

# Basic Algebra Lab Manual

Cosumnes River College

Spring 2021





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# 1. EXPRESSIONS, RELATIONS, SUBSTITUTION

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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (4 points). Substitute the given expression for the variable. Use the parentheses and do not simplify the result.

(a) Substitute 13 for  $x$  in the expression

$$3x - x^2$$

(b) Substitute  $-2$  for  $y$  in the equation

$$4y - x = \frac{25}{y}$$

(c) Substitute  $x + y$  for  $a$  in the expression

$$\frac{1 - a}{a}$$

(d) Substitute  $x^2$  for  $u$  in the equation

$$u^2 - 7u - 3 = 0$$

**2** (4 points). Identify all the **terms** in the given expression; do not just state how many terms there are: state your answer as comma-separated list of terms.

(a)  $-6x + 4$

(b)  $4y - 2(x + y) + 1$

(c)  $\frac{1}{3}xy$

(d)  $x - (1 + x^2)$

**3** (4 points). Identify all the **factors** in the given expression; do not just state how many factors there are: state your answer as a comma-separated list of factors.

(a)  $8x$

(b)  $-2xy^2$

(c)  $\frac{1}{2} - b$

(d)  $-4(x + 1)(x - 1)$

## 2. AXIOMS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

**1** (4 points). Use the distributivity to rewrite the expression without parentheses:

(a)  $13(x + 2)$

(b)  $a(3x + b + 1)$

(c)  $\frac{1}{2}(6 + 10y)$

(d)  $5f(2 + 3f)$

**2** (5 points). Use the distributivity to rewrite the expression as a product with two or more factors:

(a)  $7x + 7y$

(b)  $4x + xy$

(c)  $20x + 20xz^2 + 20$

(d)  $4x + 8y + 16z$

(e)  $6ab + abc$

**3** (4 points). Simplify the expression by appealing to the axioms:

(a)  $(7 + x) + 3$

(b)  $\frac{1}{3}(a + 3b)$



### 3. NUMBER LINE & SETS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (1 point). Find the value of the expression:

$$-4 - (-9)$$

2 (1 point). Find the value of the expression:

$$10 + (-3) - 8$$

3 (1 point). Find the value of the expression:

$$-2 + (-3) - (-7) - 1$$

4 (1 point). Find the value of the expression if  $x = -4$ :

$$3 - x$$

5 (1 point). Find the value of the expression if  $y = -2$ :

$$y - 6 - (-y)$$

6 (1 point). List all elements of the given set using the roster notation:

$$\{y \mid y \text{ is a non-negative integer and } y \leq 4\}$$

7 (1 point). List at least five elements of the given set using the roster notation:

$$\{3k + 1 \mid k \text{ is a positive integer}\}$$

8 (1 point). List at least five elements of the given set using the roster notation:

$$\{x^2 + x \mid x \text{ is a negative integer}\}$$

9 (4 points). Determine whether the inequality is true or false:

(a)  $-0.4 \leq -0.4$

(c)  $.13 < \frac{17}{100}$

(b)  $-13 \geq 0.5$

(d)  $-20 > -2$

## 4. ORDER OF OPERATIONS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (1 point). Simplify the expression:

$$(-6)(-0.2)(-7)(-10)$$

2 (1 point). Simplify the expression:

$$(-3)^4 - 2^4$$

3 (1 point). Simplify the expression:

$$4m - 9n - 3(2m - n)$$

4 (1 point). Simplify the expression:

$$a(11 - a) - 5(a + 6)$$

5 (1 point). Simplify the expression

$$\frac{1 - 5^2}{4 + |7 - 9|}$$

6 (1 point). Evaluate the expression if  $x = 3$

$$\frac{x + 4}{(x - 4)^3}$$

7 (1 point). Evaluate the expression if  $a = -2$

$$|1 - a^2| + a^3$$

8 (1 point). Evaluate the expression if  $x = -3$  and  $y = 2$

$$\frac{xy - x^2}{y - 5}$$

## 5. PRIMES & FRACTIONS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (2 points). Write the number as a product of prime factors:

(a) 52

(b) 220

2 (2 points). Rewrite the fraction in lowest terms:

(a)  $\frac{88}{96}$

(b)  $-\frac{242}{110}$

3 (2 points). Rewrite the given fraction with denominator 60:

(a)  $\frac{13}{15}$

(b)  $\frac{-3xy^2}{20}$

4 (3 points). Identify all the the factors in the expression by thinking of it as a product of numbers and reciprocals:

(a)  $\frac{-5a}{b}$

(b)  $\frac{a+b}{x-y+1}$

(c)  $\frac{3x(x-7)}{a^2(a+1)}$

5 (2 points). Simplify the expression and state the answer as a single fraction in lowest terms:

(a)  $\frac{10}{9} \cdot \frac{12}{25}$

(b)  $\frac{6}{21} \div \frac{20}{9}$

6 (2 points). Simplify the expression assuming that all variables are non-zero:

$$\frac{21xb}{14ax} \div \frac{9bx}{4yza}$$

7 (2 points). Simplify the expression assuming that all variables are non-zero:

$$(-5xy) \left( \frac{3a}{10x} \right) \left( \frac{-1}{6x} \right)$$

## 6. FRACTION ADDITION

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (3 points). Find the LCM for the given integers:

(a) 20, 35

(b) 6, 12, 30

(c) 14, 15, 16

2 (2 points). Simplify the expression:

(a)  $\frac{6}{7} + \frac{5}{3}$

(b)  $\frac{7}{6} - \frac{13}{15}$

3 (4 points). Simplify the expression:

(a)  $\frac{2}{3} - \frac{7}{6} \div \frac{3}{5}$

(b)  $\frac{1}{6}(2x - 8y) - \frac{1}{3}\left(\frac{5}{2}x - 6y\right)$

4 (1 point). Evaluate the expression when  $a = \frac{1}{2}$  and  $b = -\frac{2}{3}$

$4(a - ab)\left(\frac{1}{b}\right)$



## 7. TRANSLATION

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

**1** (6 points). Describe the variables used to represent the given quantities, and write the statements as algebraic relations.

(a) *Example:* A python is three times longer than an adder.

*Answer:*

$p$  and  $a$  are the lengths of the python and the adder respectively, in meters

$$p = 3a$$

(b) Alice makes 17 dollars per hour more at her full-time job than at her part-time job.

(c) The air near the tree tops is six °F colder than the air near the ground.

(d) The population of Capital City is one and a half times smaller than the population of Springfield.

2 (6 points). Solve applications by describing the variables used to represent the quantities of interest, and stating appropriate equations.

- (a) *Example:* Molly is taking 9 units worth of classes, and Nancy is taking 7 more units than Molly. How many units is Nancy taking?

*Answer:*

$m$  and  $n$  are the unit loads for Molly and Nancy respectively, in units

$$n = m + 7$$

$$n = (9) + 7 = 16$$

- (b) The height of the box is 180 mm, and the width of a box is 114 mm shorter than the height. Find the width of the box.

- (c) The volume of a pan is one cup smaller than the three times the volume of a teapot, which can hold 2.5 cups of liquid. Find the volume of the pan.

## 8. LINEAR EQUATIONS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (3 points). Solve the equation

$$8x - (3x - 5) = 5 - x$$

2 (3 points). Solve the equation

$$0.65x - 0.35(x - 7) = 0.3x$$

3 (3 points). Solve the equation

$$\frac{4x-5}{2} + 1 = 2x - \frac{3}{2}$$

4 (3 points). Solve the equation

$$\frac{1}{6}x - \frac{1}{2} = \frac{2}{3}(x - 12)$$

## 9. LINEAR APPS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

YOU WILL BE ASKED TO WRITE SOME EQUATIONS AND THEN SOLVE THEM. IT IS RECOMMENDED TO GO THROUGH THE LAB AND ANSWER QUESTIONS (A) AND (B) BEFORE SOLVING ANY OF THE EQUATIONS.

1 (4 points). Zelda took a bus and a train to school. Find how long each part of the trip took if she spent 13 minutes more on the train than on the bus, and the total duration of the trip was 55 minutes.

(a) Describe the variable(s) in words, give units.

(b) State the equation(s).

(c) Solve the equation(s) and state the answer.

**2** (4 points). The width of a rectangular lawn is 14 feet shorter than its length. Find the length and the width of the lawn if its perimeter is 236 feet.

(a) Describe the variable(s) in words, give units.

(b) State the equation(s).

(c) Solve the equation(s) and state the answer.

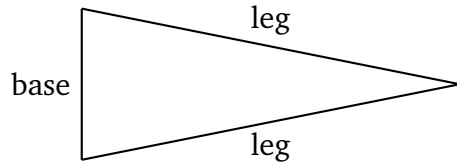
**3** (4 points). Vint is 1.2 times older than Welma, and at the same time Welma is 12 years younger than Vint. Find their ages.

(a) Describe the variable(s) in words, give units.

(b) State the equation(s).

(c) Solve the equation(s) and state the answer.

4 (4 points). The base of an isosceles triangle is three times shorter than either of the legs. Find the length of each side if the perimeter of the triangle is 6 cm.



(a) Describe the variable(s) in words, give units.

(b) State the equation(s).

(c) Solve the equation(s) and state the answer.



## 10. LINEAR FORMULAS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (2 points). Solve the formula for  $y$ :

$$6x - 2y = -1$$

2 (2 points). Solve the formula for  $z$ :

$$14x - 7z = 2(z - 5)$$

3 (2 points). Solve the formula for  $p$ :

$$\frac{mp}{t} = 5dx$$

4 (2 points). Solve the formula for  $x$ :

$$5ax + 8 = z - bx$$

## 11. PERCENT

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (1 point). 180 is 36% of what number?

2 (1 point). What is 15% of 150?

3 (1 point). 112 is what percent of 32?

4 (1 point). Alice leaves a \$3 tip for a meal that cost \$20 before the tip. What percent of the cost of the meal was the tip?

5 (1 point). Bob pays \$114 for a family meal, including the gratuity. What was the price of the meal before the 20% gratuity was added?

**6** (1 point). Charlie's salary increased by 5% in 2017. What is his new salary if he's made \$52000 in 2016?

**7** (1 point). Diane invested \$2435 into a savings account for one year, and after the interest was added, the new amount is \$2469.09. What was the percent increase? (This quantity is also known as the *simple interest rate*.)

**8** (1 point). Emily buys a dress from a 15% discount rack for \$46.75. What was the original price of the dress?

## 12. APPLICATIONS OF $w = rt$

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (6 points). Solve applications of  $w = rt$  by describing the variables and their units of measurement.

(a) The speed of sound in air is 343 meters per second. Find how far the sound travels in 20 seconds.

(b) While doing the homework, Claire solved 35 exercises in 50 minutes. Find Claire's rate of work in exercises per minute.

(c) Silvia's income from tips averages at 375 dollars per month. Find how much time is needed for Silvia to make 2100 dollars from tips.

YOU WILL BE ASKED TO WRITE SOME EQUATIONS AND THEN SOLVE THEM. IT IS RECOMMENDED TO GO THROUGH THE LAB AND ANSWER QUESTIONS (A) AND (B) BEFORE SOLVING ANY OF THE EQUATIONS.

**2** (6 points). Two cars started from the same point, at 5 am, traveling in opposite directions at 40 and 50 mph respectively. At what time will they be 450 miles apart?

(a) Describe the variable(s) in words, give units.

(b) State the equation(s).

(c) Solve the equation(s) and state the answer.

**3 (6 points).** Felix can run 3 times faster than he can walk. After running for one hour and then walking for three hours he covers the distance of 9 miles. Find his walking speed and his running speed.

(a) Describe the variable(s) in words, give units.

(b) State the equation(s).

(c) Solve the equation(s) and state the answer.

4 (6 points). Homer can mow the front lawn in 1 hour 30 minutes, and Bart works two times slower than Homer. Find how much time is needed for Bart and Homer to mow the lawn if they work together.

(a) Describe the variable(s) in words, give units.

(b) State the equation(s).

(c) Solve the equation(s) and state the answer.



# 13. INEQUALITIES

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (8 points). Describe the solution set for each of the following inequalities.

(a)  $x < 2$

Plot the solution set: \_\_\_\_\_▶

State the answer in the interval notation:

(b)  $x \geq -6$

Plot the solution set: \_\_\_\_\_▶

State the answer in the interval notation:

(c)  $x \leq 0$

Plot the solution set: \_\_\_\_\_▶

State the answer in the interval notation:

(d)  $x > -17$

Plot the solution set: \_\_\_\_\_▶

State the answer in the interval notation:

2 (3 points). Solve the inequality

$$x + 14 \leq -5(12 - x)$$

Plot the solution set: 

State the answer in the interval notation:

3 (3 points). Solve the inequality

$$-4x - 3 > \frac{5}{7}x + 1$$

Plot the solution set: 

State the answer in the interval notation:

THE FOLLOWING INEQUALITIES ARE ONLY MEANT TO BE SET UP  
**DO NOT SOLVE**

**4** (1 point). Gina wants to buy some plastic furniture for her outside patio: a table and as many chairs as she can afford. A table costs \$44.95 and each chair is \$16.95. If  $x$  denotes the number of chairs, write an inequality describing the number of chairs she can afford on a \$200 budget.

**5** (1 point). Howard needs an average score of 80 or higher on a series of 4 tests in order to advance at his job. He scores 75, 93, and 81 on the first 3 tests. If  $x$  represents Howard's score on the 4th test, write an inequality describing the test score which will allow him to advance.

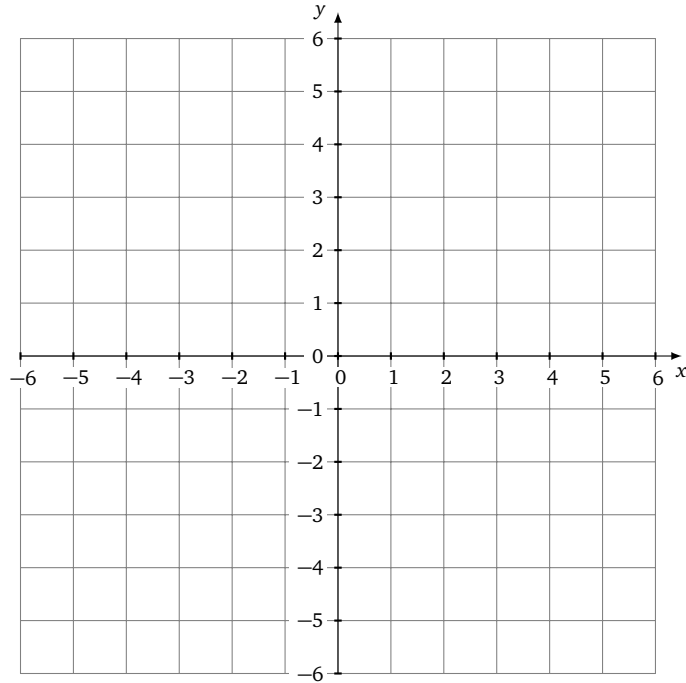
**6** (1 point). Side  $b$  of a triangle is 2 units longer than side  $a$ , while side  $c$  of the same triangle is 3 times shorter than side  $a$ . Write an inequality describing the length  $a$  if it is known that the perimeter of the triangle is less than 140 units.

# 14. COORDINATE PLANE

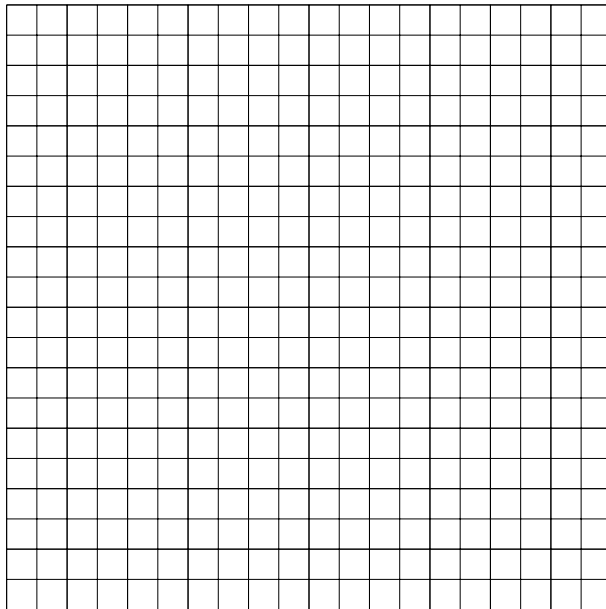
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (3 points). Plot and label the points  $A(3, 1)$ ,  $B(-3, 0)$ ,  $C(-4, 5)$ ,  $D(2, -4)$ , and  $E(0, 5)$



2 (3 points). Plot and label the points  $A(-400, 40)$ ,  $B(-300, 0)$ ,  $C(0, -20)$ ,  $D(200, 30)$ , and  $E(300, 0)$



3 (6 points). Consult the given graph and find

(a) all points with  $x$  coordinate 0

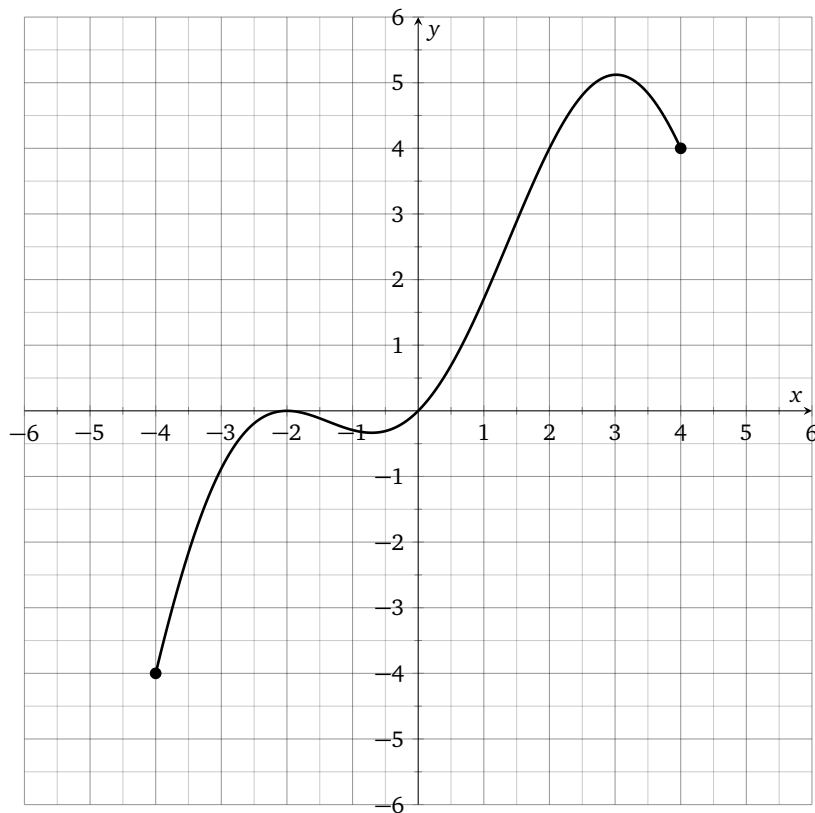
(b) all points with  $y$  coordinate 0

(c) all points with  $x$  coordinate 2

(d) all points with  $y$  coordinate 4

(e) all points with the lowest  $x$  coordinate

(f) the approximate coordinates of the point with the highest  $y$  coordinate



# 15. PLOTTING LINES

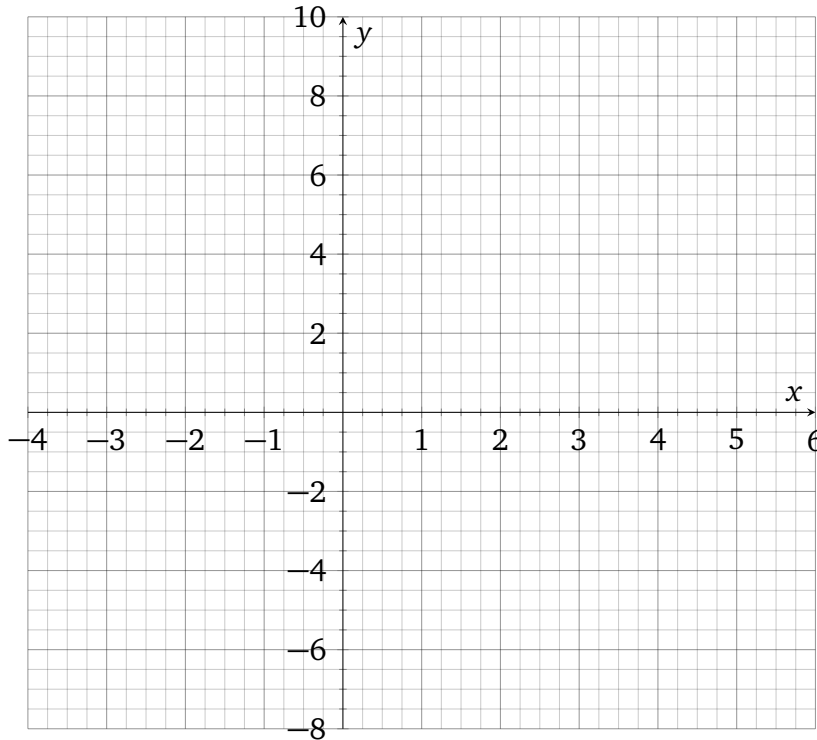
LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (4 points). Plot the line

$$y = -3x + 4$$

Find the coordinates of 2 distinct points of the line, and label these points on the graph.

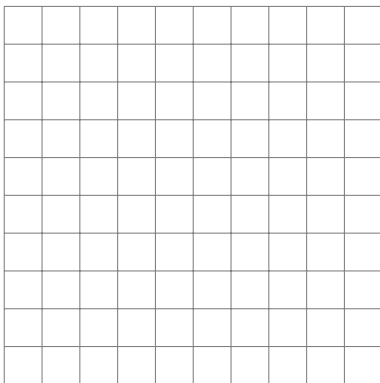


point A:

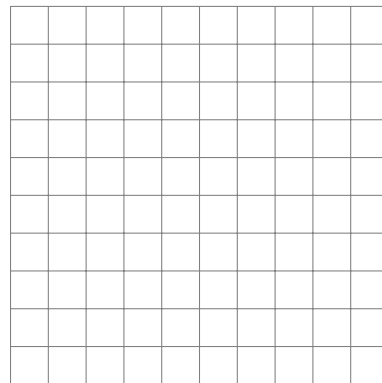
point B:

2 (2 points). Scale and label the axes; graph the solution set for the given equation.

(a)  $x = -0.02$



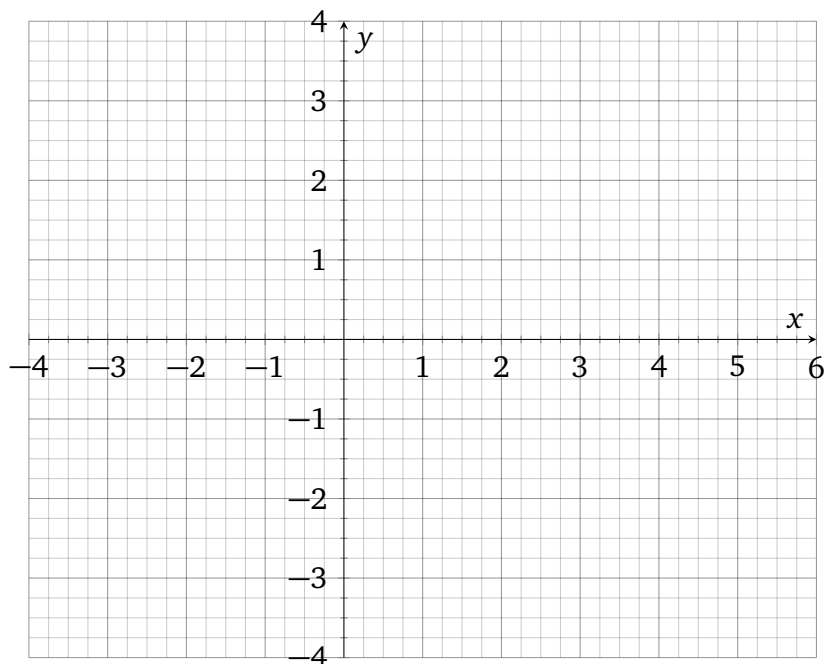
(b)  $300 - y = 50$



3 (4 points). Graph the linear equation

$$x - 2y = 2$$

Find the coordinates of 2 distinct points of the line, and label these points on the graph.



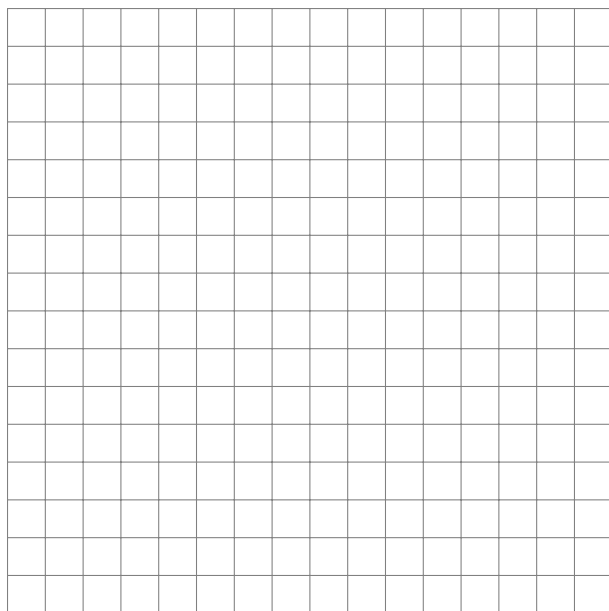
point A:

point B:

4 (4 points). Scale and label the axes; graph the linear equation

$$x = -3(2 + y)$$

Find the coordinates of 2 distinct points of the line, and label these points on the graph.



point A:

point B:



## 16. INTERCEPTS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (8 points). Find the intercepts without plotting the line.

(a)  $y = 3x - 6$

x-intercept:

y-intercept:

(b)  $6x - 5y = 60$

x-intercept:

y-intercept:

(c)  $2(x - y) = 2y - x$

x-intercept:

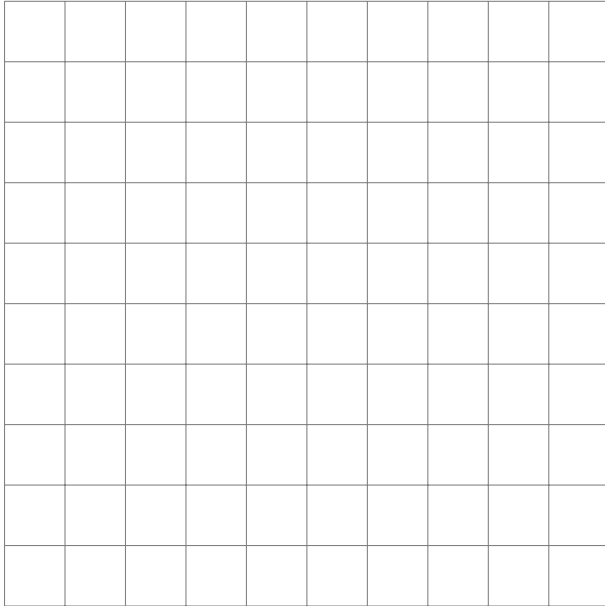
y-intercept:

(d)  $x + 3y = 4 + x$

x-intercept:

y-intercept:

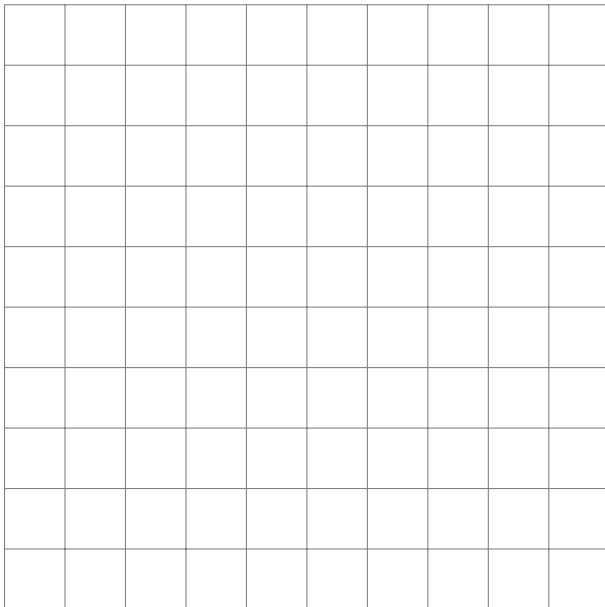
2 (4 points). Graph the linear equation  $25y = -4x - 400$ . Find and label the intercepts.



x-intercept:

y-intercept:

3 (4 points). Graph the linear equation  $14x = 7 + 70y$ . Find and label the intercepts.



x-intercept:

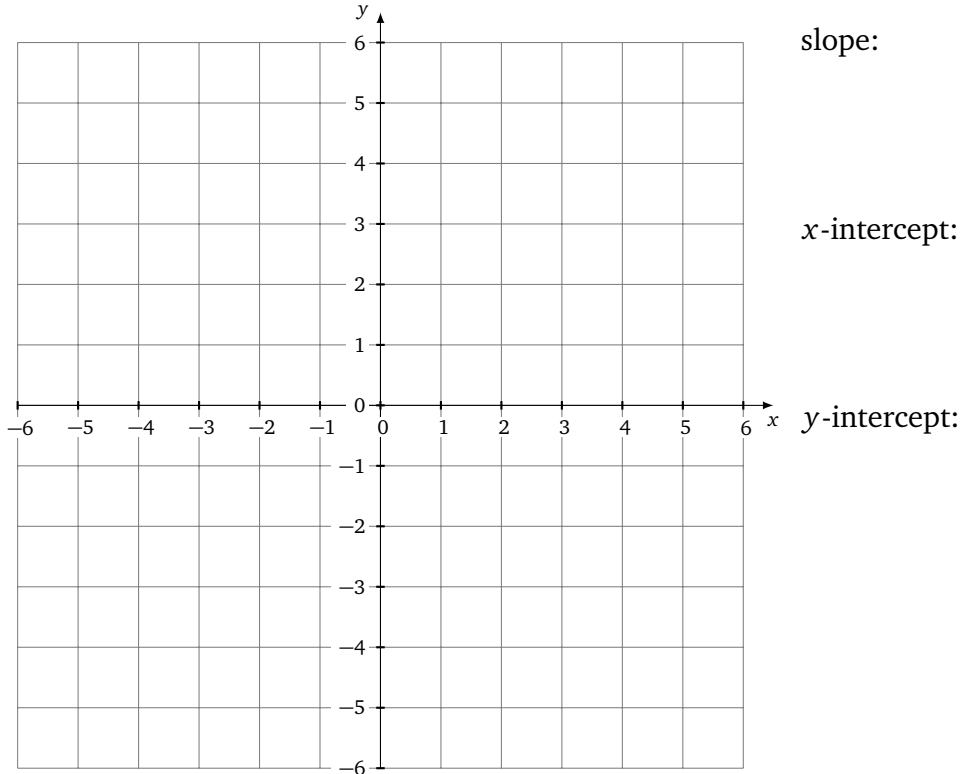
y-intercept:

# 17. SLOPE

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

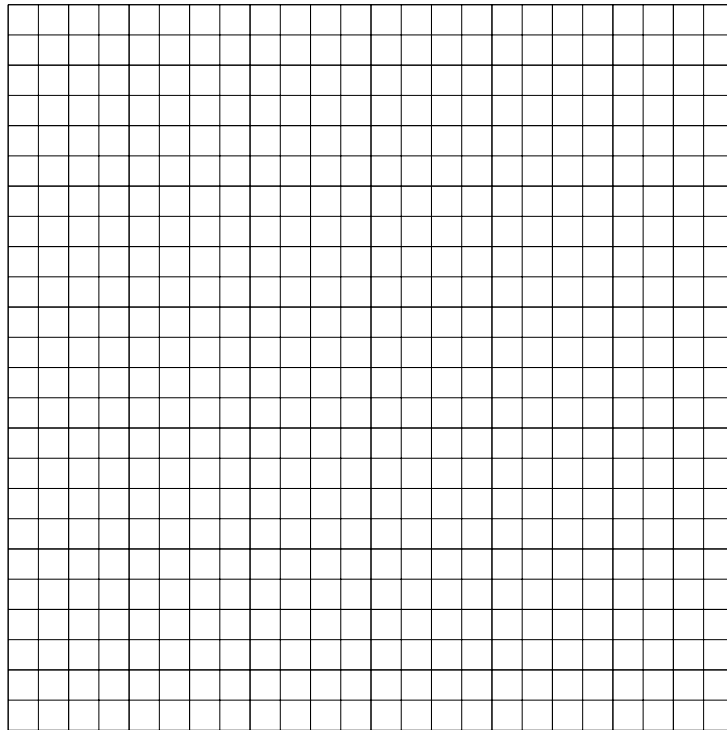
1 (4 points). Graph the linear equation  $-2x - 4y = 8$ . Find the slope and the intercepts.



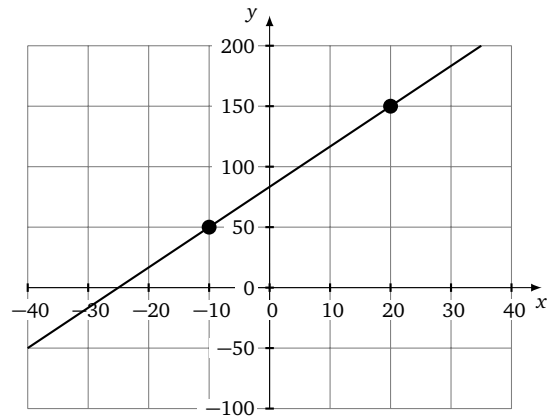
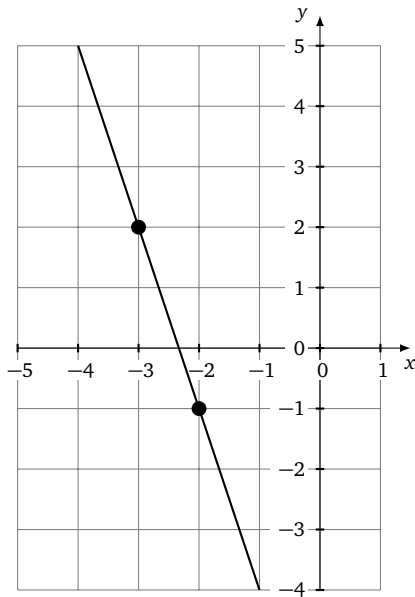
2 (1 point). Find the grade of the road which rises 1267.2 feet over the horizontal distance of 4 miles. (1 mile = 5280 feet)

3 (2 points). One hour after consuming a six-pack of beer, Charlie's Blood Alcohol Content (BAC) is 0.114%, and three hours after the consumption his BAC is 0.072%. Find the average rate of change of the BAC with respect to time, in percent per hour.

4 (4 points). Plot the line with slope  $-1/4$  and  $y$ -intercept  $(0, -3)$ .



5 (4 points). Find the slopes of the pictured lines.



## 18. SLOPE-INTERCEPT FORM

LAST NAME	FIRST NAME	DATE	CLASS
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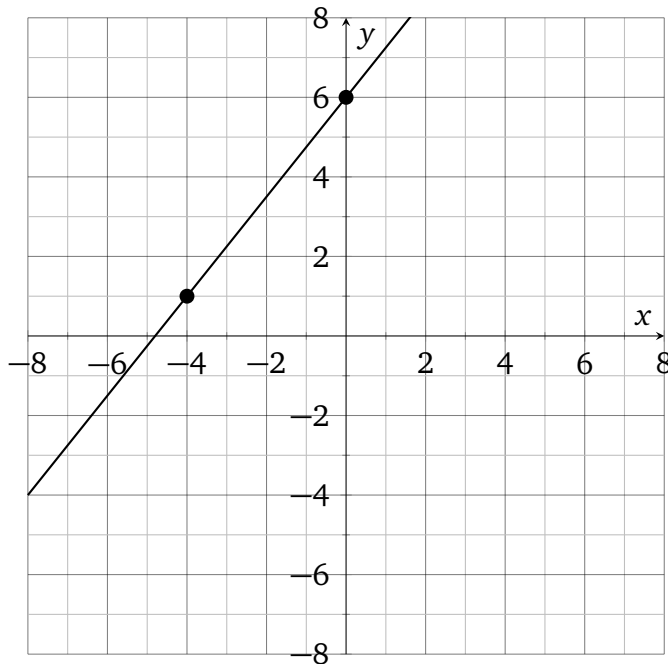
SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (6 points). Find the slope-intercept form for the given line. Determine slope and y-intercept.

(a)  $y - 4 = -(x + 7)$

(b)  $4x - \frac{y}{3} = 2$

2 (2 points). Determine the equation of the shown line and state it in the slope-intercept form.



3 (3 points). Are these lines parallel, perpendicular, or neither? Justify your answer by comparing slopes.

$$x + 3y = 6$$
$$y - 10 = \frac{1}{3}x$$

$$m_1 =$$

$$m_2 =$$

4 (3 points). Are these lines parallel, perpendicular, or neither? Justify your answer by comparing slopes.

$$4x - 5y = 0$$
$$14 = 4y + 5x$$

$$m_1 =$$

$$m_2 =$$

## 19. LINE EQUATIONS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (2 points). Find an equation of the line with the slope  $-17$  and  $y$ -intercept  $(0, 6)$ .

2 (2 points). Find an equation of the line with slope zero, passing through the point  $(3, 7)$ .

3 (2 points). Find an equation of the line passing through the points  $(2, 5)$  and  $(2, -10)$ .

4 (4 points). Find the slope of the line containing the points  $(-2, 1)$  and  $(-1, -2)$ .

(a) State the equation of this line in the **point-slope form**.

(b) State the equation of this line in the **slope-intercept form**.

5 (3 points). Find an equation of the line passing through the point  $(10, 9)$  and parallel to the line  $x + 3y = 42$ . [*Hint: their slopes are the same.*]

6 (3 points). Find an equation of the line passing through the point  $(0, -6)$  and perpendicular to the line  $2y = -\frac{1}{5}x - 28$ . [*Hint: their slopes are negative reciprocals of each other.*]



## 20. FUNCTIONS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

**1** (2 points). If  $f(x) = 1 - 3x^3$ , find  $f(-2)$ .

**2** (2 points). If  $g(x) = \frac{1-x}{2x-3}$ , find  $g(-3)$ .

**3** (2 points). If  $h(x) = 4x^2 + 1$ , find  $h(2) + h(3)$ .

4 (4 points). The population of the state of California was 33.9 million in 2000, and 37.3 million in 2010. Let  $x$  be the year since 2000 and let  $y(x)$  be the population in a corresponding year, in millions of people.

Year	$x$	$y(x)$
2000	0	33.9
2010	10	37.3

(a) Construct a linear model  $y(x)$  for the California population in a given year. State the equation in the slope-intercept form.

(b) Use the model to estimate the population in 2032.

(c) Use the model to estimate the year when the population reaches 50 million. You may round the answer to the nearest integer.

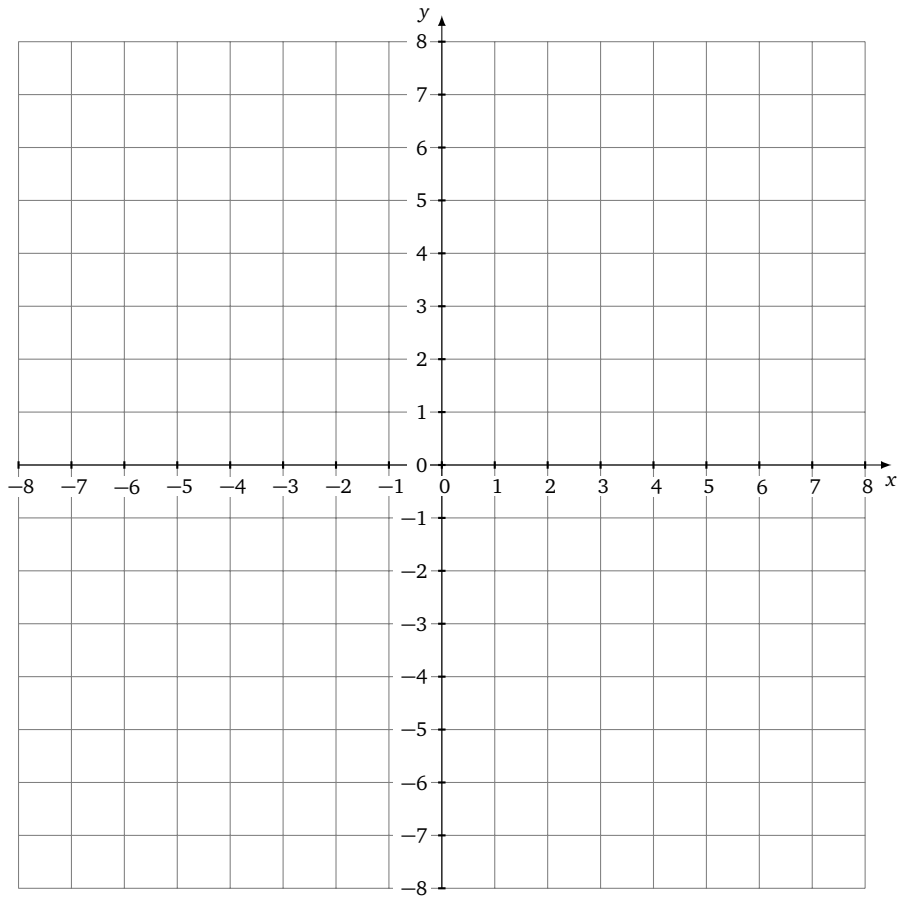
# 21. SYSTEMS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (5 points). Solve the system of linear equations by graphing. Be sure to graph both lines neatly on the grid and state the coordinates of the intersection point.

$$\begin{cases} y = \frac{5}{3}x - 2 \\ 2y - x = 3 \end{cases}$$



**2** (4 points). Solve the system of linear equations

$$\begin{cases} 2x - 3y = 14 \\ 4x - y = 13 \end{cases}$$

**3** (4 points). Solve the system of linear equations

$$\begin{cases} 14x - 20y = 27 \\ 16x + 20y = -12 \end{cases}$$

## 22. APPLICATIONS OF SYSTEMS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

YOU WILL BE ASKED TO WRITE SOME EQUATIONS AND THEN SOLVE THEM. IT IS RECOMMENDED TO GO THROUGH THE LAB AND ANSWER QUESTIONS (A) AND (B) BEFORE SOLVING ANY OF THE EQUATIONS.

1 (5 points). Alice and Bob each got a fast food chain gift card with \$42. Alice used all her money to buy 15 tacos and 2 quesadillas, while Bob used all his money to buy 6 tacos and 5 quesadillas. Set up an equation or a system of equations and find the price of one taco and the price of one quesadilla.

(a) Describe the variable(s) in words, give units.

(b) State the equation(s).

(c) Solve the equation(s) and state the answer.

**2** (5 points). A town issues 22 traffic citations in August. Some of them are \$35 parking tickets, and the rest are \$75 speeding tickets. If the total dollar amount of all citations is \$1010, find how many parking tickets and how many speeding tickets were issued in August.

(a) Describe the variable(s) in words, give units.

(b) State the equation(s).

(c) Solve the equation(s) and state the answer.

## 23. MORE APPLICATIONS OF SYSTEMS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

YOU WILL BE ASKED TO WRITE SOME EQUATIONS AND THEN SOLVE THEM. IT IS RECOMMENDED TO GO THROUGH THE LAB AND ANSWER QUESTIONS (A) AND (B) BEFORE SOLVING ANY OF THE EQUATIONS.

1 (5 points). How many ounces of pure water and how many ounces of a 15% saline solution must be mixed together to make 75 ounces of a saline solution that is 10% salt?

(a) Describe the variable(s) in words, give units.

(b) State the equation(s).

(c) Solve the equation(s) and state the answer.

**2** (5 points). A vendor wants to mix a coffee which costs 80 cents per pound with coffee which costs 55 cents per pound in order to get 25 pounds of a mix which costs 64 cents per pound. Find how much coffee of each type should be used.

(a) Describe the variable(s) in words, give units.

(b) State the equation(s).

(c) Solve the equation(s) and state the answer.

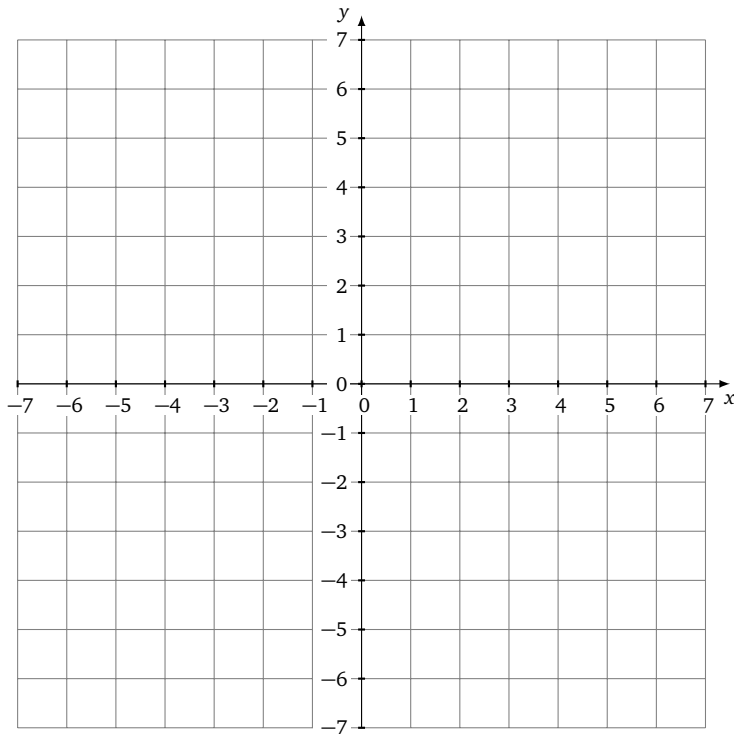


## 24. BIVARIATE INEQUALITIES

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

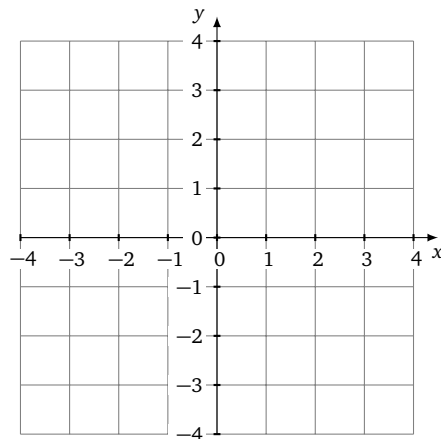
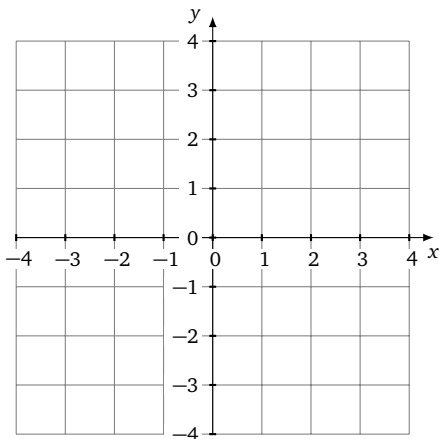
1 (3 points). Graph the solution set for the inequality:  $x - y \leq 3$



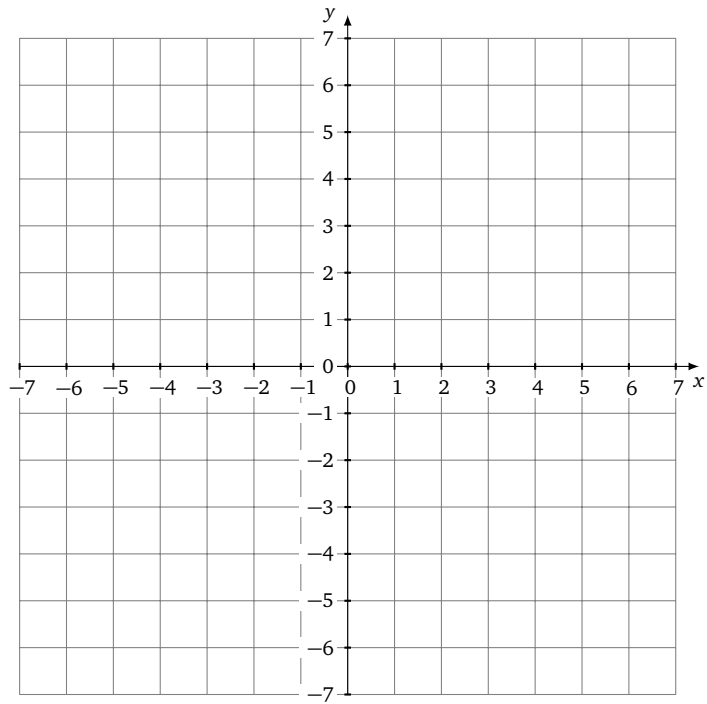
2 (4 points). Graph the solution set for each inequality.

(a)  $x \geq -3$

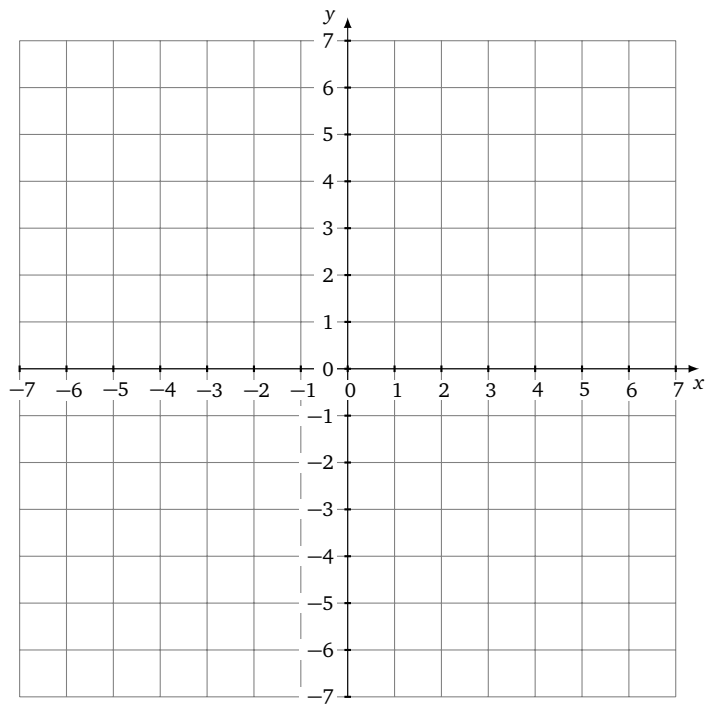
(b)  $y < 3$



3 (3 points). Graph the solution set for the inequality:  $-6x - 5y - 18 > 0$



4 (4 points). Graph the solution set for the system of inequalities: 
$$\begin{cases} y \leq -2x + 4 \\ -y \geq x \end{cases}$$



## 25. INTEGER EXPONENT

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (7 points). Simplify the expression:

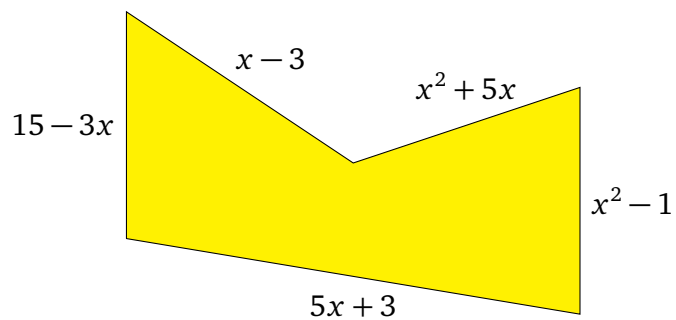
(a)  $(2x^5)(-3x^2)\left(-\frac{5}{4}x^7\right)$

(c)  $\frac{(2x^3y^4)^2}{20xy^7}$

(b)  $(xy^2)(x^4y^5)^3$

(d)  $\left(\frac{-2y^5}{1+x^4}\right)^0$

2 (3 points). Find an expression for the perimeter of the shown shape, and simplify it by combining the like terms:



3 (2 points). Simplify the expression

$$(4b^4 + b^2 - 3) - (3b^4 - b^2 - 3b)$$

4 (3 points). Rewrite the polynomial in the standard form, state its degree, its leading coefficient, and its description in English.

(a)  $7 - 7x^2$

(b)  $3y + y^3 - y^2$

(c)  $-x$

5 (3 points). State the degree of the polynomial and its description in English.

(a)  $4a - a^5x^3 + x^7$

(b)  $13a^2b^3c^4$

(c)  $-x^2y^7 + x^3y^5$

## 26. POLYNOMIAL PRODUCT

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (2 points). Multiply and simplify by combining the like terms:

$$4x^2(5x^2 - x - 3)$$

2 (2 points). Multiply and simplify by combining the like terms:

$$(x + 3)(2x - 5)$$

3 (2 points). Multiply and simplify by combining the like terms:

$$(k - 1)(4k^2 + 3k - 2)$$

4 (2 points). Exponentiate and simplify by combining the like terms:

$$(2x + 3)^2$$

5 (2 points). Exponentiate and simplify by combining the like terms:

$$(a - y^3)^2$$

6 (1 point). Factor the special product expression:

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

7 (1 point). Factor the special product expression:

$$y^2 - 10y + 25$$

8 (1 point). Multiply and simplify by combining the like terms:

$$(x + 3)(x - 3)$$

9 (1 point). Multiply and simplify by combining the like terms:

$$(2y - 5z^2)(2y + 5z^2)$$

10 (1 point). Factor the special product expression:

$$a^2 - 36$$

11 (1 point). Factor the special product expression:

$$x^{10} - y^6$$

## 27. POLYNOMIAL DIVISION

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (9 points). Divide the numerator term by term and write with positive exponents:

(a) 
$$\frac{14x^7 - 7x^4 + 28x^3}{7x^2}$$

(b) 
$$\frac{10a^3x - 6a^5x^4 + 4a^2x}{2a^2x}$$

(c) 
$$\frac{-12xy + 4x^3y^5 + a^2y^3}{6x^2y^3}$$

**2** (4 points). Divide using polynomial long division:

$$\frac{3x^2 - 2x - 13}{x - 2}$$

**3** (4 points). Divide using polynomial long division:

$$\frac{2x^3 + 7x^2 + 2x + 9}{2x + 3}$$



## 28. NEGATIVE EXPONENT

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (2 points). Simplify the expression and state the answer in **scientific** notation

$$\frac{4}{500}$$

2 (2 points). Simplify the expression and state the answer in **scientific** notation

$$(8.08 \times 10^3)(1.5 \times 10^{-7})$$

3 (2 points). Simplify the expression and state the answer in **decimal** notation

$$1.001 \times 10^5$$

4 (2 points). Simplify the expression and state the answer in **decimal** notation

$$100200 \times 10^{-4}$$

5 (2 points). Simplify the expression and state the answer with positive exponents

$$\frac{-14a^{-4}}{7a^{-7}}$$

6 (3 points). Simplify the expression and state the answer with positive exponents

$$(-5a^{-3}b^{-7})\left(\frac{1}{5}a^2b^{-3}\right)$$

7 (2 points). Simplify the expression and state the answer with positive exponents

$$\left(\frac{x^{-3}y^4}{xy^{-2}}\right)^{-2}$$

8 (3 points). Simplify the expression and state the answer with positive exponents

$$(2xy^{-3})^{-6}(x^2y^{-1})^3$$

## 29. BASIC FACTORING

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (8 points). Factor out the GCF:

(a)  $6x^6 - 9x^9$

(b)  $21cat + 7arc$

(c)  $75 + 45x - 150y$

(d)  $6x^2y - 20x^2y^2 - 12xy^5$

2 (8 points). Factor the expression completely:

(a)  $2x(x - 4) - 3y(x - 4)$

(b)  $g^2 + 13g + 42$

(c)  $2t^4 + 8t^2 + 2t^3 + 8t$

(d)  $4x^2 + 20x - 144$

## 30. FACTORING STRATEGY

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (12 points). Factor the expression completely:

(a)  $25a^2 - 70a + 49$

(b)  $49g^2 - 9h^2$

(c)  $3x^2 - 11xy + 6y^2$

(d)  $10000 - x^4$

(e)  $x^2y + 2x^2 - 9y - 18$

(f)  $2x^2 + xy - 15y^2$

## 31. FACTORING & EQUATIONS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (2 points). Solve the equation **using the zero product property**.

$$(3x + 5)(x - 4) = 0$$

2 (2 points). Solve the equation **using the zero product property**.

$$7x^2(x^2 + 1)(x - 6) = 0$$

3 (2 points). Solve the equation **by factoring**. Show all work.

$$x^2 + 13x + 42 = 0$$

4 (2 points). Solve the equation **by factoring**. Show all work.

$$4x^2 = 5x$$

5 (2 points). Solve the equation **by factoring**. Show all work.

$$2x^2 - 5x - 3 = 0$$



6 (2 points). Solve the equation **by factoring**. Show all work.

$$(x - 1)(x + 4) = 6$$

7 (3 points). Solve the equation **by factoring**. Show all work.

$$72x^3 - 50x = 0$$

8 (3 points). Solve the equation **by factoring**. Show all work.

$$x^3 - 9x - x^2 + 9 = 0$$

9 (1 point). Solve the equation **by factoring**. Show all work.

$$x^5 + 2x^4 + 5x^3 = 0$$

## 32. RATIONAL EXPRESSIONS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (2 points). Find all values of  $x$  for which the expression is undefined:

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

2 (2 points). Find all values of  $x$  for which the expression is undefined:

$$\frac{x - 6}{2x^2 - 11x - 6}$$

3 (2 points). Find all values of  $x$  for which the expression is undefined:

$$\frac{\frac{4}{x} + \frac{x}{7}}{\frac{x}{3} - \frac{1}{2}}$$

4 (2 points). Perform the operation and simplify if possible:

$$\frac{x^2 + 5x + 4}{x^2 - 6x + 8} \cdot \frac{x^2 + 5x - 14}{x^2 + 8x + 7}$$

5 (2 points). Perform the operation and simplify if possible:

$$\frac{x^2 + 14x + 49}{x - 3} \div \frac{x^2 + 3x - 28}{x - 4}$$

### 33. RATIONAL EXPRESSIONS & LCM

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (6 points). Find the LCM for the following expressions:

(a) 7, 90, 100

(b)  $6x$ ,  $9xy^4$ ,  $10x^2y$

(c)  $9n^2 - 9$ ,  $5n^2 - 10n + 5$ ,  $15n - 15$

2 (3 points). Perform the operation and simplify if possible:

$$\frac{x}{4-x} - \frac{3}{16-x^2}$$

3 (3 points). Perform the operation and simplify if possible:

$$\frac{x}{x^2 + 5x + 6} - \frac{2}{x^2 + 3x + 2}$$

4 (3 points). Perform the operation and simplify if possible:

$$\frac{4}{4 - 2a} - \frac{1}{a - 2}$$

## 34. COMPLEX FRACTIONS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (4 points). Simplify the complex fraction:

$$\frac{\frac{2}{5} - \frac{1}{10}}{\frac{7}{20} - \frac{4}{15}}$$

2 (4 points). Simplify the complex fraction and state the answer as a rational expression:

$$\frac{s + \frac{2}{s}}{s - \frac{3}{s}}$$

3 (4 points). Simplify the complex fraction and state the answer as a rational expression:

$$\frac{\frac{5}{4x^3} - \frac{5}{4x}}{\frac{3}{2x} + \frac{6x+3}{2x^3}}$$



## 35. RATIONAL EQUATIONS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (4 points). Solve the equation:

$$\frac{n+2}{n-3} = \frac{n+1}{n-2}$$

2 (4 points). Solve the equation:

$$\frac{1}{x+2} + \frac{4}{x^2-4} = 1$$

3 (4 points). Solve the equation:

$$\frac{x}{x+5} - \frac{5}{x-5} = \frac{14}{x^2-25}$$

4 (4 points). Solve the equation:

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

## 36. RADICALS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (8 points). Simplify the expression

(a)  $\sqrt{121}$

(e)  $\sqrt{\frac{1}{25}}$

(b)  $\sqrt{\frac{4}{9}}$

(f)  $\sqrt{-4}$

(c)  $\sqrt{0.64}$

(g)  $\sqrt{256}$

(d)  $\sqrt{x^{18}}$

(h)  $(\sqrt{a})^{60}$

2 (2 points). Estimate the value of the expression by an integer without using a  $\sqrt{\quad}$  calculator function.

(a)  $\sqrt{28}$

(b)  $\sqrt{2018}$

3 (8 points). Simplify the expression, assuming that variables are non-negative.

(a)  $\sqrt[3]{8}$

(e)  $\sqrt[13]{g^{13}}$

(b)  $\sqrt[5]{-32}$

(f)  $\sqrt[3]{0.027}$

(c)  $\sqrt[7]{c^{35}}$

(g)  $(\sqrt[6]{m})^{42}$

(d)  $(\sqrt[3]{10})^{12}$

(h)  $\sqrt[7]{(-3)^{21}}$

4 (2 points). Estimate the value of the expression by an integer without using a  $\sqrt{\quad}$  calculator function.

(a)  $\sqrt[3]{2018}$

(b)  $\sqrt[4]{2018}$

## 37. PRODUCTS OF RADICALS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (10 points). Simplify the expression, assuming that variables are non-negative.

(a)  $\sqrt{4x^2}$

(b)  $\sqrt{2y}\sqrt{18y^3}$

(c)  $\sqrt{a^9b^{10}}$

(d)  $\sqrt{60x^7}$

(e)  $\sqrt{z^{2017}}$

2 (10 points). Simplify the radicand and then bring the fraction to lowest terms

(a)  $\frac{\sqrt{20}}{2}$

(b)  $\frac{5 + \sqrt{100}}{3}$

(c)  $\frac{6 - \sqrt{8}}{4}$

(d)  $\frac{10 + \sqrt{50}}{5}$

(e)  $\frac{-5 - \sqrt{18}}{6}$



## 38. RADICAL QUOTIENTS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (3 points). Rationalize the denominator and simplify the expression

$$\sqrt{\frac{11}{z}}$$

2 (3 points). Rationalize the denominator and simplify the expression

$$\frac{\sqrt{3}}{\sqrt{50}}$$

3 (3 points). Rationalize the denominator and simplify the expression

$$\sqrt{\frac{b^2}{1000b}}$$

4 (3 points). Rationalize the denominator and simplify the expression

$$\frac{2x}{\sqrt{14x^3}}$$

## 39. SUMS OF RADICALS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (3 points). Simplify the expression

$$(\sqrt{32} - 7)^2$$

2 (3 points). Simplify the expression

$$(5\sqrt{2} + \sqrt{8})(2\sqrt{2} - 3\sqrt{4})$$

3 (3 points). Rationalize the denominator and simplify the expression

$$\frac{\sqrt{5}}{3 - \sqrt{5}}$$

4 (3 points). Rationalize the denominator and simplify the expression

$$\frac{\sqrt{7}}{2\sqrt{5} + \sqrt{7}}$$

## 40. RADICAL EQUATIONS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (2 points). Solve the equation

$$4 - 2\sqrt{5n} = 0$$

2 (2 points). Solve the equation

$$\sqrt{8 - 3x} = \sqrt{13 + x}$$

3 (2 points). Solve the equation

$$5\sqrt{3(x^2 - 1)} + 2 = 0$$

4 (4 points). Solve the equation

$$x = \sqrt{x+5} + 7$$

5 (4 points). Solve the equation

$$\sqrt{x+1} + \sqrt{x-2} = 3$$

## 41. RADICAL APPS

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (2 points). Find the distance between the points with coordinates  $(1, 2)$  and  $(9, 6)$ .

2 (2 points). Find the distance between the points with coordinates  $(-16, 10)$  and  $(-8, -2)$ .

3 (2 points). Find the length of the longer leg of a right triangle if its shortest leg is 12 meters, and its hypotenuse is 20 meters.

4 (2 points). Find the length of the shortest leg of a right triangle if its longer leg is 15 feet, and its hypotenuse is 16 feet.





## 42. RATIONAL EXPONENT

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (12 points). Simplify the expression

(a)  $-1000^{\frac{1}{3}}$

(b)  $256^{\frac{1}{4}}$

(c)  $(-1)^{-\frac{19}{7}}$

(d)  $100^{-\frac{1}{2}}$

(e)  $64^{\frac{3}{2}}$

(f)  $\left(-\frac{1}{8}\right)^{-\frac{5}{3}}$

2 (4 points). Simplify the expression and state the answer with positive exponents only.

(a)  $\left(x^{\frac{16}{9}}y^{-2}\right)^{\frac{3}{4}} \cdot x^{-1}y^{-\frac{3}{2}}$

(b)  $\frac{x^{\frac{1}{2}}y^{-\frac{2}{3}}}{x^{\frac{9}{4}}y^{-\frac{4}{3}} \cdot x}$

## 43. COMPLEX NUMBERS AND $\sqrt{\quad}$ PROPERTY

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

1 (8 points). Simplify the expression:

(a)  $\sqrt{-27}$

(b)  $(3 - 4i) - (-1 + 7i)$

(c)  $(1 + 2i)(3 - 4i)$

(d)  $\frac{15 \pm \sqrt{-75}}{10}$

2 (8 points). Solve the equation by taking square roots of both sides.

(a)

$$(m - 4)^2 = 21$$

(b)

$$(x + 5)^2 = -36$$

## 44. COMPLETING THE SQUARE

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

**1** (4 points). Solve the equation by completing the square.

$$x^2 + 14x = 1$$

**2** (4 points). Solve the equation by completing the square.

$$x^2 - 10x - 5 = 0$$

**3** (4 points). Rewrite the expression as a square of a binomial plus a constant:

$$x^2 - 7x + 13.5$$

**4** (4 points). Solve the equation by completing the square.

$$2x^2 - 10x = 7$$

## 45. QUADRATIC FORMULA

LAST NAME	FIRST NAME	DATE	CLASS
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SHOW WORK. DO NOT ROUND ANYTHING. BOX EVERY ALGEBRAIC ANSWER.

**1** (4 points). Solve the equation by using the quadratic formula.

$$7x + 6 = 20x^2$$

**2** (4 points). Solve the equation by using the quadratic formula.

$$2x^2 - 6x + 3 = 0$$

3 (4 points). Solve the equation by using the quadratic formula.

$$x^2 - 4x + 13 = 0$$

4 (4 points). Solve the equation by using the quadratic formula.

$$10x^2 + 62.8x + 98.596 = 0$$