

Math 3C
Practice Midterm Examination

Week 0 and 1

1. Solve the inequality

$$3|x - 7| + 5 > 20$$

to get an expression for x . Express your answer in *both* interval notation and on a number line.

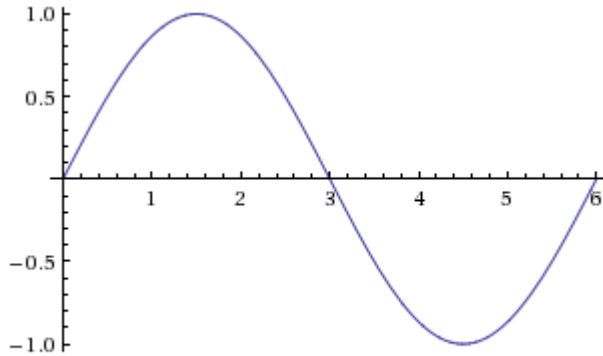
2. What is the radius of the largest circle you can make if you have 8 inches of string?
3. Let l be the line through the point $(3, 2)$ with slope $1/2$.
- (a) Find the equation of the line l . Simplify your answer so that it is in $y = mx + b$ form.
- (b) Find the equation of the line through $(2, 6)$ that is perpendicular to l .
4. Consider the line segment between $(1, 9)$ and $(-5, 1)$.
- (a) Find the length of the line segment above.
- (b) Find the midpoint of the line segment above.
- (c) Show the distance from the midpoint you found in part (b) to the point $(1, 9)$ is half the distance from $(1, 9)$ to $(-5, 1)$
5. Find the minimum value of $3x^2 + 6x + 3$.
6. Find the vertex of the parabola $y = x^2 + 3x + 1$.
7. Solve for x .
- (a) $4x^2 + 3x - 1 = 0$
- (b) $x^2 + 3x + 1 = 0$
8. Find the center and radius of the circle:

$$x^2 - 4x + y^2 + 4y = -1$$

9. Find the point on the line $y = 2x + 1$ that is closest to the point $(1, 4)$.
10. What is the largest domain where the following functions are defined?
- (a) $f(x) = \sqrt{x^2 + 1}$
- (b) $f(x) = \frac{x+1}{2x-1}$
- (c) $f(x) = \frac{x+7}{\sqrt{|x|-5}}$

Week 2

11. Let $f(x)$ be the function pictured in the figure. The domain is $[0,6]$.



- (a) What is the range of $f(x)$?
- (b) What is the domain and range for $2f(x)+3$? Describe the transformations in words. Sketch this function on the axis with the graph of f .
- (c) What is the domain and range of $f(-2x)$? Describe the transformations in words. Sketch this function on the axis with the graph of f .
- (d) What is the domain and range of $3f(x-2)$? Describe the transformations in words. Sketch this function on the axis with the graph of f .
12. Graph $y = x^3$ and $y = 3(x + 1)^3$ on the same axis.
13. Assume g is an even function and $g(x)$ has the values below.

x	$g(x)$
1	2
2	3
3	4
4	1
5	4

- (a) What is $g(2)+g(3)$?
- (b) What is $g(-2)+g(-3)$?
- (c) What is $2g(-4)$?
- (d) What is $-g(2)$?
14. Let
- $$f(x) = x^3 + 1 \qquad g(x) = \frac{x + 1}{x - 1} \qquad h(x) = (x - 1)^{1/3}$$
- (a) What is $(g \circ f)(x)$?
- (b) What is $(h \circ g \circ f)(1)$?
- (c) What is $(f \circ h)(x)$?

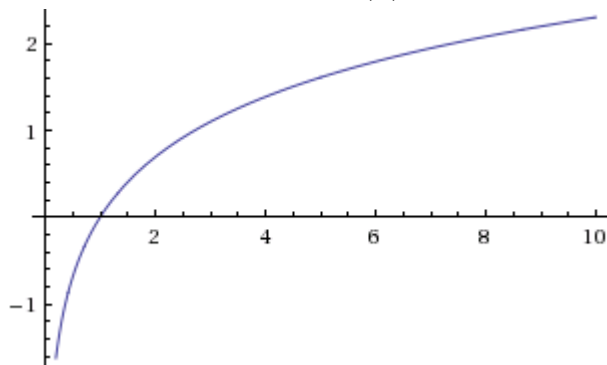
- (d) What is $(h \circ f)(x)$?
- (e) Find $f^{-1}(x)$.
15. Write $h(x) = \frac{\sqrt{x+1}+7}{(x+1)^{3/2}-1}$ as a composition of simpler functions, i.e. find $f(x)$ and $g(x)$ such that $h(x) = (f \circ g)(x)$.
16. Find the largest interval containing $x = 2$ where $f(x) = 2x^2 - 4x + 5$ has an inverse.
17. Consider the function $f(x) = x^3 + 3$ on $[0, 3]$.
- (a) Use the fact that $f(x)$ is increasing on the interval to find the range of $f(x)$.
- (b) Find $f^{-1}(y)$.
- (c) What is the domain of $f^{-1}(y)$? (Hint: Do NOT use part (b) to help you.)
- (d) What is the range of $f^{-1}(y)$?
18. Find the inverse of $f(x) = \frac{2x}{x+3}$

Week 3

19. Consider the function in the table below. It tells you for each element of the domain {newborns, infants, toddlers, kids, teens, adults} how much sleep is needed in hours.

x	f(x)
newborns	17
infants	14
toddlers	12
kids	11
teens	9
adults	8

- (a) What is $f(\text{teens})$? Write a short sentence describing in words what this means.
- (b) What is $f^{-1}(12)$? Write a short sentence describing in words what this means.
20. Below is the graph of $f(x) = \ln(x)$. The function $y = e^x$ is the inverse of $\ln(x)$.
- (a) Using the graph of $y = \ln(x)$, sketch the graph of e^x on the same axis.



- (b) The domain of $\ln(x)$ is $(0, \infty)$ and the range is $(-\infty, \infty)$. What is the domain and range of e^x ?
21. Explain why the horizontal line test works to test if a function is one-to-one.

22. Simplify $2^4 4^{15} 16^8$ as a power of 4.

23. Let

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

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

$h(x)$ = a degree 5 polynomial

- (a) How many zeros does $f(x)$ have?
- (b) How many zeros could $h(x)$ have? (List all possibilities.)
- (c) What is $f(x)g(x)$? Simplify.
- (d) What is the degree of $g(x)+h(x)$? (List all possibilities.)
- (e) What is the degree of $g(x)h(x)$?
- (f) What is $f(x)-g(x)$?
- (g) What happens to $f(x)$ as $x \rightarrow \infty$?
- (h) Describe the end behavior of $g(x)$.