

1. Express the area and circumference of a circle as functions of the circle's radius. Then express the area of the circle as the function of the circumference.
2. A point P in the first quadrant lies on the parabola $y = x^2$. Express the coordinates of P as a function of the angle of inclination of the line joining P to the origin, and the length of this line. It may help to draw a picture.
3. Determine whether the following functions are even, odd or neither.
 - (a) $y = x^2 + 1$
 - (b) $y = 1 - \cos x$
 - (c) $y = x^5 - x^3 - x$
 - (d) $y = \sec(x) \tan(x)$
4. Suppose f, g are odd functions defined for all the real line $\mathbb{R}$, determine whether fg , f^3 , $f \sin(x)$, $g \sec(x)$, and $|g|$ are even, odd, or neither.
5. Find the domain and range of the following.
 - (a) $y = |x| - 2$
 - (b) $y = -2 + \sqrt{1 - x}$
 - (c) $y = \sqrt{16 - x^2}$
 - (d) $y = 3^{2-x} + 1$
6. Write formulas for $f \circ g$ and $g \circ f$ and find the domain and range of each where $f(x) = 2 - x^2$ and $g(x) = \sqrt{x + 2}$.
7. Suppose the graph of g is given. Write equations for the graphs that are obtained from shifting the graph up $1/2$ unit and right 3, reflected in the y axis, compressed horizontally by a factor of 5.
8. Explain how the graphs for $y = f(x - 5)$, $y = f(-3x)$, $y = -3f(x) + 1/4$ are obtained from the graph for $y = f(x)$.
9. Sketch $y = \cos 2x$ and $y = \sin \pi x$ and give their periods.
10. Prove the identity $\frac{1 - \cos x}{\sin x} = \frac{\sin x}{1 + \cos x}$.
11. Graph the equation $|x| + |y| = 1 + x$.
12. Let f be a function whose domain is symmetric about the origin. Show that f is the sum of an even function E and an odd function O . Hint: Let $E(x) = (f(x) + f(-x))/2$.

13. Suppose that f and g are defined for all t and that $\lim_{t \rightarrow t_0} f(t) = -7$ and $\lim_{t \rightarrow t_0} g(t) = 0$ find the limit as $t \rightarrow t_0$ of the following functions. $3f(t)$, $f(t)^2$, $f(t)g(t)$, $\frac{f(t)}{g(t)-7}$, $\cos g(t)$.
14. On what intervals are $f(x) = x^{1/3}$ $g(x) = \frac{\sin x}{x}$ and $h(x) = x^{-2/3}$ continuous ?
15. Find the following limits or show they do not exist.
- (a) $\lim_{x \rightarrow 1} \frac{1-\sqrt{x}}{1-x}$
 - (b) $\lim_{x \rightarrow a} \frac{x^2-a^2}{x^4-a^4}$
 - (c) $\lim_{x \rightarrow -} \frac{\frac{1}{2+x} - \frac{1}{2}}{x}$
 - (d) $\lim_{x \rightarrow \pi^-} \csc x$
 - (e) $\lim_{x \rightarrow \pi} \sin(\frac{x}{2} + \sin x)$
 - (f) $\lim_{x \rightarrow 0} \frac{\cos 2x - 1}{\sin x}$
 - (g) $\lim_{x \rightarrow 0^+} \frac{2e^{1/z}}{e^{1/z} + 1}$
16. Can $f(x) = x(x^2 - 1)/|x^2 - 1|$ be extended to a continuous function at $x = 1$ or -1 ?
17. Find the limits:
- (a) $\lim_{x \rightarrow \infty} \frac{2x+3}{5x+7}$
 - (b) $\lim_{x \rightarrow -\infty} \frac{x^2-4x+8}{3x^3}$
 - (c) $\lim_{x \rightarrow \infty} \frac{\sin x}{[x]}$
 - (d) $\lim_{x \rightarrow \infty} e^{1/x} \cos(1/x)$
18. Show that the equation $x + 2 \cos x = 0$ has at least one solution.

Math 1110 Prelim #1 Topics & Information

Date: Thursday February 23rd, 7:30 pm–9 pm

Location: RCK 201 (Schwartz Auditorium)

The first Prelim will be on Chapters 1 and 2 from our text. More specifically, you will be responsible for material covered in sections 1.1, 1.2, 1.3, 1.5, 1.6 from Chapter 1, and 2.1, 2.2, 2.4, 2.5, 2.6 in Chapter 2. You may not consult books, notebooks or calculators during the prelim. **You MAY bring one 4×6 notecard to use during the exam.**

Reworking old homework exercises, and examples from class, is a great way to study. Solutions to all even numbered exercises and presentation questions are posted (or will be posted) on blackboard. Next week in Math 1011 Ray Cole will be running review sessions. Here are the times and locations:

Prelim 1 Review: Wed Feb 22nd 4:30pm – 6pm and repeated at 7:30pm-9pm in 253 MLT

Below is a list of vocabulary words, theorems, topics, notational conventions, and expectations about background knowledge in algebra and trig. This list is not intended to be all inclusive; it is intended to help answer the question, “Should I know X?”

Vocabulary

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| • polynomial and rational functions | • average rate of change, instantaneous rate of change |
| • one-to-one function, inverse function | |
| • piecewise defined function | • secant line, tangent line |
| • even/odd function | • continuity, “continuous at c ”, “continuous from the right/left at c ”, discontinuity |
| • function composition | |
| • radians | • horizontal and vertical asymptotes |
| • logarithmic function, exponential function | • integer, rational number, real number |

Things you should know/Things you should be able to do

- Be familiar with the important types of functions frequently encountered in Calculus, and be able to state the domain and range of these functions. This includes polynomials, rational functions, the six basic trig functions, inverse trig functions, rational and integer powers of x (which includes x^2 , $\sqrt{x}$, $\frac{1}{x}$), e^x , $\ln x$, $|x|$, and the floor and ceiling functions $\lfloor x \rfloor$, $\lceil x \rceil$. Note that $\sin^{-1} x$ is equal to $\arcsin x$, and not $\frac{1}{\sin x} = (\sin x)^{-1}$. However, $\sin^2 x = (\sin x)^2$.
- Find limits of all types using relevant theorems. This is important, and covers most of the sections in Chapter 2. You should expect several questions about limits. You should be familiar with Theorems 1 through 12 in this Chapter. You should know how to use Theorem 4: The Sandwich Theorem, and Theorem 11: The Intermediate Value Theorem, explicitly by verifying the hypothesis are satisfied, and referring to the relevant Theorem by name.
- Be able to find the sum, difference, product, quotient, and composition of functions. Note that $f \circ g$ denotes function **composition**, not function multiplication.
- Understand how constants determine the shifting, scaling, and reflecting of a graph of a function. (pgs. 16 & 17)
- Know the 3 pythagorean identities ($\sin^2(x) + \cos^2(x) = 1$, etc). You should be able to use the other trig identities, but we do not expect that you will have these memorized.
- Be able to convert between degrees and radians, and use the unit circle to evaluate the 6 basic trig functions at the “special” angles. A unit circle can be found below.
- Know the rules for exponents (pg. 38) and the algebraic and inverse properties of logarithms (pg. 45 & 46).
- Determine if a function is one-to-one, and be able to find the inverse of a function.
- Determine if a function is even or odd.
- Use the continuity test to determine if a function is continuous at $x = a$.

