Math 11100 Exam Jam Solutions

Contents

1 Linear Inequalities and Absolute Value Equations 2
2 Linear Equations, Graphing and Solving Systems of Equations 4
3 Polynomials and Rational Expressions 12
4 Radical Expressions and Rational Numbers as Exponents 16
5 Quadratic Equations and Functions 20
6 The Algebra of Functions, Composite Functions and Inverse Functions 24
7 Complex Numbers and Fractions 27
8 Logarithmic and Exponential Functions 30
1 Linear Inequalities and Absolute Value Equations

Solve the following expressions.

a. \(|y + 2| - 1 = 10\)

b. \(|2x - 1| \geq 7\)

c. \(|x + 5| - 6 \leq -1\)
Solve and graph the solutions for the following problems. 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

Find the equation of the line through \((-5, -2)\) that is perpendicular to \(-5x - 2y = 27\). Write the equation in slope-intercept form.
Find the equation of the line that goes through $(-3, 7)$ and $(2, -1)$ and write it in standard form.
(a.) Solve the following system of equations.

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

(b.) Is the system consistent or inconsistent? Are the equations dependent or independent?
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?
Find the domain.

a. \( f(x) = \sqrt{4 - 9x} \)

We know that the radicand of a square root must be positive. Since the radical expression is in
the numerator, the radicand can also be zero.

b. \( f(x) = \frac{x^3 - x^2 + x + 2}{x^2 + 12x + 35} \)
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 current.
3 Polynomials and Rational Expressions

a. Simplify \( \frac{(3x^5y^{-3})^{-4}}{9xy^2} \).

b. Multiply \((3x - 7y)^2\).

c. Divide \( \frac{x^2 + 3x - 10}{x + 5} \).
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. $x^2 + 6x + 9 - 4y^2$
Solve the following equations.

a. \(2k^2 = 9k - 9\)

b. \(\frac{3}{k+2} - \frac{2}{k^2-4} = \frac{1}{k-2}\)
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. \( \frac{x^2 - 16y^2}{x^2 - 4} \)

d. \( \frac{(a + b)}{ab} - \frac{b}{a^2} \)
4 Radical Expressions and Rational Numbers as Exponents

Simplify the following expressions.

a. $\sqrt[3]{s} \cdot \sqrt[5]{s}$, write the answer in radical notation.

b. $\sqrt{108}$

c. $-\sqrt[3]{-125a^8b^6c^{12}}$

d. $3x \sqrt[3]{xy^2} - 2 \sqrt[3]{8x^4y^2}$

e. $\sqrt{x^2 - 4x + 4}$, assume that all variables represent positive numbers.
Rational the denominator for the following expressions.

a. \( \frac{\sqrt{2} - \sqrt{3}}{\sqrt{6} - \sqrt{5}} \)

b. \( \frac{\sqrt{a}}{\sqrt{a} + \sqrt{b}} \)
Multiply.

a. \((3\sqrt{7} + 2\sqrt{5})(2\sqrt{7} - 4\sqrt{5})\)

b. \((\sqrt{3} - \sqrt{2})^2\)
Solve the following equations.

a. $\sqrt[3]{x} - 8 + 3 = 0$

b. $5 = \sqrt{7x} - 3$

c. $(2w - 1)^{2/3} - w^{1/3} = 0$
5 Quadratic Equations and Functions

Solve the following equations.

a. \((t + 5)^2 = 48\)

b. \(y^2 - 14y + 49 = 4\)
Find the value of $c$ such that $9x^2 - 30x + c = 0$ has exactly one solution.
For the quadratic function, $f(x) = -2x^2 - 2x + 3$, find the following:

a. The vertex
b. The line of symmetry
c. The maximum or minimum value
d. The x-intercepts
e. The y-intercept
f. Graph of the function
A club swimming pool is 30 feet long. The area of the pool is 1200 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 ft\(^2\). How wide can the strip be?
6 The Algebra of Functions, Composite Functions and Inverse Functions

Simplify as much as possible.

a. Find \( \frac{f}{g} \) if \( f(x) = \frac{x^2 - 16}{x^2 - 10x + 25} \) and \( g(x) = \frac{3x - 12}{x^2 - 3x - 10} \).

b. Find \( (f - g)(x) \) if \( f(x) = \frac{5ab}{a^2 - b^2} \) and \( g(x) = \frac{a - b}{a + b} \).

c. Find \( (f \cdot g)(-3) \) if \( f(x) = \frac{3x}{6x^2 - 13x - 5} \) and \( g(x) = 4x - 10 \).
Determine whether or not \( g(x) = \sqrt{x - 3} \) is one-to-one and, if possible, find \( g^{-1} \).
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

Simplify \( \frac{4 + 3i}{5 + 3i} \). Write your answer in the form \( a + bi \).
Multiply $2i(-4 - i)^2$. 
Simplify.

a. $i^{42}$

b. $i^{17}$
8 Logarithmic and Exponential Functions

Solve the following equations.

a. \(16^{2x+1} = 64^{x+3}\)

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

c. \(2^{x+3} = 5^{x}\)
d. \( \log_2(x) + \log_2(x - 7) = 3 \)
Rewrite the following expression as a single logarithm.

$$3 \log_p(x) + \frac{1}{2} \log_p(y) - \frac{3}{2} \log_p(z)$$
Change the base of the following logarithms and estimate them to four decimal places.

a. \( \log_{\pi}(e) \)

b. \( 3 \log_{6} 2.75 \)
Graph.

a. \( y = \left( \frac{2}{3} \right)^x \)
b. $y = \log_2 x$
Solve the following problems using the interest formulas.

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?