# Questions

## MATH 235 (Algebra 1)

1. Let A = {1, 2, 3, 4, 5} and B = {4, 5, 6, 7, 8}. Compute A union B and A intersect B.
2. Prove that (A union B) - B = A - B for any sets A and B.
3. Let f: R to R be defined by f(x) = x squared. Is f injective? Is f surjective?
4. Prove that the sum of a rational number and an irrational number is irrational.
5. Prove that there are infinitely many prime numbers.
6. Let z = a + bi be a complex number, where a, b are in R. Prove that —z— squared = z times z bar.
7. Let z, w are in C. Prove that —zw— = —z——w—.
8. Let A = ((a, b), (c, d)) be a 2 by 2 matrix. Prove that the characteristic polynomial of A is lambda squared - tr(A)lambda + det(A).

## MATH 222 (Calculus 3)

1. Compute the Taylor series expansion of sin(x) at x = 0 up to the x to the power of 4 term.
2. Let f(x, y) = x squared y - y cubed. Compute partial f/partial x and partial f/partial y.
3. Compute the double integral over R (2x - y) dA, where R is the rectangle with vertices (1, 0), (2, 0), (1, 1), (2, 1).
4. Let F(t) = (t squared, t squared) and C be the line segment from (0, 0) to (1, 1). Compute the line integral over C F dot dr.
5. Let f(x, y, z) = x squared + y squared + z squared. Compute the gradient of f.
6. Let F(x, y, z) = (x, y, z). Compute the curl of F.
7. Let F(x, y, z) = (x, y, z). Compute the divergence of F.
8. Let F(x, y, z) = (x, y, z) and S be the unit sphere. Compute the surface integral over S F dot dS.

## MATH 242 (Analysis 1)

1. Prove that the sequence {1/n} converges to 0.
2. Let {a_n} be a sequence defined by a_1 = 1 and a_n+1 = (1/2)(a_n + 2/a_n) for all n greater than or equal to 1. Prove that the sequence {a_n} converges.
3. Prove that the series from n=1 to infinity 1/n squared converges.
4. Let f(x) = x squared. Prove that f is continuous at x = 1.
5. Let f(x) = 1/x. Prove that f is not uniformly continuous on (0, 1).
6. Let f(x) = x squared. Prove that f is differentiable at x = 1.
7. Let f(x) = —x—. Prove that f is not differentiable at x = 0.
8. Let f(x) = x cubed. Prove that f is uniformly continuous on R.

## COMP 273 (Introduction to Computer Systems)

1. Convert the binary number 101101 to decimal.
2. Convert the hexadecimal number A3 to binary.
3. Design a simple combinational circuit with two inputs, A and B, and one output, F, such that F = 1 if and only if exactly one of A and B is 1.
4. Write a MIPS assembly program that computes the factorial of a non-negative integer n.
5. What is a direct-mapped cache?
6. What is virtual memory?
7. How does pipelining improve the performance of a computer?
8. What is an interrupt?

## COMP 206 (Introduction to Software Systems)

1. Write a C program that prints ”Hello, world!” to the console.
2. What is a system call?
3. What is a library in C?
4. What is a makefile?
5. What are version control systems?
6. What is debugging?

7. What is testing?
8. What is a pointer in C?