College Algebra — Joysheet 1
MAT 140, Spring 2025 — D. Ivanšić

Name: _____

Covers: JIT 6, 7, 11, 12, 14, 15, 17

Show all your work!

Write the sets in interval notation and sketch them on the number line.

1. (3pts) $\{x \mid x \leq -4\}$

2. (3pts) $\{x \mid 3 < x \leq 9\}$

Solve the equations.

3. (3pts) $4x + 1 = 7x - 5$

4. (4pts) $5(3 - 2v) = 4 - 2(v - 2)$

Simplify and write in standard form:

5. (4pts) $(3x + 1)(5x - 2) - x^2(x + 5) =$

6. (4pts) $(x - 7)^2 - (x - 3)^2 =$

Simplify and write the answer so all exponents are positive:

7. (2pts) $(2b)^3b^4 =$

8. (2pts) $\dfrac{v^2}{(3v)^4} =$

9. (3pts) $y^{-2}(x^3y)^{-2}x^2 =$

10. (5pts) $(2r^3s^{-2})^4(u^{-1}v^2)^{-3} =$

11. (7pts) $\dfrac{(6x^2y^{-2})^3}{(3x^5y^4)^2} =$

Factor the following.

12. (4pts) $x^2 + 3x - 28 =$

13. (4pts) $x^2 - 12x + 20 =$

Use the *ac*-method or another method to factor. Show how you got your answer.

14. (6pts) $2x^2 - 5x - 12 =$

15. (6pts) $6x^2 + 11x - 2 =$

College Algebra — Joysheet 2
MAT 140, Spring 2025 — D. Ivanšić

Name: _____

Covers: 1.1, 1.2 *Show all your work!*

1. (11pts) Draw the triangle with vertices $A = (-3, -1)$, $B = (4, 2)$ and $C = (-1, 4)$ in the coordinate plane.
a) Compute the lengths of all sides of the triangle and determine if it is isosceles (two sides with equal length).
b) Determine algebraicallly if the triangle ABC is a right triangle.

2. (10pts) Find the equation of the circle if the endpoints of its diameter are $(3, -2)$ and $(7, 2)$. Draw the circle.

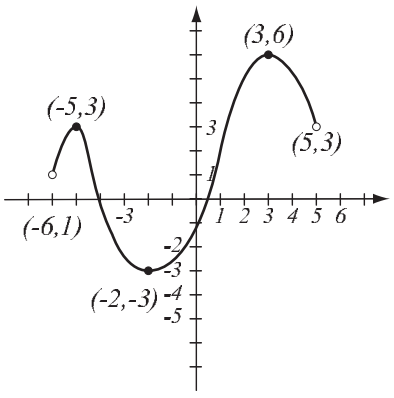
3. (8pts) Use the graph of the function f at right to answer the following questions.

a) Find $f(-2)$ and $f(5)$.

b) What is the domain of f?

c) What is the range of f?

d) What are the solutions of the equation $f(x) = 3$?



4. (12pts) The function $f(x) = x^2 + 6x\sqrt{x+4}$ is given.

a) Use your calculator to accurately its graph. Draw the graph here, and indicate units on the axes.

b) Find all the $x-$ and $y-$intercepts (accuracy: 6 decimal points).

c) State the domain and range.

5. (9pts) Find the domain of each function and write it using interval notation.

$f(x) = \dfrac{x+4}{x^2-9}$ $\qquad$ $g(x) = \dfrac{\sqrt{x}}{5-3x}$

6. (10pts) Let $h(x) = \dfrac{\sqrt{x-3}}{x^2-x+2}$. Find the following (simplify where appropriate).

$h(7) =$ $\qquad$ $h(1) =$

$h(4t) =$ $\qquad$ $h(a-1) =$

College Algebra — Joysheet 3
MAT 140, Spring 2025 — D. Ivanšić

Name: _____

Covers: 1.3, 1.4 *Show all your work!*

1. (6pts) Find the equation of the line (in form $y = mx + b$) whose x-intercept is 1, and passes through point $(-2, 3)$ Draw the line.

2. (10pts) Find the equation of the line (in form $y = mx + b$) passing through $(1, -2)$ that is perpendicular to the line $3x - 4y = 12$. Draw both lines.

3. (8pts) Draw the triangle with vertices $A = (-2, 0)$, $B = (5, 1)$ and $C = (-1, 4)$ in the coordinate plane.
a) Find the slopes of the sides AB, BC and AC.
b) Is the triangle a right triangle? Explain.

4. (4pts) In 2010 the US gross domestic product (GDP) was \$15,049 billion and in 2022 it was \$26,007 billion. What is the average rate of change of the US GDP from 2010 to 2022? What are the units for the average rate of change?

5. (12pts) On one ride with a cab company, you rode 5 miles and paid \$13.84 and on another ride with the same company, you rode 11 miles and paid \$26.98.
a) Assuming that ride cost $C(x)$ is a linear function of the number of miles driven, write a formula for $C(x)$.
b) What is the cost if no miles are driven? What is the meaning of this number?
c) What is the meaning of the slope in this example?

6. (20pts) A homebuyer is investigating the relationship between total area A of new houses (in square feet) and their prices per square foot. Below is the data they found on several homes. Solve the problems below with accuracy 6 decimal points.
a) Draw the scatterplot of the data. Does the relationship look linear?
b) Use two points in the scatterplot to get an equation of a line that models the relationship between A and P. Draw the line on the graph.
c) Use your calculator to find the "line of best fit" for the data. Draw the line on the graph.
d) Find coefficient of correlation r. How strong is the linear relationship between A and P?
e) What price per square foot can the homebuyer expect for a home with area 2350 square feet?

A	P
1450	210
1600	207
1900	205
2100	195
2200	190
2500	190

College Algebra — Joysheet 4
MAT 140, Spring 2025 — D. Ivanšić

Name: _____

Covers: 1.5, 1.6 *Show all your work!*

Solve the inequalities. Write your solution in interval notation.

1. (5pts) $-3 \leq 5x + 7 < 9$

2. (7pts) $2x + 1 < 3$ or $2x + 5 > 11$

3. (6pts) Find the domain of the function in interval notation: $f(x) = \dfrac{\sqrt{3 - 2x}}{4x + 7}$.

4. (14pts) Landscaping services Bob's Dirt and Duncan's Lawns are offering spring yard cleanup services. Bob's Dirt charges \$50 plus \$45 per hour and Duncan's Lawns charges \$200, which includes the first three hours, plus \$35 per hour for every hour after the first three. Assuming your yard needs at least three hours of work, for which number of hours is Duncan's Lawns the better option? Solve as an inequality.

5. (14pts) The distance between Murray and Nashville is 121 miles. Celia drives from Murray towards Nashville. Driving along the same road and starting at the same time, her friend Dana drives from Nashville towards Murray, driving 4mph faster than Celia. After 55 minutes, they meet on the road.
a) How fast was each of them driving?
b) How far from Murray did the friends meet?

6. (14pts) Friends Tim, Josh and Kathy go out to lunch and split the total cost of $28.68. Tim pays four fifths of the amount Josh pays and Kathy pays $1.25 more than Tim. How much did each of them pay?

College Algebra — Joysheet 5
MAT 140, Spring 2025 — D. Ivanšić

Name: _____

Covers: 2.1, 2.2, 2.3 Show all your work!

1. (10pts) Use your calculator to accurately sketch the graph of the function $f(x) = \dfrac{8x-3}{x^2+1}$. (When entering function into calculator, don't forget to put parentheses around numerator and denominator if the calculator doesn't have fractional notation.) Draw the graph here, indicate units on the axes, and solve the problems below with accuracy 6 decimal points.

a) Find the local maxima and minima for this function.

b) State the intervals where the function is increasing and where it is decreasing.

2. (20pts) Let $f(x) = \dfrac{x^2}{x-3}$, $g(x) = \sqrt{9-2x}$. Find the following (simplify where possible):

$(f+g)(-8) =$

$(fg)(-3) =$

$\dfrac{f}{g}(x) =$

$(g \circ f)(1) =$

$(f \circ g)(x) =$

The domain of $(f-g)(x)$ in interval notation

3. (8pts) Consider the function $h(x) = \sqrt[7]{x^2 - 5}$ and find **two** different solutions to the following problem: find functions f and g so that $h(x) = f(g(x))$, where neither f nor g are the identity function.

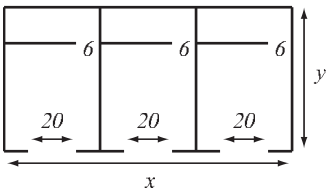
4. (8pts) Sketch the graph of the piecewise-defined function:

$$f(x) = \begin{cases} x - 3, & \text{if } -4 < x < 1 \\ 4 - 2x & \text{if } x \geq 1. \end{cases}$$

5. (14pts) A real estate investor is building a 3-store shopping center with total area 4800 square feet in which every store has a 20-ft door and shopwindow and a 6-ft door to the back area. The investor wishes to minimize the construction cost, which is same as minimizing the total length of the walls.

a) Express the total length of the walls as a function of the length of one of the sides x. What is the domain of this function?

b) Graph the function in order to find the minimum. What are the dimensions of the shopping center for which the total length of the walls is minimal? What is the minimal wall length?



College Algebra — Joysheet 6
MAT 140, Spring 2025 — D. Ivanšić

Name: _____

Covers: 2.4, 2.5 *Show all your work!*

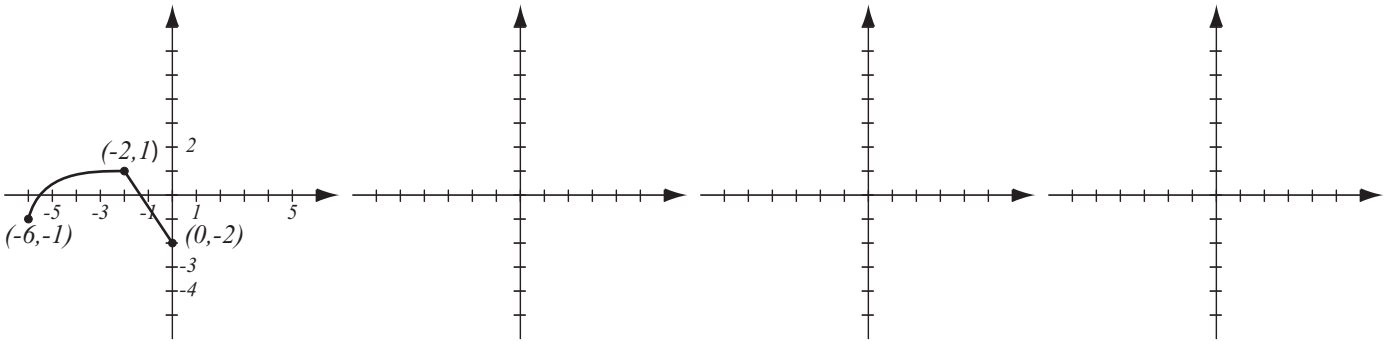
1. (21pts) For the following functions:
a) determine algebraically whether they are odd, even, or neither
b) use the calculator to draw their graphs here and verify your conclusions by stating symmetry.

$f(x) = x^4 - 5x^2 + 2$ $\qquad$ $g(x) = \dfrac{x^5}{120} - \dfrac{x^3}{6} + x$ $\qquad$ $h(x) = x^3 - 7|x|$

2. (16pts) Draw the graphs of $f(x) = 2 - \frac{1}{x}$ and $g(x) = -4\sqrt{-x}$ using transformations. Explain how you transform graphs of basic functions in order to get the graphs of f and g. Indicate at least two points on each graph.

3. (10pts) Write the equation for the function whose graph has the following characteristics:
a) shape of $y = \sqrt[3]{x}$, shifted right 4 units,
b) shape of $y = |x|$, reflected about the x-axis, then stretched horinzontally by factor 2,
c) shape of $y = x^2$, reflected about the y-axis, then stretched vertically by factor 4, then shifted down 1 unit.

4. (13pts) The graph of $f(x)$ is drawn below. On separate coordinate systems, sketch the graphs of the functions $f(2x)$, $-f(x-3)$ and $3f(-x)$ and label all the relevant points.



College Algebra — Joysheet 7
MAT 140, Spring 2025 — D. Ivanšić

Name: _____

Covers: JIT 13, 21–23, 25

Show all your work!

Use formulas to expand:

1. (4pts) $(5a - b^2)(5a + b^2) =$

2. (4pts) $(3x + y)^2 =$

3. (5pts) $(u^3 - 4v^3)^2 =$

4. (8pts) Compute expressions with fractions by hand.

$\frac{9}{20} \cdot \frac{16}{15} =$ $\frac{21}{10} \div \frac{49}{6} =$

$\frac{3}{5} - \frac{4}{15} =$ $\frac{11}{12} - \frac{21}{20} =$

Multiply or divide the rational expressions.

5. (7pts) $\dfrac{5x + 20}{x^2 + 5x - 14} \cdot \dfrac{x^2 + 4x - 21}{10x + 40} =$

6. (7pts) $\dfrac{3x-12}{3x^2+2x-5} \div \dfrac{x^2-3x-4}{3x-3} =$

Add or subtract the rational expressions.

7. (6pts) $\dfrac{4x^2+7}{x^2-5x-24} - \dfrac{3x+2}{x-8} =$

8. (8pts) $\dfrac{6x-6}{2x^2-x-10} + \dfrac{-3x+2}{x^2-4} =$

Simplify the following expressions, assuming all variables are positive.

9. (3pts) $\sqrt{54x^3y^8} =$

10. (4pts) $\sqrt[3]{20a^4b^5}\ \sqrt[3]{2a^2b^5} =$

11. (4pts) $(7+\sqrt{5})(3-\sqrt{20}) =$

College Algebra — Joysheet 8
MAT 140, Spring 2025 — D. Ivanšić

Name: _____

Covers: 3.1, 3.2, 3.3 Show all your work!

Simplify, so that the answer is in form $a + bi$.

1. (4pts) $3i(1+i) - 2(5+5i) =$

2. (6pts) $\dfrac{2-i}{4-5i} =$

3. (4pts) Simplify and justify your answer.

$i^{325} =$

4. (8pts) The number of flat screen TVs (in thousands) at a warehouse is described by the function $N(x) = -x^2 + 8x + 84$, where x is the number of days after January 20th.
a) On what dates did the warehouse have 64 thousand flat screen TVs?
b) On what date did the number of flat screen TVs reach its maximum?

5. (8pts) Solve the equation: $x^4 + 10x^2 + 21 = 0$

6. (6pts) Solve by completing the square.

$x^2 - 16x + 21 = 0$

7. (12pts) The quadratic function $f(x) = 4x^2 + 8x - 21$ is given. Do the following without using the calculator.
a) Find the x-intercepts of its graph, if any. Find the y-intercept.
b) Find the vertex of the graph.
c) Sketch the graph of the function.

8. (12pts) In a rectangle, the length is 3cm longer than the width. If we increase both width and length by 2cm, we get a rectangle with twice the area of the original one. What are the dimensions of the original rectangle?

College Algebra — Joysheet 9
MAT 140, Spring 2025 — D. Ivanšić

Name: _____

Covers: 3.3, 3.4, 3.5 Show all your work!

1. (4pts) Solve the equation.

$|3x + 7| = 5$

2. (12pts) Solve the inequalities. Draw your solution and write it in interval form.

$|x + 2| > 7$ $|5x - 12| \leq 3$

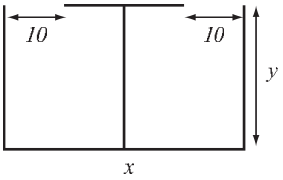
Solve the equations:

3. (8pts) $\dfrac{x+1}{x-5} + \dfrac{x+2}{x-4} = \dfrac{x^2 - 4x + 1}{x^2 - 9x + 20}$

4. (8pts) $x + \sqrt{4x - 8} = 2$

5. (14pts) A ball is thrown upwards from a height of 15 meters with initial velocity 18 meters per second. Its height in meters after t seconds is given by $s(t) = -5t^2 + 18t + 15$.
a) Sketch the graph of the height function.
b) When does the ball reach its greatest height, and what is that height?
c) When does the ball fall to the ground?

6. (14pts) Manuel is planning a building meant to house two stores, each with doors 10 feet wide (see picture). He has budgeted for total wall length 800 feet and his goal is to maximize the enclosed area.
a) Express the area of the building as a function of one of the sides of the rectangle. What is the domain of this function?
c) Sketch the graph of the area function in order to find the maximum (no need for the graphing calculator — you should already know what the graph looks like). What are the dimensions of the building that has the greatest area and what is the greatest area possible?

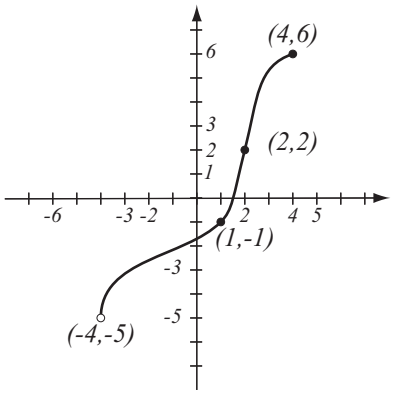


College Algebra — Joysheet 10
MAT 140, Spring 2025 — D. Ivanšić

Name: _____

Covers: 5.1–5.3 *Show all your work!*

1. (6pts) The graph of a function f is given.
a) Is this function one-to-one? Justify.
b) If the function is one-to-one, find the graph of f^{-1}, labeling the relevant points.



2. (12pts) Let $f(x) = \dfrac{2x+1}{x-7}$. Find the formula for f^{-1}. Find the ranges of f and f^{-1}.

3. (8pts) Evaluate without using the calculator. For each problem, write the question you should ask yourself in order to find the logarithms.

$\log_8 64 =$ $\log_5 \frac{1}{125} =$ $\log_3 \sqrt[4]{9} =$ $\log_{a^2} a =$

4. (4pts) Use the change-of-base formula and your calculator to find $\log_4 15$ with accuracy 6 decimal places. Show how you obtained your number.

5. (12pts) Investigate the effect of increased frequency of compounding: for a deposit of \$2,500 and annual interest rate of 3.96%, calculate the amount in the account after 1 year for the frequencies of compounding below.
a) Write the general formula for the amount, replacing the variables by numbers, if known.
b) Use the table feature on your calculator to quickly compute amounts after 1 year.
c) Does compounding more often make a big difference?

Frequency: every	n	Amount after 1 year
year		
quarter		
month		
day		
hour		
second		

6. (3pts) Find the domain of $f(x) = \ln(2x - 9)$. Write your solution in interval notation.

7. (8pts) A home's monthly electricity cost is given by the formula $C(x) = 35.49 + 0.13x$, where x is the number of kilowatt-hours (kWh) used in a month.
a) Determine the monhly cost if 956 kWh and 1,291 kWh are used.
b) Find a formula for the inverse function and explain what it represents.
c) How many kWh were used if the monthly bills were \$198.38 and \$133.64?

8. (7pts) Using transformations, draw the graph of $f(x) = -\ln(x - 4)$. Explain how you transform the graph of a basic function in order to get the graph of f. Show at least one point on the graph, and asymptotes to the graph, if any.

College Algebra — Joysheet 11
MAT 140, Spring 2025 — D. Ivanšić

Name: _____

Covers: 5.4-5.6 *Show all your work!*

1. (5pts) If $\log_a 4 = 0.6667$ and $\log_a 9 = 1.0566$, calculate:

$\log_a 36 =$ $\log_a \frac{16}{9} =$

2. (11pts) Write as a sum and/or difference of logarithms. Express powers as factors. Simplify if possible.

$\log_3 (81x^4y^9) =$

$\ln \frac{\sqrt{e}x^3y^5}{\sqrt[3]{x^7}z^4} =$

3. (12pts) Write as a single logarithm. Simplify if possible.

$3\log_2(4x^2) - \log_2(48y^5) + 3\log_2 x^4 =$

$2\log_2(x^2+5x+4) - 3\log_2(x+4) - \log_2(x+1) =$

4. (3pts) Simplify. $\log 10^{5a-2} =$ $7^{\log_7 \sqrt{x+13}} =$

Solve the equations.

5. (5pts) $36^{x-3} = 6^{4x+3}$

6. (7pts) $5^{x+1} = 3^{2x-5}$

7. (5pts) An investor puts \$15,000 into a stock. The stock's value increases by 7% every year, so after t years the value of the stock holding is given by the function $V(t) = 15 \cdot (1.07)^t$ (in thousands). When will the stock holding be worth \$40,000?

8. (12pts) According to census data, Nashville, TN, had 546,000 inhabitants in 2000 and 689,000 in 2020. Assume the population of Nashville grows exponentially.
a) Write the function describing the number $P(t)$ of people in Nashville t years after 2000. Then find the exponential growth rate for this population.
b) Graph the function.
c) According to this model, when will the population reach 800,000?