MATH 241, Spring 2023 Nathan Reading
A *very-far-from-complete* review of Calc 1

You should know and correctly use the following differentiation rules. (Some are written here in several different notations.)

Derivative of a Constant	$\frac{\mathrm{d}}{\mathrm{d}x}k = 0$		for constant k
Constant Multiple Rule	$(kf)' = kf'$	$\dfrac{\mathrm{d}}{\mathrm{d}x}\,kf = k\,\dfrac{\mathrm{d}f}{\mathrm{d}x}$	for constant k
Sum Rule	$(f+g)' = f' + g'$	$\dfrac{\mathrm{d}}{\mathrm{d}x}\,(f+g) = \dfrac{\mathrm{d}f}{\mathrm{d}x} + \dfrac{\mathrm{d}g}{\mathrm{d}x}$	
Product Rule	$(fg)' = fg' + f'g$	$\dfrac{\mathrm{d}}{\mathrm{d}x}\,fg = f\,\dfrac{\mathrm{d}g}{\mathrm{d}x} + \dfrac{\mathrm{d}f}{\mathrm{d}x}\,g$	
Quotient Rule	$\left(\dfrac{f}{g}\right)' = \dfrac{gf' - fg'}{g^2}$	$\dfrac{\mathrm{d}}{\mathrm{d}x}\,\dfrac{f}{g} = \dfrac{g\frac{\mathrm{d}f}{\mathrm{d}x} - f\frac{\mathrm{d}g}{\mathrm{d}x}}{g^2}$	
Chain Rule	$(f\circ g)' = f'(g)\cdot g'$	$\dfrac{\mathrm{d}}{\mathrm{d}x}\,f(g(x)) = \dfrac{\mathrm{d}f(g(x))}{\mathrm{d}g(x)}\cdot\dfrac{\mathrm{d}g(x)}{\mathrm{d}x}$	

You should know and correctly use the the derivatives of functions given below. *You should also either know the derivatives of the other* 4 *trigonometric functions or be able to find them using the Quotient Rule.*

$\dfrac{\mathrm{d}}{\mathrm{d}x}\,k = 0$	for constant k
$\dfrac{\mathrm{d}}{\mathrm{d}x}\,x^p = px^{p-1}$	
$\dfrac{\mathrm{d}}{\mathrm{d}x}\sin x = \cos x$	
$\dfrac{\mathrm{d}}{\mathrm{d}x}\cos x = -\sin x$	
$\dfrac{\mathrm{d}}{\mathrm{d}x}\arcsin x = \dfrac{1}{\sqrt{1-x^2}}$	

$\dfrac{\mathrm{d}}{\mathrm{d}x}\arctan x = \dfrac{1}{1+x^2}$	
$\dfrac{\mathrm{d}}{\mathrm{d}x}\,e^x = e^x$	
$\dfrac{\mathrm{d}}{\mathrm{d}x}\ln x = \dfrac{1}{x}$	
$\dfrac{\mathrm{d}}{\mathrm{d}x}\,a^x = (\ln a)a^x$	for $a > 0$
$\dfrac{\mathrm{d}}{\mathrm{d}x}\log_a x = \dfrac{1}{(\ln a)x}$	for $a > 0$

Using differentiation rules, you should be able to find the derivative of any function that we could write down using addition, subtraction, multiplication, division, composition, and the functions above.

You should be able to analyze a given function f, in particular finding critical values, intervals where f is increasing or decreasing, local maxima/minima, global maxima/minima if either or both exists, intervals where f is concave up or concave down, and points of inflection. You should be able to use your analysis of a given function to make a reasonable sketch of the function.

You should be able to compute an indefinite integral by recognizing a known antiderivative, using basic derivative facts (like constant multiple rule, addition/subtraction rules), using substitution, and/or using integration by parts.

You should be able to compute a definite integral by finding an antiderivative and using the Fundamental Theorem of Calculus. (Finding the antiderivative might involve any of the techniques described above for indefinite integrals.)