

Practice Questions for Midterm 1 – Math 1060Q – Fall 2014

The following is a selection of problems to help prepare you for the first midterm exam. Please note the following:

- there may be mistakes – email steven.pon@uconn.edu if you find one.
 - learning math is about more than just memorizing the steps to certain problems. You have to understand the concepts behind the math. In order to test your understanding of the math, you may see questions on the exam that are unfamiliar, but that rely on the concepts you've learned. Therefore, you should concentrate on learning the underlying theory, not on memorizing steps without knowing *why* you're doing each step.
1. Review your algebra skills! Although there will not be explicit “algebra” questions on the exam, your grade on the exam will be hurt significantly if you make algebraic mistakes. You can go back to the Algebra Exam Review for some practice problems.
 2. Let $f(x) = 5x - 2$ and $g(x) = x^2 + 3x$.
 - (a) What is $(f \circ g)(3)$?
 - (b) What is $g(\sqrt{x})$?
 - (c) What is $g(1 + h)$?
 - (d) What is $f^{-1}(2)$?
 - (e) Is g one-to-one? Why or why not?
 - (f) Which of the following points is on the graph of f^{-1} ?
 (a) (0,3) (b) (2,1) (c) (0,0) (d) (3,1)
 - (g) Compute a formula for $(g \circ f)(x)$ and simplify it.
 - (h) What is the range of g ?
 - (i) Compute a formula for $f^{-1}(x)$.
 - (j) What is the domain of f/g ?
 - (k) What is the domain of g/f ?
 - (l) What is the domain of $f \circ g$?
 - (m) What is the domain of $g \circ f$?
 3. Let $f(x) = \sqrt{2-x}$ and $g(x) = 4/x$. Find a formula for each of $f + g$, $f \cdot g$, f/g , g/f , $f \circ g$, and $g \circ f$. In the first four cases, find the domain of the function.
 4. Find $f^{-1}(x)$ if $f(x) = 1 + \frac{2}{3+x}$.
 5. Find $g^{-1}(x)$ if $g(x) = \frac{x-1}{2x+5}$.

6. Let f and g be 1-1 functions satisfying

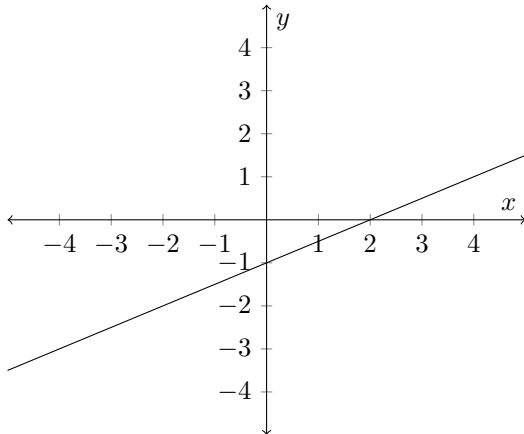
x	$f(x)$	$g(x)$
0	1	3
1	2	2
2	3	4
3	4	0

Evaluate the following:

- (a) $(f \circ g)(0)$
- (b) $(g \circ f)(0)$
- (c) $f^{-1}(2)$
- (d) $(g^{-1} \circ f)(1)$
- (e) $(f^{-1} \circ g^{-1})(0)$

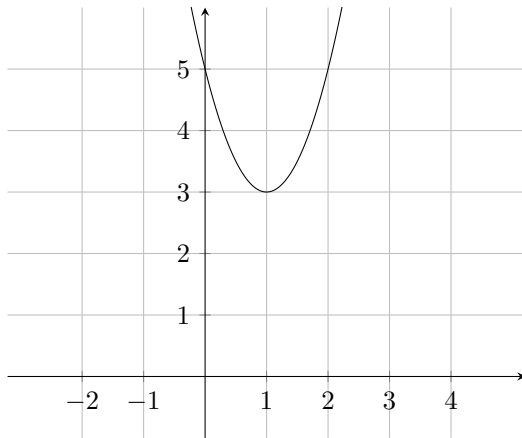
7. Sketch a graph of the function $f(x) = \begin{cases} \sqrt{x} + 2 & \text{if } x > 1 \\ 0 & \text{if } x = 1, \\ -x - 2 & \text{if } x < 1 \end{cases}$, and state its domain and range.
8. If $f(x) = (x - 2)^2 + 1$, find a subset of the domain on which f is 1-1, and on this subset, find a formula for f^{-1} .
9. Repeat the previous problem for $g(x) = |x - 3| - 4$.
10. Find the equation of the line through $(1, 2)$ and $(3, 4)$.
11. Find the equation of the line through $(5, 6)$ parallel to $y + 5 = 3x$.

12. Find the equation of the line below.

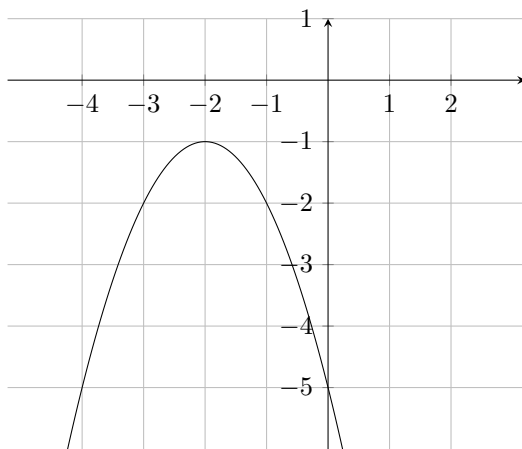


13. Find the equation of the line through $(-3, 2)$ perpendicular to $y = 5x + 7$.
14. For each of the quadratic functions below, do five things:
1. find its roots, if any
 2. find its y-axis intercept
 3. complete the square
 4. graph it
 5. determine its range
- (a) $x^2 - 4x$
- (b) $x^2 + 10x - 4$
- (c) $-x^2 + 6x + 2$
- (d) $x^2 + 5x + 1$
- (e) $3x^2 - 9x + 12$
- (f) $2x^2 + 3x + 4$
15. Find a function f whose graph is a parabola with a vertex at $(1, 3)$ such that $f(2) = 7$.

16. What is the equation of the parabola below?



17. What is the equation of the parabola below?



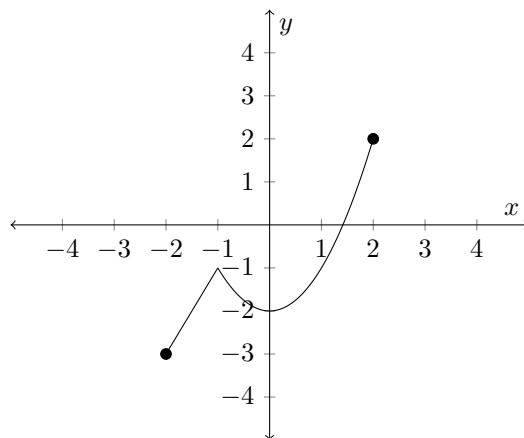
18. Sketch a graph of the function $g(x) = \sqrt{2x-1} + 2$, and label three points on the graph, in addition to its axis intercepts.

19. Sketch a graph of the function $f(x) = -|x+3| - 2$, and state its range.

20. Sketch a graph of the function $f(x) = 2^{1-x}$.

21. Sketch a graph of the function $h(x) = |x^2 - 3|$.

22. Given the graph of f below, sketch the graphs of $f(-x-1)$, $-f(x)-1$, and $2f(2x)$.



23. Calculate $(3x^3 - 2x^2 + 4x - 3) \div (x^2 + 3x + 3)$.

24. Calculate $(20x^3 + 16x^2 + 26x - 9) \div (5x - 1)$.
25. What is the degree and the leading coefficient of the polynomial $-3(x - 3)^2(x + 5)(2x - 2)^4$? Determine its end behavior. Sketch a graph of the polynomial.
26. Sketch a graph of the polynomial $f(x) = (x - 2)(x^2 + 6x + 9)$.
27. Sketch a graph of the polynomial $g(x) = -\frac{1}{2}(x - 3)(x + 1)(x - 2)^2$.
28. Sketch a graph of the polynomial $h(x) = -x^3 + 2x$.
29. Use the Intermediate Value Theorem to show that the polynomial $p(x) = x^{94} - 3x^2 + 1$ has a root in the interval $[-2, 1]$.
30. True or false? If $f(x) = \frac{3}{x-2}$, since $f(-2) = -\frac{3}{4}$ and $f(3) = 3$, by the Intermediate Value Theorem, f must have a root in $(-2, 3)$.
31. Compute or simplify the following:
- (a) $\log_3 3$
 - (b) $\log_7 1$
 - (c) $\log_{25} 5$
 - (d) $\log_{25} \frac{1}{5}$
 - (e) $\log_{25} -5$
 - (f) $\log_{25} 125$
 - (g) $\log_{25} 0$
 - (h) $\log_4 2^{37}$
 - (i) $\log_2 4^{37}$
 - (j) $3^{\log_3 9}$
 - (k) $3^{\log_2 16}$
 - (l) $e^{\ln x}$
 - (m) $e^{\ln x^2 + 5}$
 - (n) $\ln e^2$
 - (o) $\ln e^0$
32. Does the function $x^3 - x$ have an inverse?
33. Find an inverse for the function $f(x) = 2 \log_3 x$.
34. Find an inverse for the function $g(x) = \frac{e^{x+4}}{2}$.
35. What is the domain of the function $\ln |x|$? Can you find an inverse for this function?
36. Sketch a graph of $\log_2(x + 4)$.
37. Solve for x : $3 \ln(x) - 2 = 4$.
38. Solve for x : $\log_2 \frac{1}{2} + 3 = \frac{1}{x}$.
39. Simplify $\ln(e^{\ln(e^x)})$.
40. Given the function $f(x) = \frac{x^2 - 9}{x(x - 3)}$:
- (a) Find any vertical asymptotes of f .
 - (b) Find any horizontal asymptotes of f .
 - (c) Find any zeros of f .
 - (d) What is the domain of f ?

- (e) Sketch a graph of f .
41. Given the function $f(x) = \frac{(x+1)(x-4)}{(x+4)(x+1)(x+7)}$:
- Find any vertical asymptotes of f .
 - Find any horizontal asymptotes of f .
 - Find any zeros of f .
 - What is the domain of f ?
 - Sketch a graph of f .
42. Graph the function $f(x) = \frac{1}{x-2} + \frac{3}{x+2}$, clearly indicating any zeros, holes, and asymptotes.
43. Does the function $f(x) = \frac{3x-6}{2^x}$ have any vertical asymptotes?
44. Does the function $f(x) = \frac{3}{2^x-8}$ have any vertical asymptotes? Horizontal asymptotes?
45. Kyle is driving from City A to City C at a constant rate of 30 mph. In between, is City B. City A is 180 miles from City B, and City B is 40 miles from City C. Write Kyle's distance from City B as a function of time.
46. The length of a rectangle is six feet more than twice its width. Its area is 28. Find the dimensions of the rectangle.
47. The concentration of a certain antibiotic in a patient's bloodstream is given by $C(t) = \frac{25t}{t^2+600}$, where t represents the number of hours since the antibiotic was taken.
- Explain the meaning of the horizontal asymptote of this function.
 - What is the concentration after 3 hours on the antibiotic?
 - The antibiotic is only effective if its concentration is above 0.5. When must the patient take another dose?
48. You could see a few conceptual questions on the exams as well, i.e., questions that require written explanation or critical thought, rather than calculation. Here are a few examples.
- Explain the difference between $f(x) = \frac{x^2-2x+1}{x-1} = \frac{(x-1)(x-1)}{x-1}$ and $g(x) = x - 1$.
 - Explain why a function needs to be one-to-one in order to have an inverse. If you like, you can use the function $f(x) = |x|$ as an example.
 - Explain why the vertical line test tells you if a graph represents the graph of a function or not.
 - If the range of f is $[0, \infty)$ and the domain of f is $(-\infty, \infty)$, what is the domain of f^{-1} ?
 - Is $f(x) = \sqrt{x}$ the inverse of $g(x) = x^2$?
 - Complete the following definition: a function f is increasing if, for all $x_1 < x_2, \dots$
 - Let $f(x) = \sqrt{x}$. Then as $x \rightarrow \infty, \sqrt{x} \rightarrow ???$.
 - Define the function $\log_2 x$.
 - True or false? If a function passes the horizontal line test, then so does its inverse.
 - Give an example of a function whose domain is $(1, \infty)$ and whose range is $(-\infty, \infty)$.
 - Which is a bigger number, $\ln(10)$ or $\log_{10}(e)$?
 - In order for 3 to be in the domain of $f \circ g$, must it be true that 3 is in the domain of f ?
49. Want more questions? Check out the Learning Objectives in the Course Outline. Each week's set of learning objectives contains some sample problems as well. These sample problems won't have solutions, but you can talk to your instructor, fellow students, or the Q Center to get solutions.