MAT 266 Test 1 Review

5.5 Integration with substitution: the idea is to recognize when an integral problem has the form of a function that came from applying the chain rule to the original function. To do these first find the inside function part of your integrand which is a composite function. Let u be equal to that. Then compute the differential du. Substituting u and du into the original integrand should give you a new integral with only u in it!!! Find the antiderivative in terms of u first then put back your original variables according to your substitution. Also understand how to find the new endpoint for a definite integral question without going back to the original variable.

6.1 Integration by parts: always choose *v dv* such that it is easy to find its antiderivative, and if you have a choice choose *u* such that its derivative simplifies the integration on the right hand side. Remember the examples when integration by parts is used twice. Be able to find an integral using the boomerang method.

6.2 **Part I:** If you have an odd power of sin(x) [or cos(x)] then rewrite the term as sin(x) times an even power of sin(x) [or cos(x)] and then use the trig. identity $\sin^2(x) = 1 - \cos^2(x)$. Next, use substitution $u = \cos(x)$ [or sin(x)]. Otherwise use double angle formulas in your integral. Similar techniques work for the functions tan x and sec x. **Part II:** Understand the basic ideas of trigonometric substitution. Know when to choose and which function. Don't forget to restrict the domain to be able to work with the inverse functions. Always draw a nice picture of a right triangle to express the trigonometric function needed in your solution.

6.3 Partial Fractions -- Always **divide first** numerator by denominator if the degree of numerator is not smaller than the degree of the denominator. Remember the special cases: multiple factors and irreducible quadratic factors. Use the zeros of the denominator to solve for the constants in your form. If you have multiple factors or irreducible quadratic factors then you have to choose some "nice" values. Be able to use complete the square technique and breaking up the integral into two

pieces for the integrals when it consists of a single term with an irreducible quadratic as the denominator.

6.4 Know how to use a table of integrals. Always identify the constants you are using in your problem. Remember that for the reduction formulas, sometime you have to apply the same formula again and again to obtain the final result. In some examples you will have to transform the integrand into the form as in the table. This might involve a substitution of variables or completing the square.

6.5 Be familiar with the different approximation rules (left, right, midpoint, trapezoid and Simpson's). Know the relations between them. Be able to do hand calculation when the function is given algebraically, numerically or graphically. Understand what properties of functions determine if the approximation is an under or overestimate (increasing-decreasing property for right and left sum and concavity for trapezoid and midpoint rule).