AP Calculus – Final Review Sheet

When you see the words ….	**This is what you think of doing**
1. Find the zeros	
2. Find equation of the line tangent to $f(x)$ at (a,b)	
3. Find equation of the line normal to $f(x)$ at (a,b)	
4. Show that $f(x)$ is even	
5. Show that $f(x)$ is odd	
6. Find the interval where $f(x)$ is increasing	
7. Find interval where the slope of $f(x)$ is increasing	
8. Find the minimum value of a function	
9. Find the minimum slope of a function	
10. Find critical values	
11. Find inflection points	
12. Show that $\lim_{x\to a} f(x)$ exists	
13. Show that $f(x)$ is continuous	
14. Find vertical asymptotes of $f(x)$	
15. Find horizontal asymptotes of $f(x)$	

16. Find the average rate of change of $f(x)$ on $[a,b]$	
17. Find instantaneous rate of change of $f(x)$ at a	
18. Find the average value of $f(x)$ on $[a,b]$	
19. Find the absolute maximum of $f(x)$ on $[a,b]$	
20. Show that a piecewise function is differentiable at the point a where the function rule splits	
21. Given $s(t)$ (position function), find $v(t)$	
22. Given $v(t)$, find how far a particle travels on $[a,b]$	
23. Find the average velocity of a particle on $[a,b]$	
24. Given $v(t)$, determine if a particle is speeding up at $t=k$	
25. Given $v(t)$ and $s(0)$, find $s(t)$	
26. Show that Rolle's Theorem holds on $[a,b]$	
27. Show that Mean Value Theorem holds on $[a,b]$	
28. Find domain of $f(x)$	
29. Find range of $f(x)$ on $[a,b]$	
30. Find range of $f(x)$ on $(-\infty,\infty)$	
31. Find $f'(x)$ by definition	
32. Find derivative of inverse to $f(x)$ at $x=a$	

33. y is increasing proportionally to y	
34. Find the line $x = c$ that divides the area under $f(x)$ on $[a,b]$ to two equal areas	
35. $\frac{d}{dx}\int_a^x f(t)\,dt =$	
36. $\frac{d}{dx}\int_a^u f(t)\,dt$	
37. The rate of change of population is …	
38. The line $y = mx + b$ is tangent to $f(x)$ at (a,b)	
39. Find area using left Riemann sums	
40. Find area using right Riemann sums	
41. Find area using midpoint rectangles	
42. Find area using trapezoids	
43. Solve the differential equation …	
44. Meaning of $\int_a^x f(t)\,dt$	
45. Given a base, cross sections perpendicular to the x-axis are squares	
46. Find where the tangent line to $f(x)$ is horizontal	
47. Find where the tangent line to $f(x)$ is vertical	
48. Find the minimum acceleration given $v(t)$	
49. Approximate the value of $f(0.1)$ by using the tangent line to f at $x = 0$	

50. Given the value of $f(a)$ and the fact that the anti-derivative of f is F, find $F(b)$	
51. Find the derivative of $f(g(x))$	
52. Given $\int_a^b f(x)\,dx$, find $\int_a^b [f(x)+k]\,dx$	
53. Given a picture of $f'(x)$, find where $f(x)$ is increasing	
54. Given $v(t)$ and $s(0)$, find the greatest distance from the origin of a particle on $[a,b]$	
55. Given a water tank with g gallons initially being filled at the rate of $F(t)$ gallons/min and emptied at the rate of $E(t)$ gallons/min on $[t_1,t_2]$, find a) the amount of water in the tank at m minutes	
56. b) the rate the water amount is changing at m	
57. c) the time when the water is at a minimum	
58. Given a chart of x and $f(x)$ on selected values between a and b, estimate $f'(c)$ where c is between a and b.	
59. Given $\frac{dy}{dx}$, draw a slope field	
60. Find the area between curves $f(x), g(x)$ on $[a,b]$	
61. Find the volume if the area between $f(x), g(x)$ is rotated about the x-axis	

BC Problems

62. Find $\lim_{x\to\infty}\frac{f(x)}{g(x)}$ if $\lim_{x\to\infty} f(x)=\lim_{x\to\infty} g(x)=0$	
63. Find $\int_0^{\infty} f(x)\ dx$	
64. $\frac{dP}{dt}=\frac{k}{M}P(M-P)$ or $\frac{dP}{dt}=kP\left(1-\frac{P}{M}\right)$	
65. Find $\int \frac{dx}{x^2+ax+b}$ where x^2+ax+b factors	
66. The position vector of a particle moving in the plane is $r(t)=\langle x(t), y(t)\rangle$ a) Find the velocity.	
67. b) Find the acceleration.	
68. c) Find the speed.	
69. a) Given the velocity vector $v(t)=\langle x(t), y(t)\rangle$ and position at time 0, find the position vector.	
70. b) When does the particle stop?	
71. c) Find the slope of the tangent line to the vector at t_1.	
72. Find the area inside the polar curve $r=f(\theta)$.	
73. Find the slope of the tangent line to the polar curve $r=f(\theta)$.	
74. Use Euler's method to approximate $f(1.2)$ given $\frac{dy}{dx}$, $(x_0,y_0)=(1,1)$, and $\Delta x=0.1$	
75. Is the Euler's approximation an underestimate or an overestimate?	
76. Find $\int x^n e^{ax}dx$ where a, n are integers	
77. Write a series for $x^n\cos x$ where n is an integer	

78. Write a series for $\ln(1+x)$ centered at $x=0$.	
79. $\sum_{n=1}^{\infty}\frac{1}{n^p}$ converges if…..	
80. If $f(x)=2+6x+18x^2+54x^3+...$, find $f\left(-\frac{1}{2}\right)$	
81. Find the interval of convergence of a series.	
82. Let S_4 be the sum of the first 4 terms of an alternating series for $f(x)$. Approximate $\lvert f(x)-S_4\rvert$	
83. Suppose $f^{(n)}(x)=\frac{(n+1)\ n!}{2^n}$. Write the first four terms and the general term of a series for $f(x)$ centered at $x=c$	
84. Given a Taylor series, find the Lagrange form of the remainder for the 4th term.	
85. $f(x)=1+x+\frac{x^2}{2!}+\frac{x^3}{3!}+...$	
86. $f(x)=x-\frac{x^3}{3!}+\frac{x^5}{5!}-\frac{x^7}{7!}+...+\frac{(-1)^n x^{2n+1}}{(2n+1)!}+...$	
87. $f(x)=1-\frac{x^2}{2!}+\frac{x^4}{4!}-\frac{x^6}{6!}+...+\frac{(-1)^n x^{2n}}{(2n)!}+...$	
88. Find $\int(\sin x)^m(\cos x)^n dx$ where *m* and *n* are integers	
89. Given $x=f(t), y=g(t)$, find $\frac{dy}{dx}$	
90. Given $x=f(t), y=g(t)$, find $\frac{d^2y}{dx^2}$	
91. Given $f(x)$, find arc length on $[a,b]$	
92. $x=f(t), y=g(t)$, find arc length on $[t_1,t_2]$	
93. Find horizontal tangents to a polar curve $r=f(\theta)$	

94. Find vertical tangents to a polar curve $r = f(\theta)$	
95. Find the volume when the area between $y = f(x), x = 0, y = 0$ is rotated about the y-axis.	
96. Given a set of points, estimate the volume under the curve using Simpson's rule.	