNCTIONS

**Simplify**

1. \(-\sqrt{121}\)
2. \(\sqrt[4]{16x^4}\)
3. \(\sqrt[3]{64}\)

4. \(\sqrt[4]{16x^2y^4}\)
5. \(\sqrt[6]{6x^2y} \cdot \sqrt[7]{6x^3y^7}\)
6. \(\frac{\sqrt[6]{4a^2b^3}}{\sqrt[12]{12a^2b}}\)

7. \(5\sqrt{12}\)
8. \((6\sqrt{3})(2\sqrt{6})\)
9. \(\frac{\sqrt{15}}{\sqrt{5}}\)

10. \(6\sqrt{2} + 3\sqrt{2} - 7\)
11. \(3\sqrt{16} - 4\sqrt{75} + \sqrt{3}\)
12. \((4 + \sqrt{6})(4 - \sqrt{6})\)

**Rationalize the denominator.**

13. \(\frac{2}{\sqrt{6}}\)
14. \(\frac{5}{\sqrt{2}}\)
15. \(\frac{3}{1 + \sqrt{2}}\)

**Express the following using rational exponents.**

16. \(\sqrt[4]{15}\)
17. \(\sqrt[3]{x^2}\)
18. \(\sqrt[7]{3x^2y^4}\)
Express the following in simplest radical form. No decimal answers.

19. \( \frac{\frac{1}{5}}{\sqrt[6]{5}} \)
20. \( \frac{\frac{4}{5}}{\sqrt[3]{y^2}} \)
21. \( \sqrt[6]{36} \)

22. \( \frac{2}{3} \)
23. \( \frac{1}{\left(\frac{4}{5}\right)^{\frac{1}{4}}} \)
24. \( 8^{\frac{3}{4}} \)

25. \( 2^2 \cdot 2^{\frac{3}{4}} \)
26. \( 5\sqrt{7} \cdot 4\sqrt{7^3} \)
27. \( 3\sqrt{16} \)

Solve Each Equation.

28. \( m^4 - 625 = 0 \)
29. \( (x + 4)^3 = -33 \)
30. \( t^4 - 2t^2 + 80 = 0 \)

Solve the following equations.

31. \( \sqrt{x - 3} = 7 \)
32. \( \sqrt[3]{2a + 4} = 2 \)
33. \( \sqrt[4]{r + 12} - \sqrt{r} = 2 \)

34. \( \sqrt{8x + 9} + 3 = 6 \)
35. \( \sqrt[7]{7x - 7} = \sqrt[3]{3x - 2} \)
36. \( x - 6 = \sqrt{3x} \)
37. \( 2x^2 = 16 \)
38. \((x - 5)^5 - 73 = 170 \)
39. \( \frac{1}{4}(7x + 8)^3 = 54 \)

**Find the inverse of each function. Then graph the function and its inverse.**

40. \( g(x) = 2x - 1 \)
41. \( f(x) = 3x \)
42. \( y = \frac{2}{3}x + 2 \)

**Determine whether each pair of functions are inverse functions.**

43. \( \begin{cases} f(x) = 5x - 5 \\ g(x) = \frac{1}{5}x + 1 \end{cases} \)
44. \( \begin{cases} f(x) = 6x - 2 \\ g(x) = \frac{1}{6}x + 3 \end{cases} \)
Find the inverse.

45. \( f(x) = -\frac{1}{2}x + 1 \)
46. \( g(x) = x^2 + 7; \ x \geq 0 \)

Given \( f(x) = 3x^2 - 2x + 1 \) and \( g(x) = x - 4 \) find the following and state the domain.

47. \( f(x) + g(x) \)
48. \( f(x) - g(x) \)

49. \( f(x) \cdot g(x) \)
50. \( \frac{f(x)}{g(x)} \)

51. \( f(g(7)) \)
52. \( f(g(x)) \)

53. \( g(f(x)) \)
CHAPTER 7 – EXPONENTIAL AND LOGARITHMIC FUNCTIONS

Determine whether each function represents exponential growth or decay.
1. \( y = 5(6)^x \) 
2. \( y = .1(2)^x \) 
3. \( y = 5 \cdot 4^{-x} \)

Describe the shifts of the following exponential equations from its parent function and then graph. Then, identify the functions domain and range.
4. \( y = -2 \left( \frac{1}{2} \right)^{x-3} \)
5. \( y = .25(4)^{x+1} - 2 \)

Write each expression in logarithmic form.
6. \( 2^7 = 128 \)
7. \( 8^{-2} = \frac{1}{64} \)

Write each equation in exponential form.
8. \( \log_{15} 225 = 2 \)
9. \( \log_4 32 = \frac{5}{2} \)

Write an equivalent exponential or logarithmic equation.
10. \( e^{15} = x \)
11. \( \ln 20 = x \)
12. \( e^{-5x} = 0.2 \)
13. \( \ln 0.0002 = x \)

Evaluate each expression.
14. \( \log_4 25 \)
15. \( \log_4 \frac{1}{64} \)
16. \( 7^{\log_7 x} \)
17. \( e^{\ln 3} \)
18. \( \ln e^y \)

Solve each equation. Check your solutions.
19. \( \log_3 x = 5 \)  
20. \( \log_6 3 = \frac{1}{2} \)  
21. \( \log_e 216 = x \)

22-25, use \( \log_3 3 \approx 0.6826 \) and \( \log_4 4 \approx 0.8614 \) to evaluate each expression.

22. \( \log_5 12 \)  
23. \( \log_5 \frac{81}{5} \)

24. \( \log_5 \frac{9}{16} \)  
25. \( \log_5 144 \)

Expand the following logarithms.

26. \( \log_3 4x^2 \)  
27. \( \ln \frac{3x^3}{2y} \)

Condense the following logarithms.

28. \( \log_3 24 - \log_3 6 \)  
29. \( \log_8 6 + 2 \log_8 3 \)

Solve each equation or inequality. Check your solution.

30. \( 3^{3x-5} = 81 \)  
31. \( 2^{3n-1} = \left( \frac{1}{8} \right)^n \)  
32. \( 9^{2x-1} = 27^{x+4} \)

33. \( e^x = 5 \)  
34. \( 2e^x - 1 = 11 \)

Solve each equation. Check your solutions.
35. \( \log_6(4x + 12) = 2 \)

36. \( \log_3(x + 2) = \log_3(3x) \)

37. \( \log_4 5 + \log_4 x = \log_4 60 \)

38. \( \log_5 y - \log_5 8 = \log_5 1 \)

39. \( 3\log_8 2 - \log_8 4 = \log_8 b \)

40. \( \ln 8x = 3 \)

41. \( \ln (x + 3) = 1 \)

42. \( y = 4^x \)

43. \( y = \ln(x + 3) \)

44. \( y = \log_8 x \)

Find the inverse.

45. A computer system depreciates at a rate of 6.5% per year. If the computer system originally cost $4000, how long would it take for it to be worth half its value?

46. Suppose you deposit $1000 in an account paying 5% annual interest compounded continuously.
   a. What is the balance after 10 years?

   b. How long will it take for the balance in your account to reach $1500?
47. Suppose you deposit $100 in an account paying 3.5% interest compounded continuously. How long will it take for your money to double?

48. A cup of coffee contains 130 milligrams of caffeine. If caffeine is eliminated from the body at a rate of 11% per hour, how long will it take for half of this caffeine to be eliminated from a person’s body?

49. You’re off to college! You buy a computer for $2500. It is expected to depreciate at a rate of 20% per year. What will be the value of the computer in 2 years?

50. A computer system depreciates at an average rate of 4% per month. If the value of the computer system was originally $12000, in how many months is it worth $7350?

51. A piece of machinery valued at $250,000 depreciates at a fixed rate of 12% per year. After how many years will the value have depreciated to $100,000?

52. The Miller’s bought a condominium for $185,000. Assuming that the value of the condo will appreciate at approximately 5% a year, how much will the condo be worth in 7 years?

53. The population of a city of one million people is increasing at a rate of 3% per year. If the population continues to grow at this rate, in how many years will the population have doubled?
CHAPTER 11 – STATISTICS

1. Of the 42 employees at Speedy Pizza, sixteen make $4.75 an hour, four earn $5.50 an hour, three earn $6.85 an hour, six earn $4.85 an hour and thirteen earn $5.25 an hour. Find the mean, median and mode of the hourly wages.

Mean: _________________
Median: ________________
Mode: _________________

2. Given the following set of data:

32, 45, 67, 93, 82, 55, 58, 45, 13, 54

a. Make a stem and leaf plot of this data.

Stem | Leaf
-----|-----

b. What is the minimum? b._____________

c. What is the maximum? c._____________

d. What is the range? d._____________

e. What is the mean? (to nearest tenth) e._____________

f. What is the mode? f._____________

g. What is the median? g._____________

h. Construct a box plot of the data.

j. What is the lower quartile? j._____________

k. What is the upper quartile? k._____________

l. What is the inter-quartile range? (IQR) l._____________

m. What is the outlier number? m._____________

n. What is the lower fence? n._____________

o. What is the upper fence? o._____________

p. Name the outlier(s) if any. p._____________
3. From the box plot, answer the following questions.
   a. What is the lower quartile? __________________
   b. What is the upper quartile? ________________
   c. What is the inter-quartile range? (IQR) ________________
   d. What is the outlier number? ________________
   e. What is the lower fence? ________________
   f. What is the upper fence? ________________
   g. Name the outlier(s) if any. ________________

4. Below are the weights of 14 people boarding a sailboat.
   134, 167, 137, 138, 120, 134, 145, 155, 152, 159, 164, 135, 144, 156
   a. What is the mean weight? __________________
   b. What is the standard deviation of the weights? ________________
   c. Construct a normal distribution of the weights.
   d. Between what 2 numbers does 68% of the data lie? ________________
   e. Between what 2 numbers does 95% of the data lie? ________________
   f. Above what number can we find weights that are 3 or more standard deviations above of the mean? ________________
   g. Calculate the z-score for a person weighing 135 pounds. ________________
   h. What is the probability for a person to have a z-score of -2.5? ________________