AB Calculus Exam – Review Sheet

A. Precalculus Type problems

	When you see the words …	This is what you think of doing
A1	Find the zeros of $f(x)$.	
A2	Find the intersection of $f(x)$ and $g(x)$.	
A3	Show that $f(x)$ is even.	
A4	Show that $f(x)$ is odd.	
A5	Find domain of $f(x)$.	
A6	Find vertical asymptotes of $f(x)$.	
A7	If continuous function $f(x)$ has $f(a)<k$ and $f(b)>k$, explain why there must be a value c such that $a<c<b$ and $f(c)=k$.	

B. Limit Problems

	When you see the words …	This is what you think of doing
B1	Find $\lim\limits_{x\to a} f(x)$.	
B2	Find $\lim\limits_{x\to a} f(x)$ where $f(x)$ is a piecewise function.	
B3	Show that $f(x)$ is continuous.	
B4	Find $\lim\limits_{x\to\infty} f(x)$ and $\lim\limits_{x\to-\infty} f(x)$.	
B5	Find horizontal asymptotes of $f(x)$.	

C. Derivatives, differentiability, and tangent lines

	When you see the words …	This is what you think of doing
C1	Find the derivative of a function using the derivative definition.	
C2	Find the average rate of change of f on $[a, b]$.	
C3	Find the instantaneous rate of change of f at $x = a$.	
C4	Given a chart of x and $f(x)$ and selected values of x between a and b, approximate $f'(c)$ where c is a value between a and b.	
C5	Find the equation of the tangent line to f at (x_1, y_1).	
C6	Find the equation of the normal line to f at (x_1, y_1).	
C7	Find x-values of horizontal tangents to f.	
C8	Find x-values of vertical tangents to f.	
C9	Approximate the value of $f(x_1 + a)$ if you know the function goes through point (x_1, y_1).	
C10	Find the derivative of $f(g(x))$.	
C11	The line $y = mx + b$ is tangent to the graph of $f(x)$ at (x_1, y_1).	
C12	Find the derivative of the inverse to $f(x)$ at $x = a$.	
C13	Given a piecewise function, show it is differentiable at $x = a$ where the function rule splits.	

D. Applications of Derivatives

	When you see the words …	This is what you think of doing
D1	Find critical values of $f(x)$.	
D2	Find the interval(s) where $f(x)$ is increasing/decreasing.	
D3	Find points of relative extrema of $f(x)$.	
D4	Find inflection points of $f(x)$.	
D5	Find the absolute maximum or minimum of $f(x)$ on [*a*, *b*].	
D6	Find range of $f(x)$ on $(-\infty,\infty)$.	
D7	Find range of $f(x)$ on [*a*, *b*]	
D8	Show that Rolle's Theorem holds for $f(x)$ on [*a*, *b*].	
D9	Show that the Mean Value Theorem holds for $f(x)$ on [*a*, *b*].	
D10	Given a graph of $f'(x)$, determine intervals where $f(x)$ is increasing/decreasing.	
D11	Determine whether the linear approximation for $f(x_1+a)$ over-estimates or under-estimates $f(x_1+a)$.	
D12	Find intervals where the slope of $f(x)$ is increasing.	
D13	Find the minimum slope of $f(x)$ on [*a, b*].	

E. Integral Calculus

	When you see the words …	This is what you think of doing
E1	Approximate $\int_a^b f(x)\,dx$ using left Riemann sums with n rectangles.	
E2	Approximate $\int_a^b f(x)\,dx$ using right Riemann sums with n rectangles.	
E3	Approximate $\int_a^b f(x)\,dx$ using midpoint Riemann sums.	
E4	Approximate $\int_a^b f(x)\,dx$ using trapezoidal summation.	
E5	Find $\int_b^a f(x)\,dx$ where $a < b$.	
E8	Meaning of $\int_a^x f(t)\,dt$.	
E9	Given $\int_a^b f(x)\,dx$, find $\int_a^b \left[f(x)+k\right]dx$.	
E10	Given the value of $F(a)$ where the antiderivative of f is F, find $F(b)$.	
E11	Find $\frac{d}{dx}\int_a^x f(t)\,dt$.	
E12	Find $\frac{d}{dx}\int_a^{g(x)} f(t)\,dt$.	

F. Applications of Integral Calculus

	When you see the words …	This is what you think of doing
F1	Find the area under the curve $f(x)$ on the interval $[a, b]$.	
F2	Find the area between $f(x)$ and $g(x)$.	
F3	Find the line $x = c$ that divides the area under $f(x)$ on $[a, b]$ into two equal areas.	

	When you see the words …	This is what you think of doing
F4	Find the volume when the area under $f(x)$ is rotated about the x-axis on the interval [a, b].	
F5	Find the volume when the area between $f(x)$ and $g(x)$ is rotated about the x-axis.	
F6	Given a base bounded by $f(x)$ and $g(x)$ on [a, b] the cross sections of the solid perpendicular to the x-axis are squares. Find the volume.	
F7	Solve the differential equation $\frac{dy}{dx} = f(x)g(y)$.	
F8	Find the average value of $f(x)$ on [a, b].	
F9	Find the average rate of change of $F'(x)$ on $[t_1, t_2]$.	
F10	y is increasing proportionally to y.	
F11	Given $\frac{dy}{dx}$, draw a slope field.	

G. Particle Motion and Rates of Change

	When you see the words …	This is what you think of doing
G1	Given the position function $s(t)$ of a particle moving along a straight line, find the velocity and acceleration.	
G2	Given the velocity function $v(t)$ and $s(0)$, find $s(t)$.	
G3	Given the acceleration function $a(t)$ of a particle at rest and $s(0)$, find $s(t)$.	
G4	Given the velocity function $v(t)$, determine if a particle is speeding up or slowing down at $t = k$.	
G5	Given the position function $s(t)$, find the average velocity on $[t_1, t_2]$.	
G6	Given the position function $s(t)$, find the instantaneous velocity at $t = k$.	

	When you see the words …	This is what you think of doing
G7	Given the velocity function $v(t)$ on $[t_1, t_2]$, find the minimum acceleration of a particle.	
G8	Given the velocity function $v(t)$, find the average velocity on $[t_1, t_2]$.	
G9	Given the velocity function $v(t)$, determine the difference of position of a particle on $[t_1, t_2]$.	
G10	Given the velocity function $v(t)$, determine the distance a particle travels on $[t_1, t_2]$.	
G11	Calculate $\int_{t_1}^{t_2} \lvert v(t) \rvert \, dt$ without a calculator.	
G12	Given the velocity function $v(t)$ and $s(0)$, find the greatest distance of the particle from the starting position on $[0, t_1]$.	
G13	The volume of a solid is changing at the rate of …	
G14	The meaning of $\int_a^b R'(t) \, dt$.	
G15	Given a water tank with g gallons initially, filled at the rate of $F(t)$ gallons/min and emptied at the rate of $E(t)$ gallons/min on $[t_1, t_2]$ a) The amount of water in the tank at $t = m$ minutes. b) the rate the water amount is changing at $t = m$ minutes and c) the time t when the water in the tank is at a minimum or maximum.	