Review Math 1850

Stewart, Essential Calculus

1. Shifts and stretchs: Graph $y = 2\sin(x - \pi/2) - 1$ by appropriately adjusting the graph of $y = \sin x$.

2. Limits.

$$\lim_{x\to 3} \frac{x^2 - 9}{x - 3} \qquad \lim_{\theta\to 0} \frac{\tan 3\theta}{\sin\theta} \qquad \lim_{x\to\infty} \frac{x - 2x^3}{x^3 + 2x + 5}$$

$$\lim_{t\to 3+} \frac{3 - t}{|3 - t|} \qquad \lim_{x\to -2-} \frac{x}{x + 2} \qquad \lim_{x\to 3} \frac{\frac{1}{x} - \frac{1}{x}}{x - 3} \qquad \lim_{x\to 1} \frac{\sqrt{x+1} - 1}{x - 1}$$

3. Continuity. For what value of the constant c is the function f
(12) continuous on $(-\infty,\infty)$?

$$f(x) = \begin{cases} 5x & \text{if } x \le 2 \\ x^2 + c & \text{if } x > 2 \end{cases}$$

4. Continuity. Find the numbers at which the function

$$f(x) = \begin{cases} 3 - x & \text{if } x \le 0 \\ x^2 - 1 & \text{if } 0 < x \le 2 \\ x + 1 & \text{if } x > 2 \end{cases}$$

is discontinuous. Sketch the graph of f.

5. Find the derivative dy/dx of $y = f(x)$ at $x = 1$ *using the definition of derivative* if

$$f(x) = \sqrt{2x + 7}.$$

or

$$f(x) = \frac{2}{3x + 5}$$

6. Product Rule. Differentiate $y = x\tan x$. See page 140 of Stewart's Essential Calculus. Determine what methods must be used.

7. Quotient Rule. Differentiate $y = \dfrac{x^{1/3}}{\cos x + 6}$

8. Chain Rule. Differentiate $y = \dfrac{1}{(t^2 + t)^{1/3}}$

9. Velocity: If a particle's position is $s(t) = 25 + 45t - t^2/2 + t^3/6$ meters from the starting lime at time t in seconds then what is the velocity?

10. Implicit Differentiation. Find dy/dx if $x^2 + 4xy + y^2 = 13$. Find an equation of the tangent line at (2,1).

11. Find dy/dx by implicit differentiation if $\sqrt{xy} = 1 + x^2 y$

12. Tangent Lines: Find an equation for the tangent line to the curve $y = \sec 3x$ at $x = \pi/12$

13. Related Rates: P 131, 18, 20

14. Linear Approximation. $L(x) = f(a) + f'(a)(x - a)$. Find the linear approximation to $y = \sqrt{2x+3}$ at $x = 3$.

15. Differentials: Find dy if $y = 3\csc x + \cot x$

16. Absolute Maximum and Minimum on closed bounded intervals. Check for critical points in the interior and then check the end-points. Compare the values of $f(x)$ at the points x found. $f(t) = t\sqrt{4 - t^2}$, [-1.2]. Page 148 35-44. page 192, 1-4

17. Graphing. Page 192 9-18 13 or 14.$y = 3x^5 - 5x^3$

    (a) Vertical and horizontal asymptotes.

    (b) Critical points ($f'(x) = 0$ or f not differentiable.)

    (c) Intervals of increase and decrease.

    (d) Local max and min.

    (e) Inflection Points ($f''(x) = 0$).

    (f) Intervals of concavity

18. Maximum and/or Minimum of $f(x)$. First derivative test. Second derivative test. $f(x) = 2/x + x^2$.

19. Optimization. p 176-179, 4, 18

20. Antiderivatives: Page 189 3-28

21. Riemann Integrals. Page 203 6; Page 217, 32

22. Evaluate the integrals. Page 225 1-28 24; Page 241 7-44

$$\int \frac{1}{x^{1/3}}\,dx, \qquad \int_0^{\pi/8} \sec^2 2x\,dx \qquad \int \frac{x}{(1+x^2)^3}\,dx$$

23. Find $g'(x)$ if $g(x) = \int_2^x \tan\theta\,d\theta$ or $g(x) = \int_x^{x^2} \sqrt{4+t^3}\,dt$. Page 234 5-13

24. Displacement $\int_0^3 t^2-4\,dt$ and distance $\int_0^3 |t^2-4|\,dt$. (Here the velocity is t^2-4.) (Page 226,55,56)

25. Find the area enclosed by the curve $y = x^2+1$, and lines $x=-1$, $x=2$ and the x-axis.

26. If $f(x) = x^3+2x-3$ then f is one-to-one. Find $(f^{-1})'(0)$

27. Simplify the expression: $\log_3(\sqrt{3}/81)$, $\arcsin(\sqrt{3}/2)$, $\arccos(-1)$, $\arctan(-1/\sqrt{3})$ $e^{-x+2\ln x}$.

28. Differentiate the function.

    (a) $g(t) = \ln(2t+5) + e^{7t}$

    (b) $f(x) = \ln\sqrt{\dfrac{2x+1}{x-1}}$

    (c) $h(s) = 5^s + \log_5 s^9$

    (d) $g(x) = \arcsin(x/2) + \arctan(x^2)$

29. Evaluate the integral.

$$\int \frac{e^x}{e^x+3} \qquad \int_0^4 3^x\,dx$$