

# Math 11100 Exam Jam

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## 1 Linear Inequalities and Absolute Value Equations

1. Solve the following expressions.

a.  $|y + 2| - 1 = 10$

b.  $|2x - 1| \geq 7$

c.  $|x + 5| - 6 \leq -1$

2. Solve and graph the solutions for the following inequalities. Also write the solutions in interval notation.

a.  $4 - 3x \geq 10$  **or**  $5x - 2 > 13$

b.  $7x + 4 \geq -17$  **and**  $6x + 5 \geq -7$

## 2 Linear Equations, Graphing and Solving Systems of Equations

3. Find the equation of the line through  $(-5, -2)$  that is perpendicular to  $-5x - 2y = 27$ . Write the equation in slope-intercept form.

4. Find the equation of the line that goes through  $(-3, 7)$  and  $(2, -1)$  and write it in standard form.

5. a. Solve the following system of equations.

b. Is the system consistent or inconsistent? Are the equations dependent or independent?

$$\begin{cases} 9x + 5y = -19 \\ 4x - 3y = 2 \end{cases}$$

6. a. Solve the following system of equations.  
b. Is the system consistent or inconsistent? Are the equations dependent or independent?

$$\begin{cases} 2x - 7y = -20 \\ -6x + 21y = 15 \end{cases}$$

7. Solve each problem.

- a. Heather paid \$16 for her phone. Her monthly service fee is \$40. Formulate a linear function to model the cost,  $C(t)$ , for  $t$  months of service, and determine the amount of time required for the total cost to reach \$560.
- b. Rosanna walks 2 mph slower than Simone. In the time it takes Simone to walk 8 mi, Rosanna walks 5 mi. Find the speed of each person.
- c. A well and a spring are filling a swimming pool. Together they can fill the pool in three hours. The well working alone can fill the pool in 8 hours less time than the spring. How long will the spring take working alone to fill the pool?

8. Find the domain.

- a.  $f(x) = \sqrt{4 - 9x}$
- b.  $f(x) = \frac{x^3 - x^2 + x + 2}{x^2 + 12x + 35}$

9. Solve.

- a. Two solutions, one with a concentration of 25% alcohol and another with a concentration of 35% alcohol, are mixed together to form 20 gallons of solution. How many gallons of each should be mixed together if the result is to have a concentration of 32% alcohol?
- b. Paint Town sold 45 paintbrushes, one type at \$8.50 each and another type at \$9.75 each. In all, \$398.75 was taken in for the brushes. How many of each type were sold?
- c. A cruise boat travels 72 miles downstream in 4 hours and returns to its starting point upstream in 6 hours. Find the speed of the river.

### 3 Polynomials and Rational Expressions

10. a. Simplify  $\frac{(3x^5y^{-3})^{-4}}{9xy^2}$ .  
b. Multiply  $(3x - 7y)^2$ .  
c. Divide  $\frac{x^2 + 3x - 10}{x + 5}$ .

11. Factor the following expressions.

- a.  $64x^9y^9 + 24x^2y^6$   
b.  $m^3 + 4m^2 - 6m - 24$   
c.  $8x^2 - 6x - 9$   
d.  $16x^2 - 81$   
e.  $8c^3 + 125$   
f.  $x^2 + 6x + 9 - 4y^2$

12. Solve the following equations.

- a.  $2k^2 = 9k - 9$   
b.  $\frac{3}{k+2} - \frac{2}{k^2-4} = \frac{1}{k-2}$

13. Simplify the following expressions.

- a.  $\frac{m^2 - 49}{m + 1} \div \frac{7 - m}{m}$   
b.  $\frac{5x}{x^2 + xy - 2y^2} - \frac{3x}{x^2 + 5xy - 6y^2}$   
c.  $\frac{\frac{xy}{x^2 - 16y^2}}{\frac{1}{y} - \frac{4}{x}}$   
d.  $\frac{(a + b)}{\frac{a}{ab} - \frac{b}{a^2}}$

## 4 Radical Expressions and Rational Numbers as Exponents

14. Simplify the following expressions.

- $\sqrt[5]{s^3} \cdot \sqrt[4]{s}$ , write the answer in radical notation.
- $\sqrt{108}$
- $-\sqrt[3]{-125a^6b^9c^{12}}$
- $3x\sqrt[3]{xy^2} - 2\sqrt[3]{8x^4y^2}$
- $\sqrt{x^2 - 4x + 4}$ , assume that all variables represent positive numbers.

15. Rationalize the denominator for the following expressions.

- $\frac{\sqrt{2} - \sqrt{3}}{\sqrt{6} - \sqrt{5}}$
- $\frac{\sqrt{a}}{\sqrt{a} + \sqrt{b}}$

16. Multiply.

- $(3\sqrt{7} + 2\sqrt{5})(2\sqrt{7} - 4\sqrt{5})$
- $(\sqrt{3} - \sqrt{2})^2$

17. Solve the following equations.

- $\sqrt[3]{x - 8} + 3 = 0$
- $5 = \sqrt{7x - 3}$
- $(2w - 1)^{2/3} - w^{1/3} = 0$

## 5 Quadratic Equations and Functions

18. Solve the following equations.

- $(t + 5)^2 = 48$
- $y^2 - 14y + 49 = 4$

19. Find the value of  $c$  such that  $9x^2 - 30x + c = 0$  has exactly one solution.
20. For the quadratic function,  $f(x) = -2x^2 - 2x + 3$ , find the following:
- The vertex
  - The line of symmetry
  - The maximum or minimum value
  - The x-intercepts
  - The y-intercepts
  - The graph of the function
21. A club swimming pool is 30 feet long. The area of the pool is  $1200 \text{ ft}^2$ . The club members want a paved walkway in a strip of uniform width around the pool. They have enough material to cover  $296 \text{ ft}^2$ . How wide can the strip be?

## 6 The Algebra of Functions, Composite Functions and Inverse Functions

22. Simplify as much as possible.

- Find  $\frac{f}{g}$  if  $f(x) = \frac{x^2 - 16}{x^2 - 10x + 25}$  and  $g(x) = \frac{3x - 12}{x^2 - 3x - 10}$ .
- Find  $(f - g)(x)$  if  $f(x) = \frac{5ab}{a^2 - b^2}$  and  $g(x) = \frac{a - b}{a + b}$ .
- Find  $(f \cdot g)(-3)$  if  $f(x) = \frac{3x}{6x^2 - 13x - 5}$  and  $g(x) = 4x - 10$ .

23. Determine whether or not  $g(x) = \sqrt{x - 3}$  is one-to-one and, if possible, find  $g^{-1}$ .

24. Find  $(f \circ g)(x)$  and  $(g \circ f)(x)$  given  $f(x) = 4x^2 - 1$  and  $g(x) = \frac{2}{x}$ .

## 7 Complex Numbers and Fractions

25. Simplify  $\frac{4+3i}{5+3i}$ . Write your answer in the form  $a+bi$ .

26. Multiply  $2i(-4-i)^2$ .

27. Simplify.

a.  $i^{42}$

b.  $i^{17}$

## 8 Logarithmic and Exponential Functions

28. Solve the following equations.

a.  $16^{2x+1} = 64^{x+3}$

b.  $\log_4(2x+4) = 3$

c.  $2^{x+3} = 5^x$

d.  $\log_2(x) + \log_2(x-7) = 3$

29. Rewrite the following expression as a single logarithm.

$$3 \log_p(x) + \frac{1}{2} \log_p(y) - \frac{3}{2} \log_p(z)$$

30. Change the base of the following logarithms and estimate them to four decimal places.

a.  $\log_\pi(e)$

b.  $3 \log_6 2.75$

31. Graph.

a.  $y = \left(\frac{2}{3}\right)^x$

b.  $y = \log_2 x$

32. Solve the following problems using the interest formulas.

Compound Interest Formula:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

Continuous Compound Interest Formula:

$$A = Pe^{rt}$$

- a. What will be the amount  $A$  in an account with an initial principal of \$4000 if interest is compounded continuously at a rate of 3.5% for 6 years? Also, how long does it take for the account to double?
- b. A college loan of \$29,000 is made at 3% interest compounded annually. After  $t$  years, the amount,  $A$ , due is given by the function  $A(t) = 29,000(1.03)^t$ . If no payments are made, how long will it take for the amount due to reach \$35,000?