

Simplify and write the answer so all exponents are positive:

1. (5pts) $(2x^{-5}y^{-2})^2(3x^{-2}y^2)^4 =$

2. (7pts) $\frac{(6a^{-5}b^3)^2}{(4a^3b^{-2})^3} =$

3. (4pts) Convert to scientific notation or a decimal number:

$4.72391 \times 10^4 =$

$0.000000029571 =$

Simplify and write in standard form:

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

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

Use formulas to expand:

6. (4pts) $(7u - 2v)(7u + 2v) =$

7. (5pts) $(3x^2 + 5y^3)^2 =$

8. (6pts) $(3x - 2)^3 =$

Factor the following. Use either a known formula or a factoring method.

9. (3pts) $x^2 + 3x - 40 =$

10. (6pts) $6x^2 + 11x - 7 =$

11. (6pts) $64u^3 - 125 =$

12. (6pts) The total gross domestic product for Kentucky in 2014 was estimated to be 188,602 million dollars. Kentucky's population for 2014 was estimated at 4,413,500. Calculate the total gross domestic product per person for Kentucky (dollars per person), and write it in scientific notation, rounded to six decimal points.

College Algebra — Joysheet 2
MAT 140, Spring 2016 — D. Ivanšić

Name: _____

Covers: R.5-R.7 Show all your work!

Solve the equations.

1. (3pts) $3x - 7(2x + 1) = 5(x - 2) + 4$

2. (6pts) $x^2 - 4 = 5x + 10$

3. (5pts) Solve the equation for z :

$$b^2z = az - 7$$

Simplify.

4. (8pts) $\frac{x - 3}{4x^2 + 23x + 15} - \frac{2x}{x^2 - 25} =$

5. (8pts) $\frac{\frac{3}{x} - \frac{x + 1}{x - 3}}{\frac{2x}{x - 3} + \frac{x + 4}{x}} =$

Simplify, showing intermediate steps. Assume variables can be any real numbers.

6. (2pts) $\sqrt{108} =$

7. (4pts) $\sqrt{45x^3y^4} =$

8. (5pts) $\frac{\sqrt[3]{54x^7y^{10}}}{\sqrt[3]{16xy^2}} =$

9. (8pts) Simplify. Express answers first in terms of positive exponents, then convert to root notation.

$$\frac{\left(x^{\frac{2}{5}}y^{\frac{4}{3}}\right)^{\frac{3}{2}}}{\left(x^{\frac{1}{5}}y^{-\frac{2}{3}}\right)^2} =$$

10. (6pts) Simplify.

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

11. (5pts) Rationalize the denominator.

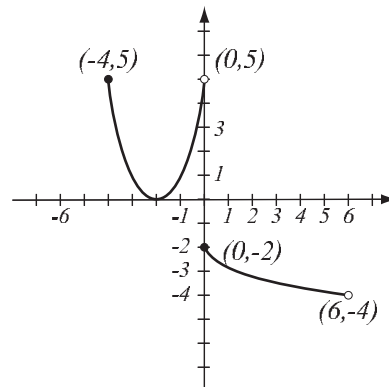
$$\frac{\sqrt{5} + 3\sqrt{2}}{\sqrt{5} - \sqrt{2}}$$

1. (10pts) Draw the points $A = (0, 3)$, $B = (3, -4)$ and $C = (7, 6)$.
- a) Which of points B or C is closer to A ?
- b) Are the lines AB and AC perpendicular? (*Hint: That's the same as asking whether the triangle ABC is a right triangle.*)

2. (8pts) Write the equation of the circle whose diameter has endpoints $(4, -5)$ and $(2, 1)$. Sketch the circle.

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

- a) Find $f(-4)$ and $f(0)$.
- b) What is the domain of f ?
- c) What is the range of f ?
- d) What are the solutions of the equation $f(x) = 1$?



4. (12pts) The function

$$f(x) = 2x\sqrt{6-x} + 3 \text{ is given.}$$

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. (12pts) Find the domain of each function and write it using interval notation.

$$g(x) = \frac{x^2 + 5}{x^2 + 6x - 16}$$

$$f(x) = \frac{\sqrt{x}}{3x - 2}$$

6. (10pts) Let $g(x) = \frac{\sqrt{3x+15}}{x^2-4}$. Find the following (simplify where appropriate).

$$g(7) =$$

$$g(-6) =$$

$$g(2u) =$$

$$g(x+7) =$$

5. (12pts) Manuela used the same cab company twice recently. On one occasion, she traveled 4 miles and paid \$11.71. On another occasion, she traveled 11 miles and paid \$28.44.
- Assuming that the cost of a cab ride with this company $C(x)$ is a linear function of miles traveled x , write a formula for $C(x)$.
 - How much would Manuela pay if she rode 0 miles? What is the meaning of this number?
 - What is the meaning of the slope in this example?

6. (20pts) A convenience store manager is trying to establish the relationship between the daily high temperature and the number of bottles of beverages sold on the day. The table shows the data: T is the temperature in $^{\circ}\text{F}$, and S is the number of bottles sold. Solve the problems below with accuracy 6 decimal points.
- Draw the scatterplot of the data. Does the relationship look linear?
 - Use two points in the scatterplot to get an equation of a line that models the relationship between T and S . Draw the line on the graph.
 - Use your calculator to find the “line of best fit” for the data. Draw the line on the graph.
 - Find the coefficient of correlation r . How strong is the linear relationship between T and S ?
 - What amount of sales does the manager expect if the temperature is 92° ?

T	S
58	335
64	410
68	460
70	450
75	610
80	735
84	780

Solve the inequalities. Write your solution in interval notation.

1. (5pts) $-2 \leq 3x - 4 < 8$

2. (7pts) $3x - 1 \leq 5$ or $2x + 7 > 18$

3. (6pts) Find the domain of the function in interval notation: $f(x) = \frac{\sqrt{4 - 5x}}{2x + 15}$.

4. (14pts) For her birthday, Christa is considering renting an event venue. Her choices are Party Pad, which charges \$100 per event plus \$40 per hour, or Fiesta Flat, which charges \$200, which includes two hours, and then \$30 per hour for every hour after the first two. Christa plans her party to last at least two hours. For which number of hours is Party Pad the better option for her?

5. (14pts) A 250-mile-long road joins cities Frogtown and Snakeville. At the same time, one car leaves Frogtown and drives toward Snakeville, and another car, driving 11mph faster than the first car, leaves Snakeville and drives toward Frogtown. After 2 hours they meet on the road.

- a) What are the speeds of the cars?
- b) How far from Frogtown did they meet?

6. (14pts) How many liters of a 10% solution of hydrobromic acid must be mixed with 7 liters of a 25% solution of hydrobromic acid in order to get a 19% solution of hydrobromic acid?

1. (10pts) Use your calculator to accurately sketch the graph of the function $f(x) = |x + 7| \cdot \sqrt[3]{x}$. Draw the graph here, indicate units on the axes, and solve the problems below with accuracy 6 decimal points.

- Find the local maxima and minima for this function.
- State the intervals where the function is increasing and where it is decreasing.

2. (20pts) Let $f(x) = \sqrt{2x + 7}$, $g(x) = \frac{2x}{x^2 + 5x - 14}$. Find the following (simplify where possible):

$$(f - g)(1) =$$

$$(fg)(-2) =$$

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

$$(f \circ g)(2) =$$

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

The domain of $(fg)(x)$ in interval notation

3. (8pts) Consider the function $h(x) = \sqrt{x^2 + 5}$. Find functions f and g so that $h(x) = f(g(x))$. Find two different solutions to this problem, neither of which is the “stupid” one.

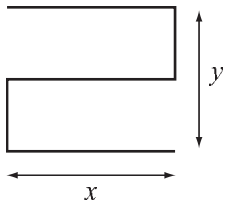
4. (8pts) Sketch the graph of the piecewise-defined function:

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

5. (14pts) A self-storage business is adding a 1000-square-foot building with two large units that share a wall and have openings on opposite sides (see picture). They wish to minimize the total length of the walls.

a) Express the total length of the walls of the building 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 building for which the total length of the walls is minimal?



1. (21pts) For the following functions:

a) determine algebraically whether they are odd, even, or neither

b) use the calculator to draw their graphs on paper and verify your conclusions by stating symmetry.

$$f(x) = x^2 - 3|x|$$

$$g(x) = x^3 + x^2 - 3x - 5$$

$$h(x) = x^3 + 5x$$

2. (16pts) Using transformations, draw the graphs of $f(x) = (x+1)^2 - 3$ and $g(x) = -\frac{1}{2}x^3 + 4$. Explain how you transform graphs of basic functions in order to get the graphs of f and g .

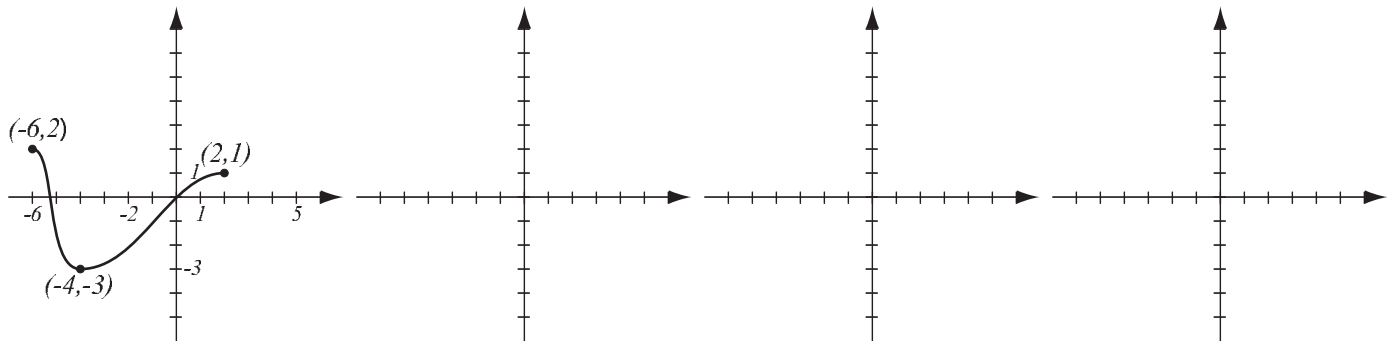
3. (10pts) Write the equation for the function whose graph has the following characteristics:

a) shape of $y = \frac{1}{x}$, shifted up 4 units

b) shape of $y = \sqrt{x}$ shifted left 2 units, then stretched vertically by factor 3

c) shape of $y = x^2$, stretched horizontally by factor 2, then reflected about the x -axis, then shifted right 5 units.

4. (13pts) The graph of $f(x)$ is drawn below. On three separate graphs, sketch the graphs of the functions $f(x - 1)$, $-f(2x)$ and $f(-x) + 3$ and label all the relevant points.



College Algebra — Joysheet 8
MAT 140, Spring 2016 — 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) $2 + 3i - 2i(4 - i) =$

2. (6pts) $\frac{1 - 2i}{4 + 9i} =$

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

$i^{135} =$

4. (6pts) Starting from rest, an object falling t seconds travels approximately $s = 5t^2$ meters. How long would it take for a TV set to fall from a tower 80 meters tall?

5. (8pts) Solve the equation: $6x^4 + 13x^2 - 5 = 0$

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

$x^2 + 22x + 5 = 0$

7. (12pts) The quadratic function $f(x) = 4x^2 - 4x - 15$ 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. (14pts) Cory has a plot of land that is 45 by 70 meters. He plans to irrigate it from a well inside the plot (whose location is not known in advance) with a hose 60 meters long. In order to be sure the hose can reach all parts of the plot he decides to reduce the dimensions of the plot: the 45-meter side by a certain amount, and the 70-meter side by 5 meters more than the amount the 45-meter side is reduced. By how much will Cory reduce the 45- and 70-meter sides to be sure that the hose can reach every part of the plot, wherever the well is in the plot? (Note that this is equivalent to having the diagonal of the new plot be 60 meters, since the diagonal represents the greatest distance between any two points in a rectangle.)

College Algebra — Joysheet 9
MAT 140, Spring 2016 — D. Ivanšić

Name: _____

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

1. (4pts) Solve the equation.

$$|3x - 1| = 10$$

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

$$|x + 4| < 7$$

$$|2x - 1| \geq 5$$

Solve the equations:

3. (8pts) $\frac{x}{x-3} - \frac{3}{x+1} = \frac{4x+16}{x^2-2x-3}$

4. (8pts) $x = 4 + \sqrt{40 - 6x}$

5. (14pts) A ball is thrown upwards from the ground with initial velocity 24 meters per second. Its height in meters after t seconds is given by $s(t) = -5t^2 + 24t$.

a) Sketch the graph of the height function.

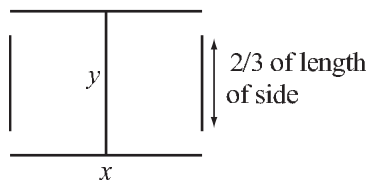
b) When does the ball reach its greatest height, and what is that height?

c) When is the ball at height 21 meters?

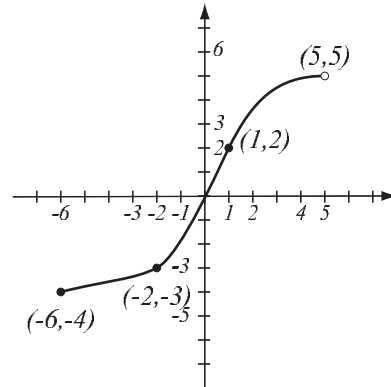
6. (14pts) A company is building a warehouse divided into two parts with four doors, so the walls with the doors have length $2/3$ the length of that side of the building (see picture). They have budgeted for 9000 feet of walls, and their goal is to maximize the enclosed area.

a) Express the area of the warehouse 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 warehouse that has the greatest area and what is the greatest area possible?



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



2. (12pts) Let $f(x) = \frac{x}{2x - 1}$. Find the formula for f^{-1} . Find the domain and range of f^{-1} .

3. (8pts) Evaluate without using the calculator:

$$\log_3 81 =$$

$$\log_2 \frac{1}{16} =$$

$$\log_8 16 =$$

$$\log_b \sqrt[8]{b^5} =$$

4. (4pts) Use your calculator to find $\log_3 33$ 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 \$10,000 and annual interest rate of 4%, calculate the amount in the account after 1 year for the frequencies of compounding below.

- Write the general formula for the amount, replacing the variables by numbers, if known.
- Use the table feature on your calculator to quickly compute amounts after 1 year and enter them below.
- 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 $f(x) = \log_4(3 - 6x)$.

7. (6pts) The number of students from India enrolled in U.S. universities is modeled by the function $I(t) = 9000(1.0878)^t$, where t is the number of years since 1980.

- Estimate the number of students from India in 1992. According to the model, what will be the number of students from India in 2020? (Round to whole numbers.)
- Use the intersect feature on the calculator to estimate in what year the number of students from India went past 100,000.

8. (9pts) Using transformations, draw the graph of $f(x) = 4 - \log_3(x + 5)$. 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.

1. (5pts) If $\log_a 5 = 0.5943161$ and $\log_a 8 = 0.767874$, find (show how you obtained your numbers):

$$\log_a \frac{5}{8} =$$

$$\log_a 200 =$$

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

$$\log_4 (16u^3v^8) =$$

$$\log_3 \sqrt[5]{\frac{81x^{-2}y^4}{x^{-5}y}} =$$

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

$$\frac{1}{3} \log(8x^2) - 4 \log(3y^{\frac{3}{2}}) - \log(x^{\frac{5}{3}}) =$$

$$3 \ln(x - 2) - 2 \ln(x + 5) + 4 \ln(x^2 + 3x - 10) =$$

Solve the equations.

4. (5pts) $32^{2x+1} = \left(\frac{1}{8}\right)^{2x-5}$

5. (7pts) $7^{3-2x} = 3^{x+4}$

6. (8pts) $2^x + 3 = 18 \cdot 2^{-x}$

7. (12pts) According to World Bank data, world population was 5.2827 billion in 1990 and 7.2607 billion in 2014. (Do you still feel unique?) Assume it grows exponentially.

a) Write the function describing the number $P(t)$ of people t years after 1990. Then find the exponential growth rate of world population.

b) Graph the function.

c) According to this model, when will the population reach 9 billion?