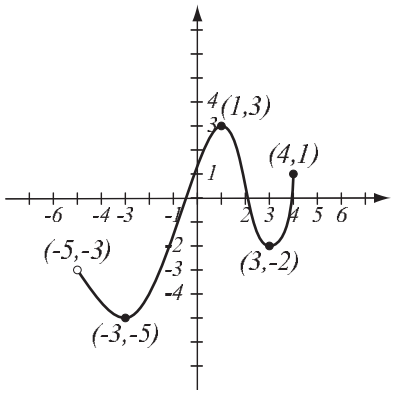
College Algebra — Exam 1
MAT 140C, Spring 2025 — D. Ivanšić

Name: _____

Show all your work!

1. (8pts) Use the graph of the function f at right to answer the following questions.



a) Find: $f(-3) =$ $f(5) =$

b) What is the domain of f?

c) What is the range of f?

d) What are the solutions of the equation $f(x) = 2$?

2. (12pts) Use your calculator to accurately sketch the graph of $f(x) = x^2 - 2x\sqrt{x+2} - 1$.

a) Draw the graph on paper and indicate units on the axes.

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

c) Determine the domain of the function in interval notation either algebraically or by looking at the graph.

3. (6pts) Find the equation of the line (in form $y = mx + b$) with x-intercept -2 and y-intercept 4. Draw the requested line.

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

5. (9pts) In a coordinate system, draw the quadrangle with vertices
$A = (-1, 0)$, $B = (1, -1)$, $C = (5, 1)$ and $D = (3, 2)$.
a) Compute the slopes of all sides.
b) Use slopes to determine if the quadrangle is a parallelogram (two pairs of sides parallel).

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

$f(9) =$ $f(-3) =$

$f(u^2) =$ $f(a + 3) =$

7. (6pts) Find the domain of the function below and write it using interval notation.

$$f(x) = \frac{3x + 2}{x^2 + 4x - 5}$$

8. (5pts) Solve and write the solution in interval notation.

$1 < 2x - 5 \leq 8$

9. (8pts) A circle is centered at $(-1, 2)$ and passes through $(1, 3)$.
a) Find the equation of the circle.
b) Draw the circle in the coordinate plane.

10. (12pts) At a county fair, you can pay for rides in one of two ways:
A) \$5 flat fee plus \$1.50 per ride.
B) \$15 flat fee that includes 5 rides, and then \$1 per ride for rides beyond 5.
Assuming a child plans to go on at least 5 rides, for which number of rides is plan B better? Solve as an inequality.

11. (14pts) You drive to Cadiz on the highway at 67mph. On the way back, you take the scenic road, driving 55mph. This road is 20 miles longer and takes a half hour longer to drive.
a) How long did it take you to drive to Cadiz?
b) How long is the scenic road?

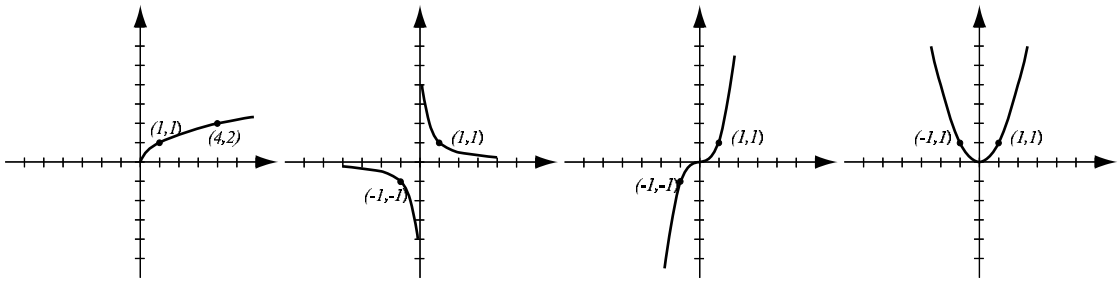
Bonus (10pts) Antonia will invest some money into accounts bearing 4% and 5% interest. She invests \$750 more in the account bearing 5% interest and finds that her total interest over 1 year is \$244.50. How much is invested in each account?

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

Name: _____

Show all your work!

1. (8pts) The following are graphs of basic functions. Write the equation of the graph under each one.



2. (20pts) Let $f(x) = \dfrac{2x}{x-3}$, $g(x) = \dfrac{1}{x}$.

Find the following (simplify where possible):

$(f-g)(2) =$ $(fg)(5) =$

$\dfrac{f}{g}(x) =$ $(g \circ f)(4) =$

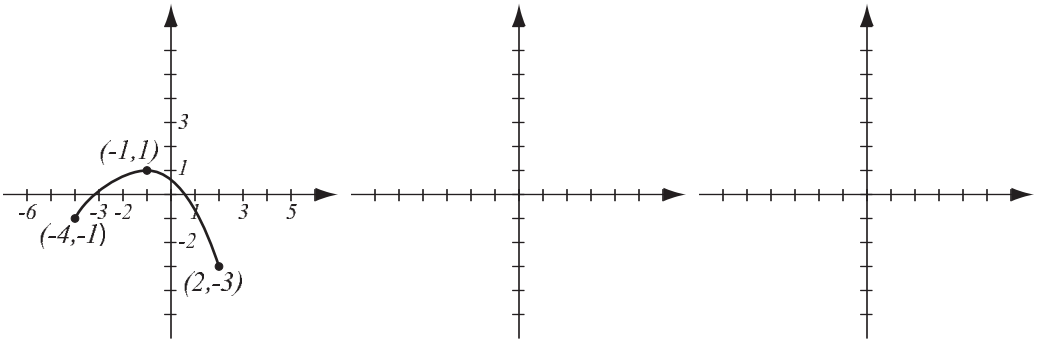
$(f \circ g)(x) =$

The domain of $f - g$ in interval notation

3. (6pts) Consider the function $h(x) = \dfrac{7}{3x^2+1}$ 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. (6pts) Write the equation for the function whose graph has the following characteristics:
a) shape of x^3, reflected over the y-axis.
b) shape of $y = x^2$, stretched vertically by factor 2 and then shifted up 1.

5. (10pts) The graph of $f(x)$ is drawn below. Find the graphs of $-f(x+2)$ and $f(2x)-3$ and label all the relevant points.



6. (8pts) Sketch the graph of the piecewise-defined function:

$$f(x) = \begin{cases} 4-x, & \text{if } -2 \le x \le 2 \\ 5-\frac{1}{2}x, & \text{if } 2 < x < 6 \end{cases}$$

7. (5pts) Find the values of the piecewise-defined function.

$$f(x) = \begin{cases} x^2 + 2x - 3, & \text{if } x < -3 \\ \sqrt{2x+7}, & \text{if } -3 \leq x \leq 2 \end{cases}$$

$f(0) =$

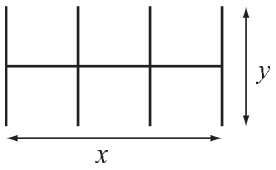
$f(7) =$

$f(-6) =$

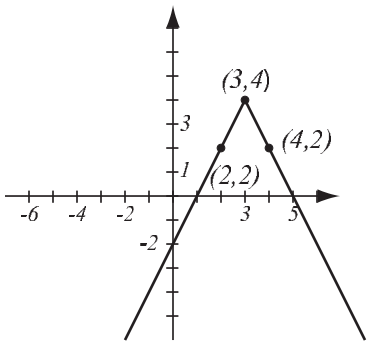
8. (3pts) Sketch a graph of an even function. You can draw any curve you like, as long as it has the property requested.

9. (20pts) Let $f(x) = x^3 - 7x$ (answer with 6 decimal points accuracy).
a) Use your graphing calculator to accurately draw the graph of f (on paper!). Indicate units on the axes.
b) Determine algebraically whether the function is odd, even, or neither.
c) Verify your conclusion from b) by stating symmetry.
d) Find the local maxima and minima for this function. If there is symmetry, use it to reduce the work here.
e) State the intervals where the function is increasing and where it is decreasing.

10. (14pts) Entrepreneur Kaja is building a block of six self-storage units, with total area 1800 square feet. They are open on one side to accommodate a garage door. Kaja's goal is to minimize building cost, which is same as minimizing the total length of the walls.
a) Express the total length of walls of the block 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 block that has the smallest total wall length? What is the smallest total wall length?



Bonus. (10pts) The graph below was obtained by transformations of a graph of a standard function. Identify the standard function and the transformations and use them to write the formula for the function in the picture.



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

Name: _____

Show all your work!

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

1. (4pts) $3i(7 + 2i)^2 =$

2. (6pts) $\dfrac{1 - 5i}{7 - 3i} =$

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

$i^{135} =$

4. (6pts) Solve the equation by completing the square.

$x^2 - 12x = 12$

5. (6pts) Solve the inequality. Write the solution in interval form.

$|3x - 7| < 4$

6. (6pts) Let $P(x)$ be a polynomial of degree 3.
a) Draw a graph of P that has exactly one x-intercept and no turning points.
b) Draw a graph of P that has exactly two x-intercepts.

7. (12pts) The quadratic function $f(x) = -x^2 - 2x + 3$ is given. Do the following without using the calculator.
a) Find the x- and y-intercepts of its graph, if any.
b) Find the vertex of the graph.
c) Sketch the graph of the function.

Solve the equations:

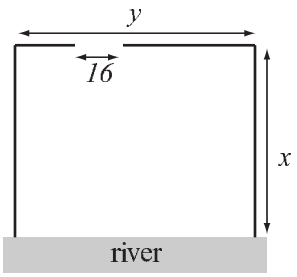
8. (8pts) $\dfrac{x}{x+4} = \dfrac{2}{x+1} + \dfrac{5x-1}{x^2+5x+4}$

9. (8pts) $\sqrt{3x+7} - x = 1$

10. (14pts) The polynomial $f(x) = (x-2)^2(x+4)^2$ is given.
a) What is the end behavior of the polynomial?
b) List all the zeros and their multiplicities. Find the y-intercept.
c) Use the graphing calculator along with a) and b) to accurately sketch the graph of f (yes, on paper!).
d) Find all the turning points (i.e., local maxima and minima) with accuracy 6 decimal points.

11. (12pts) Starting with a $5\,\text{ft} \times 7\,\text{ft}$ rectangle, we increased the width and length by the same amount to get a rectangle with area $50\,\text{ft}^2$. How much was added to the width and length of the 5×7 rectangle?

12. (14pts) Farmer Felix is constructing a rectangular enclosure in a field along a river. He has 1000 feet of fencing. The side along the river does not need fencing, and the enclosure has one 16-foot opening. Felix's goal is to maximize the area of the enclosure.
a) Express the area of the enclosure as a function of the length of one of the sides. What is the domain of this function?
b) Graph the 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 enclosure that has the biggest possible area and what is the biggest possible area?



Bonus. (10pts) Find the equation of a parabola whose vertex is $(2, -5)$ and whose y-intercept is 3. One way to approach this is to write $y = ax^2 + bx + c$ and find a, b and c based on the information above.

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

Name: _____

Show all your work!

1. (8pts) Evaluate without using the calculator. For each problem, write the question you should ask yourself in order to find the logarithms.

$\log_2 32 =$ $\log_5 \frac{1}{25} =$ $\log_c \sqrt[9]{c^2} =$ $\log_{a^3} a^9 =$

2. (4pts) Use the change-of-base formula and your calculator to find $\log_4 14$ with accuracy 6 decimal places. Show how you obtained your number.

3. (5pts) If $\log_a 5 = 0.6712$ and $\log_a 8 = 0.8672$, calculate the following values:

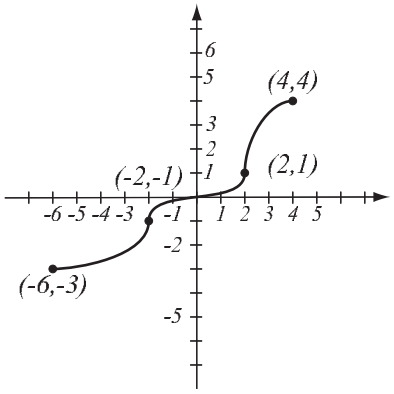
$\log_a 40 =$ $\log_a \frac{8}{125} =$

4. (4pts) Simplify.

$\ln e^{|x+11|} =$ $5^{\log_5(3x^2+1)} =$

5. (8pts) If you deposit \$5,000 in an account bearing 4.4% interest, compounded quarterly, how much is in the account after 6 years?

6. (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, and showing any asymptotes.



7. (9pts) Let $f(x) = \dfrac{4x+3}{x+2}$.
a) Find the formula for f^{-1}.
b) Find the range of f.

8. (6pts) Using transformations, draw the graph of $f(x) = 5^{-x} - 3$. Explain how you transform the graph of a basic function in order to get the graph of f. Indicate at least one point on the graph and any asymptotes.

9. (12pts) Write as a sum and/or difference of logarithms. Express powers as factors. Simplify if possible.

$\log_7 \left(49x^4 \sqrt[7]{y^3}\right) =$

$\log_4 \dfrac{x^5 y^3}{16x^{\frac{2}{3}}} =$

10. (12pts) Write as a single logarithm. Simplify if possible.

$3\log(u^2v^5) + 4\log(u^{-3}v^3) =$

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

Solve the equations.

11. (6pts) $25^{x+3} = 5^{3x-7}$

12. (8pts) $6^x = 3^{2x-1}$

13. (12pts) Census data has the population of Knoxville, TN, as 179,000 in 2010 and 191,000 in 2020. Assume that it has grown according to the formula $P(t) = P_0 e^{kt}$.
a) Find k and write the function that describes the population at time t years since 2010. Graph it on paper.
b) Find the predicted population in the year 2027.

Bonus (10pts) Solve the equation.

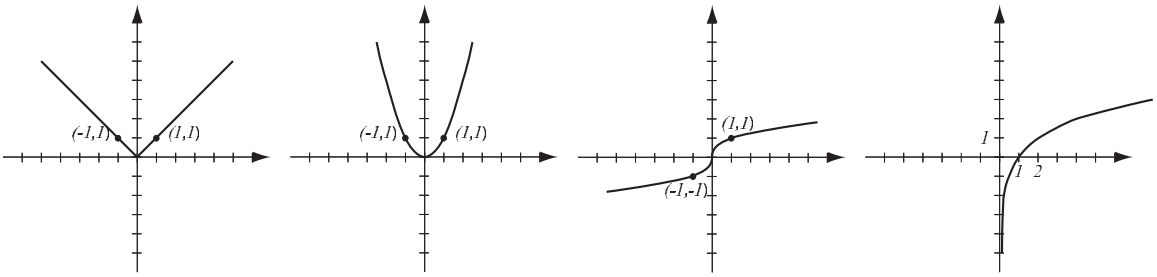
$\log_2(x-1) + \log_2(x+5) = 4$

College Algebra — Final Exam
MAT 140C, Spring 2025 — D. Ivanšić

Name: _____

Show all your work!

1. (8pts) The following are graphs of basic functions. Write the equation of the graph under each one.



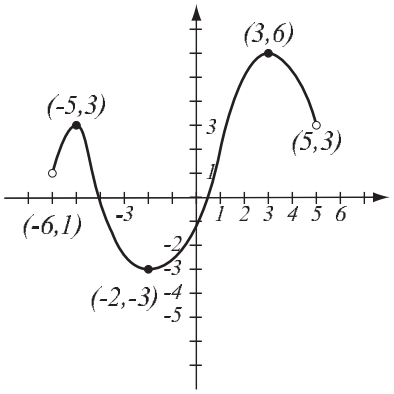
2. (8pts) Use the graph of the function f at right to answer the following questions.

a) Find: $f(3) =$ $\qquad$ $f(-7) =$

b) What is the domain of f?

c) What is the range of f?

d) What are the solutions of the equation $f(x) = 5$?



3. (11pts)

a) Find the equation of the line that passes through point $(4, 1)$ and has y-intercept 2.

b) Find the equation of the line (in form $y = mx + b$) that is perpendicular to the line in a) and also passes through the point $(4, 1)$.

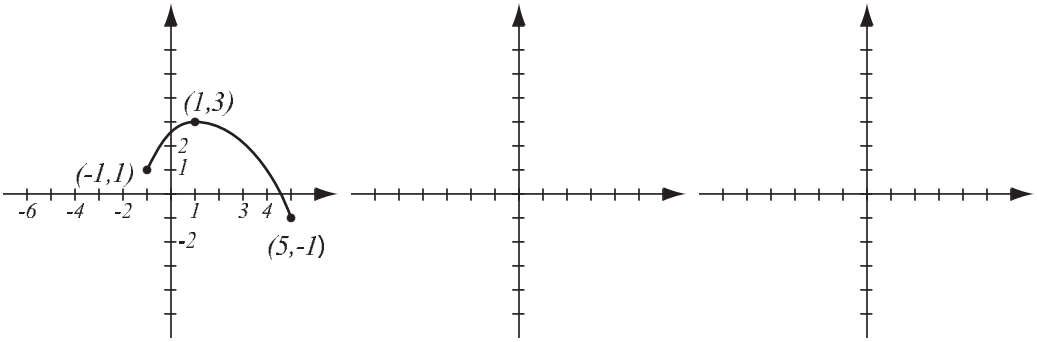
c) Draw both lines.

4. (3pts) Find the domain of the function $f(x) = \log_3(5 - 3x)$ and write it in interval notation.

5. (6pts) Solve and write the solution in interval notation.

$|x - 3| < 7$

6. (10pts) The graph of $f(x)$ is drawn below. Find the graphs of $f(-x) + 2$ and $2f(x + 1)$ and label all the relevant points.



7. (5pts) Let $f(x) = 52e^{x+3}$. Find the formula for $f^{-1}(x)$.

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

9. (5pts) Write as a sum and/or difference of logarithms. Express powers as factors. Simplify if possible.

$\log_6 \left(216x^5 \sqrt[3]{y^2}\right) =$

10. (6pts) Write as a single logarithm. Simplify if possible.

$2\log_4(x-2) - \log(x^2 - 5x + 6) + 3\log(x-3) =$

11. (8pts) Let $f(x) = 3x + 5$, $g(x) = x^2 - 2$. Find the following (simplify where possible):

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

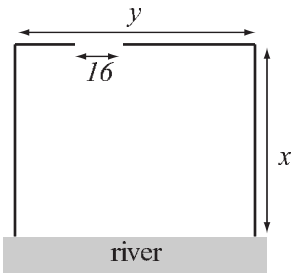
12. (20pts) The polynomial $P(x) = x^4 - 9x^2$ is given (answer with 6 decimals accuracy).
a) What is the end behavior of the polynomial?
b) Factor the polynomial to find all the zeros and their multiplicities. Find the y-intercept.
c) Determine algebraically whether the function is odd, even, or neither.
d) Use the graphing calculator along with a) and b) to sketch the graph of P (yes, on paper!).
e) Verify your conclusion from c) by stating symmetry.
f) Find all the turning points (i.e., local maxima and minima).

13. (8pts) Solve the equation.

$3 + \sqrt{3x - 5} = x$

14. (14pts) You drive to Cadiz on the highway at 72mph. On the way back, you take the scenic road, driving 63mph. This road is 18 miles longer and takes a half hour longer to drive.
a) How long did it take you to drive to Cadiz?
b) How long is the scenic road?

15. (14pts) Farmer Felix is constructing a rectangular enclosure in a field along a river. He has 800 feet of fencing. The side along the river does not need fencing, and the enclosure has one 16-foot opening. Felix's goal is to maximize the area of the enclosure.
a) Express the area of the enclosure as a function of the length of one of the sides. What is the domain of this function?
b) Graph the 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 enclosure that has the biggest possible area and what is the biggest possible area?



16. (12pts) Census data has the population of Knoxville, TN, as 165,000 in 1990 and 191,000 in 2020. Assume that it has grown according to the formula $P(t) = P_0 e^{kt}$.
a) Find k and write the function that describes the population at time t years since 1990. Graph it on paper.
b) Find the predicted population in the year 2030.

Bonus (10pts) Find the equation of a parabola whose vertex is $(2, -5)$ and whose y-intercept is 3. One way to approach this is to write $y = ax^2 + bx + c$ and find a, b and c based on the information above.