Math 124: Algebra with Applications
Fall 2023
Practice Problems for Final Exam

Name (Print): _____

- Evaluate each expression using the order of operations.

  1. $3(4) + 3 - 1 + 6^2/2$
  2. $7 - 3 \cdot 2 + 6$
  3. $\dfrac{2(4 \cdot 8 + 2)}{(2 \cdot 2)}$
  4. $10 + 2 \cdot 5 - 20$
  5. $\dfrac{3(-6) + 12/(-\sqrt{16}) - 6/(-2)}{\sqrt{25} - 3}$
  6. $7 + 2 \cdot 3 - 8$
  7. $3(10 - 4) + 6 - 2$
  8. $5 - 7 \cdot 3 + 2$
  9. $4^2 + 9^2(2 - 1) + 3 - (4^2 - 6)$
  10. $\dfrac{7^2 - 5\sqrt{64}}{\sqrt{2^2 + 5}}$
  11. $\dfrac{(5 - 2 \cdot (6 + 7))/ - 3}{9 - 8 + (\frac{25}{5} + 1)}$
  12. $7 \cdot 2 + 5 - 12$
  13. $(3 \cdot 2 + 4) \cdot 5$
  14. $(10 - 12) \cdot 5 + 4$
  15. $\dfrac{10 - (-4 + 7)}{3 \cdot 2 - 8 + 5 - 2}$
  16. $(5 + 11) \cdot (7 + 8)$
  17. $10 - 6 \cdot 2(2 + 11) + 1$

- Add, subtract, or multiply as indicated.

  1. $(5c + 7)(6c + 8)$
  2. $(7k + 5)(k + 3)$
  3. $(4x^3 - x^2 + 16) + (2x^3 - 2x^2 + 4)$
  4. $(4x^3 + 2x^2 - x) - (3x^3 - 2x^2 + 7x)$
  5. $(7b - 3)(2b + 6)$
  6. $(5x^4 + 2x^3 + x + 5) \cdot (-6x^3 + 5x - 2)$
  7. $(15y^2 + 10x - 18) - (-8y^3 + 8x - 20)$
  8. $(4x^3 + 2x^2 + 6) + (6x^3 + 7x^2 + 8)$
  9. $(2x + 3)(5x^2 - 3x + 2)$
  10. $(12x^3 + 7x^2 - 3x + 1) - (8x^3 + 15x^2 + 5x - 3)$
  11. $(x - 4)(x^2 + 3x - 6)$
  12. $(8x - 5)(11 + 3x)$
  13. $(3r + 2)(4r^2 + 3r - 5)$
  14. $(5x^3 + 3x^2 - 6x) - (-5x^3 - 2x^2 - 9x)$

- Factor each polynomial as much as possible.

1. $x^2 + 11x + 30$

2. $12r^2 + 36r^4 + 6r$

3. $6x^2 + 18x - 36$

4. $x^2 + 5x - 24$

5. $11x^2 - 77x$

6. $x^2 - 36$

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

8. $10x^6 + 50x^3 - 28x$

9. $x^2 + 6x + 9$

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

11. $36x^{12} - 24x^7 + 12x^5 - 6x^3$

12. $10x^2 + 15x^3 + 20x^4$

13. $x^2 - 11x + 24$

14. $6x^2 - 19x - 7$

15. $4x^2 + 23x - 6$

16. $5x^2 - 28x - 12$

17. $x^2 - 2x - 80$

18. $x^2 + 7x + 10$

- Add, subtract, multiply, or divide the rational expressions as indicated, and write your answers in lowest terms.

1. $\dfrac{4a^3}{21} \cdot \dfrac{3}{2a^2}$

2. $\dfrac{5}{15} \cdot \dfrac{x}{2}$

3. $\dfrac{5a^2}{3} \cdot \dfrac{7}{3a^2}$

4. $\dfrac{2p+7}{(p+2)(p-5)} - \dfrac{p+5}{(p+2)(p-5)}$

5. $\dfrac{4x^2}{36} \cdot \dfrac{10}{2x^3}$

6. $\dfrac{6z^3}{7} \cdot \dfrac{2z}{3}$

7. $\dfrac{3}{x^2 - 3x - 10} + \dfrac{7}{x^2 - x - 20}$

8. $\dfrac{12b^3}{36} \cdot \dfrac{6}{4b^5}$

9. $\dfrac{4}{6k} + \dfrac{18}{6k}$

10. $\dfrac{4}{x-1} + \dfrac{5}{3(x-1)}$

11. $\dfrac{3}{3(m+2)} + \dfrac{2}{4(m+2)}$

12. $\dfrac{3}{5x} - \dfrac{2}{6x}$

13. $\dfrac{8x}{10} \div \dfrac{16x^2}{40u}$

14. $\dfrac{y^2 - y - 6}{y^2 - 2y - 8} \div \dfrac{y^2 - 9}{y^2 + 7y + 12}$

15. $\dfrac{b^2 + 12b + 36}{b^2 + 10b + 25} \cdot \dfrac{b^2 + 6b + 9}{b^2 - 11b + 18}$

16. $\dfrac{4b^2}{24} \cdot \dfrac{6}{2b^3}$

17. $\dfrac{6x}{18} \div \dfrac{12x^2}{9y}$

- Simplify each expression by writing your answer in lowest terms with only positive exponents.

  1. $\dfrac{x^{-3}x^7}{x^5}$

  2. $\left(\dfrac{5}{6}\right)^{-3}$

  3. 5^{-3}

  4. $\left(\dfrac{5}{x^3}\right)^{-2}$

  5. $\dfrac{x^{10} \cdot x^{12}}{x^{24}}$

  6. $\dfrac{w^{12}}{w^4 \cdot w^{10}}$

  7. $v^8(v^4 + v^6)$

  8. $\dfrac{p^{12} \cdot p^6}{p^{10}}$

  9. $\dfrac{x^6 \cdot x^5}{x^{10}}$

- Simplify each radical expression.

  1. $\sqrt{49} \cdot \sqrt{9}$
  2. $\sqrt[3]{343}$
  3. $\sqrt{69 - 5}$
  4. $\sqrt[4]{16}$

  5. $\sqrt[3]{216}$
  6. $\sqrt{252}$
  7. $\sqrt{75} + \sqrt{192}$

- Solve each equation.

  1. $6z + 5 = 59$
  2. $5m + 10 = 30$
  3. $5x + 4 = 19$
  4. $3x + 4 = 22$
  5. $12x + 3 = 27$
  6. $6 + 7x = 55$
  7. $4x + 16 = 20$
  8. $5x = 6 + 2x$

  9. $5x + 5 = 20$
  10. $25x + 30 = 50$
  11. $5r + 15 = 240$
  12. $5x + 6(4x - 17) = 14$
  13. $2(x + 5) - 7 = 3(x - 2)$
  14. $2x + 30 = 56$
  15. $\dfrac{3}{x} - \dfrac{3}{4x} = \dfrac{21}{8}$

- Solve each inequality.

  1. $4 - 2a \leq 36$
  2. $6x - 7 \leq 4 - 2x$
  3. $-7a \leq 21$
  4. $3x + 2 \leq 8$
  5. $-3x + 5 \leq -16$
  6. $-3(4y - 8) \leq 5(2y - 4)$
  7. $4(x + 2) \geq -2$
  8. $10x + 5 < 12 - 18x$
  9. $-4b \leq 16$

  10. $3(x + 3) \leq 5(x - 1)$
  11. $3x + 6 \leq 18$
  12. $-10x \geq 30$
  13. $4k + 3 < 10$
  14. $4x - 12 < 48$
  15. $|x| \leq 2$
  16. $|3 + x| < 7$
  17. $|5x - 3| \geq 13$
  18. $|12t + 9| - 64 < 1$

19. $|3x + 4| < 5$

20. $|x + 2| \leq 4$

21. $|6x + 4| \geq 8$

22. $2 \cdot |4x + 2| < 12$

23. $|s| \leq 10$

24. $|7a + 5| < 21$

25. $\left|x - \frac{2}{3}\right| > 4$

26. $|4x + 6| \leq 18$

27. $|x| > 5$

28. $|5x + 3| \geq 11$

29. $|x + 5| > 15$

- Find the x-intercepts and y-intercepts of the graph of each equation.

1. $5x + 10y = 50$

2. $3x + 5y = 15$

3. $10x - 4y = 20$

4. $2x + 6y = 18$

5. $5x + 4y = 20$

6. $5x + 3y = 30$

7. $y = 5x - 2$

8. $y = -2x + 4$

9. $6x + 2y = 12$

10. $9x + 4y = 18$

11. $x - 2y = 1$

- Find an equation of the line satisfying the given conditions.

1. Find an equation of the line that passes through $(5, 10)$ and $(-3, 6)$.

2. Find an equation of the line that passes through $(5, 7)$ and $(8, -10)$.

3. Find an equation of the line that passes through $(3, 4)$ and $(5, 1)$.

4. Find an equation of the line that passes through $(2, 4)$ and $(5, 5)$.

5. Find an equation of the line that passes through $(3, 5)$ and $(0, 2)$.

6. Find an equation of the line with slope $m = 6$ that passes through the point $(12, 6)$.

7. Find an equation of the line with slope $m = 4$ that passes through the point $(4, 3)$.

8. Find an equation of the line with undefined slope that passes through the point $(4, 3)$.

9. Find an equation of the line with slope $m = -4$ that passes through the point $(12, 3)$.

10. Find an equation of the line with slope $m = 2$ that passes through the point $(3, 6)$.

11. Find an equation of the line with undefined slope that passes through the point $(3, 4)$.

12. Find an equation of the line with slope $m = 0$ that passes through the point $(2, 5)$.

13. Find an equation of the line with slope $m = \frac{1}{3}$ that passes through the point $(6, 4)$.

14. Find an equation of the line that passes through the point $(2, -4)$ and is parallel to $3x + 2y = 6$.

15. Find an equation of the line that passes through the point $(0, 3)$ and is perpendicular to $2x + y = 6$.

- Find all real solutions to each equation.

1. $(x + 5)(x - 7) = 0$

2. $(x - 2)(4x + 8) = 0$

3. $(x + 7)(x - 14) = 0$

4. $(x - 8)(4x + 12) = 0$

5. $2x^2 - 8x - 24 = 0$

6. $4x^2 - 25 = 0$

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

8. $x^2 + 4x = 96$

9. $x^2 - 5x + 6 = 0$

10. $x^2 = 3x + 4$

11. $16x^2 - 81 = 0$

12. $r^2 - 16 = 0$

13. $8x^2 + 4x + 10 = 0$

- Solve each inequality.

1. $x^2 + x \leq 3$

2. $\dfrac{2x + 10}{x + 3} \geq 1$

3. $x^3 - 16x \geq 0$

4. $(x + 7)(6x - 12) \leq 0$

5. $x^2 + 9x > -14$

6. $(x - 5)(x + 4) \leq 0$

7. $x^2 + 11x + 18 \geq 0$

8. $x^2 - 24x > 0$

9. $x^2 - 3x \geq -2$

10. $x^2 - x - 6 < 0$

11. $x^2 + x - 20 \leq 0$

12. $x^2 + 2x - 8 \geq 0$

- Evaluate each given function at the given values.

1. Let $f(x) = x^5$. FInd $f(0)$, $f(-1)$, and $f(2)$.

2. Let $f(x) = 4x^2 + 2x$. Find $f(1)$, $f(2)$, and $f(-3)$.

3. Let $f(x) = x^2 + 4x$. Find $f(3)$ and $f(4)$.

4. Let $f(x) = \sqrt{x + 2}$. Find $f(7)$, $f(5)$, and $f(-11)$.

5. Let $f(x) = |7x - 9|$. Find $f(3)$, $f(-2.5)$, and $f(4.6)$.

6. Let $g(x) = 2x^2 - 4x + 6$. Find $g(4)$.

- Sketch the graph of each function by plotting a few points.

1. $f(x) = 2x + 4$

2. $f(x) = 6x + 8$

3. $f(x) = 6 - 2x^2$

4. $f(x) = |x + 2| + 1$

5. $f(x) = \begin{cases} 2x + 3 & \text{if } x < 0 \\ 3 - x & \text{if } x \geq 0 \end{cases}$

6. $f(x) = \begin{cases} x + 2 & \text{if } x < 3 \\ -3x - 2 & \text{if } x \geq 3 \end{cases}$

- Find the x-intercepts and y-intercepts of each function.

1. $f(x) = x^2 - 16$

2. $f(x) = 2x^2 + 8x + 6$

3. $f(x) = x^2 - 5x + 3$

4. $f(x) = x^2 - 9$

5. $f(x) = 3x^2 + 12x + 9$

- Find the vertex of each quadratic function.

1. $g(x) = x^2 - 9x + 18$

2. $f(x) = 3x^2 - 12x + 5$

- Solve each polynomial or rational inequality.

  1. $f(x) = (x+3)(x+4)(x-2) < 0$
  2. $f(x) = (2x+4)(x-2)(x-1) \geq 0$
  3. $f(x) = (x+1)(x-5)(x-2) > 0$
  4. $f(x) = (x+2)(x-1)^2(x-4) \leq 0$
  5. $f(x) = (x+4)(x-2)(x-3) < 0$
  6. $f(x) = x^2(x+4)(x+1) > 0$
  7. $f(x) = (3x+2)(x-2)^2 \geq 0$
  8. $f(x) = (x-7)(x+4)(x+8) < 0$

  9. $f(x) = (3x+4)(x-2)(x+3) \leq 0$
  10. $\dfrac{x+1}{x-7} > 2$
  11. $\dfrac{(x+1)(x-4)}{(x+3)(x-3)} \leq 0$
  12. $\dfrac{x-2}{x^2-64} < 0$
  13. $\dfrac{x^2+6x+8}{x^2-5x-24} \geq 0$

- For each function, find the specified values of the function.

  1. Let $f(x) = 3^x$. Find $f(0)$ and $f(1)$.
  2. Let $f(x) = 2^x$. Find $f(0)$ and $f(1)$.
  3. Let $f(x) = 4^x$. Find $f(2)$ and $f(-1)$.
  4. Let $f(x) = 3^{-x}$. Find $f(2)$ and $f(4)$.
  5. Let $f(x) = 7^x$. Find $f(0)$ and $f(1)$.
  6. Let $g(x) = (0.5)^x$. Find $g(0)$ and $g(1)$.
  7. Let $f(x) = 8^x$. Find $f(1)$ and $f(-2)$.
  8. Let $f(x) = 5^x$. Find $f(0)$ and $f(1)$.
  9. Let $f(x) = (2.5)^x$. Find $f(0)$ and $f(1)$.
  10. Let $f(x) = (0.3)^x$. Find $f(0)$ and $f(1)$.
  11. Let $f(x) = 3^{0.5x}$. Find $f(0)$ and $f(1)$.
  12. Let $f(x) = 16^{x/2}$. Find $f(0)$ and $f(1)$.

- Translate each logarithmic statement into an equivalent exponential statement.

  1. $\log(100) = 2$
  2. $\log_6(216) = 3$
  3. $\log_5(25) = 2$
  4. $\log(100000) = 5$
  5. $\log(100) = 2$

  6. $\log_2(8) = 3$
  7. $\log_6(1296) = 4$
  8. $\log(10000) = 4$
  9. $\log_2(\frac{1}{16}) = -4$
  10. $\log_4(64) = 3$

- Evaluate each expression.

  1. $\log_7(49)$
  2. $\log_5(\frac{1}{25})$
  3. $\log_8(\frac{1}{2})$

  4. $\log(.001)$
  5. $\ln(\sqrt{e})$
  6. $\log_7(7^{3.84})$

- Solve each equation. You may round answers to 3 decimal places.

  1. $\ln(x+5) = \ln(2x-15)$
  2. $e^{-2x} = 10$
  3. $\ln(2x+6) = \ln(x+12)$
  4. $4^{x+2} = 16$
  5. $\log_7(70x-7) = 3$

  6. $4^{3x-8} = 64$
  7. $\ln(x+2) = \ln(2x-3)$
  8. $5^{x-1} = 25$
  9. $\log_3(5x-1) = \log_3(x+7)$
  10. $10^{1-x} = 10^4$

11. $\log_4(6x - 2) = 3$

12. $25^x = 625$

13. $\ln(2x + 5) = 1 + \ln(x - 2)$

14. $4^{-2x} = 10^{x-1}$

15. $\ln(x - 7) = \ln(5x + 11)$

16. $7^x = 5$

17. $\ln(6x + 3) = \ln(3) + \ln(x + 4)$

18. $4^x = 9$

19. $\log_2(3x - 1) = 2$

20. $\left(\dfrac{2}{3}\right)^x = \dfrac{9}{4}$

21. $\ln(x + 4) = \ln(3x + 1)$

22. $3^{x+5} = 17$

23. $\log_8(x + 4) = 2 - \log_8(2x)$

24. $12^{x-2} = 144$

25. $\ln(8x + 2) = \ln(3x - 5)$

26. $9^{2-x} = 81^{x+4}$

- Write each expression with a rational exponent as a radical expression.

  1. $x^{1/2}$
  2. $x^{1/4}$
  3. $x^{2/3}$

  4. $x^{-4/3}$
  5. $x^{5/2}$
  6. $x^{-1/3}$

- Match each radical expression in the left column to the equivalent expression with rational exponents in the right column.

  1. $\dfrac{3}{\sqrt[3]{x}}$

  2. $\sqrt[3]{3x}$

  3. $3\sqrt[3]{x}$

  4. $\dfrac{1}{\sqrt[3]{3x}}$

  5. $\dfrac{-3}{\sqrt[3]{x}}$

  6. $\sqrt[3]{-3x}$

  7. $\dfrac{1}{\sqrt[3]{-3x}}$

  8. $-3\sqrt[3]{x}$

  (a) $(-3x)^{1/3}$

  (b) $(-3x)^{-1/3}$

  (c) $3x^{1/3}$

  (d) $(3x)^{1/3}$

  (e) $-3x^{-1/3}$

  (f) $-3x^{1/3}$

  (g) $(3x)^{-1/3}$

  (h) $3x^{-1/3}$

- Solve each system of equations.

  1.
  $$x + 2y = 6$$
  $$4x - 3y = 3$$

  3.
  $$2x + y = 6$$
  $$x + 3y = 9$$

  2.
  $$3x + y + z = 9$$
  $$7y - 11z = -51$$
  $$-34z = -156$$

  4.
  $$8x + 7y + z = 15$$
  $$4y - 3z = 6.5$$
  $$2z = 1$$

5.
$$2x + 3y = 15$$
$$x - 3y = 3$$

6.
$$2x - y + z = 3$$
$$5x + 2y - 3z = 1$$
$$2x + y - z = 2$$

7.
$$2x - 11y = 8$$
$$4x + y = 16$$

8.
$$x + 5y + 5z = 5$$
$$2x - y + 2z = 4$$
$$-x - 2y - 4z = 6$$

9.
$$3x - 2y = 12$$
$$x + 3y = 16$$

10.
$$3x + 5y - z = 11$$
$$x - 3y + z = -3$$
$$5x + y - 2z = 5$$

11.
$$2x - 4y = 9$$
$$x - y = 3$$

12.
$$3x + 4y - 2z = 4$$
$$-x + 2y + 3z = 8$$
$$6x + 10y + 6z = 7$$

13.
$$5x - 3y = 16$$
$$-2x - 4y = 4$$

14.
$$x + y + 2z = 8$$
$$-x + 2y + 3z = 1$$
$$3x - 7y - 10z = 10$$

15.
$$2x + 4y = 8$$
$$3x - 6y = 12$$

16.
$$x + 2y + z = 4$$
$$2x + y + z = 6$$
$$4x + 6y + 2z = 8$$

17.
$$x + y = 7$$
$$x + 2y = 11$$

18.
$$4x + 2y - 2z = 10$$
$$2x + 8y + 4z = 32$$
$$30x + 12y - 4z = 24$$

19.
$$3x + y = 7$$
$$x + 2y = 4$$

20.
$$2x + 3y + 4z = 12$$
$$x + 4y + 6z = 9$$
$$x - 2y + 4z = 12$$

21.
$$5x - 2y = 1$$
$$x - 6y = 3$$

22.
$$2x + 7y + z = 2$$
$$4x + 7y + 2z = 1$$
$$2x + 7y + 3z = 4$$

23.
$$2x - 3y = 12$$
$$-4x + 6y = 15$$

- Answer each of the following problems.

   1. Susie needs to rent a car. The Renta car company rents cars with a cost of $12 per day plus a $30 insurance fee. First, find an expression for the total cost of renting the car for x days. Then, if Susie needed the car for 10 days, find the total cost that she would have to pay.

2. It is found that at Little General, the distance you can travel on x dollars worth of gas is given by $y = 8x$, where y is the total distance in miles. How much will it cost to get enough gas to travel 120 miles?

3. A fundraiser is selling t-shirts. The profit in dollars is modeled by the function

$$P(x) = \begin{cases} x + 7 & \text{if } 0 \le x < 50 \\ x + 9 & \text{if } 50 \le x < 100 \\ x + 12 & \text{if } x \ge 100 \end{cases}$$

   where x is the number of t-shirts sold. Find the profits from selling 23 t-shirts, 74 t-shirts, and 109 t-shirts.

4. Suppose the supply curve for radial tires in dollars is given by $p = \dfrac{2}{5}q$ and the demand curve is given by $p = 100 - \dfrac{2}{5}q$. Find the equilibrium quantity and price.

5. Suppose you deposit $700 in a savings account with an interest rate of 3% compounded quarterly. How much is in the account after 2 years, after 7 years, and after 16 years?

6. In assembly line operations, it is found that a worker who is new to the job will produce $P(t)$ items on day t, where $P(t) = 50 - 50e^{-.5t}$. How many items will be produced on the first day? How many items will be produced on the fifth day? According to the function, what is the maximum number of items the worker can produce?

7. Suppose you owe $3500 on a credit card. To pay it off, you don't make any new purchases on it and each month you make a payment that is slightly more than the monthly interest, so that the remaining balance on the card after t months is given by $B(t) = 3500(.9898)^t$. What is the balance after 3 months? What is the balance after 6 years? What is the balance after 11 years?

8. You place $10,000 into an account that compounds interest continuously at an annual interest rate of 5%. How long will it take until the account has $20,000?

9. A $1000 investment is made with an annual interest rate of 12% compounded monthly. How long until you reach $2000?

10. A party store has a total of 300 balloons for sale. Large balloons are sold for $5 and small balloons are sold for $3. The total revenue from selling all the balloons is $1220. How many large and small balloons were sold?