1. Calculate the following limits:

a.
$$\lim_{x \to 3} \frac{3x^2 + 5x - 28}{x^2 - 16}$$

b.
$$\lim_{x\to +\infty} e^{-x}(x+1)^2$$

2. Use the definition of the derivative to find f'(x) when $f(x) = x^2 + 6x + 18$.

3. Give a delta-epsilon argument that $\lim_{x\to 2} 8x - 5 = 11$.

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4. Tell why $f(x) = |x^2 - 25|$ is continuous at x = 5 or not. Is f(x) differentiable there? Why or why not.

5. Calculate $\frac{dy}{dx}$ for the following:

a.
$$y = [x^2 \sin(5x) - 4]^{10}$$

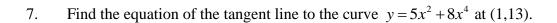
b.
$$y = \frac{x^3 + 8x}{e^{\frac{x}{2}} + 2}$$

c.
$$y = 4^{5x} + \tan^{-1}(3x)$$

d.
$$y = (\cos(2x))^{(9x+17)}$$

e.
$$y^4 + \arcsin y = (x+3)^3 + 2y$$

f.
$$y = \int_{0}^{2} (t \sin(t^{2}) + 3)^{5} dt$$



8. Two small airplanes depart ILM at 3:00 PM. One flies north at 200 MPH and the other west at 150 MPH. At what rate are the planes separating at 4:00 PM?

9. What are the dimensions of a box of minimum cost of materials if the volume is to be 8000 cubic feet, the base is square, and the top is closed? The vertical sides cost \$4.00 per square foot and the top and bottom cost \$7.00 per square foot.

- 10. For $f(x) = x^5 60x^3$
 - a. Calculate the first and second derivative of f(x).

b. Find the intervals where f(x) is increasing and decreasing.

c. Find the intervals where f(x) is concave up and concave down.

d. Identify the local maximum, local minimum, and inflection points.

- e. Find the *x* and *y*-intercepts of y = f(x).
- f. Sketch the graph of y = f(x).

11. Calculate

$$a. \qquad \int_{1}^{6} \left(x^2 + \sin(x)\right) dx$$

$$b. \qquad \int \frac{e^{2x}}{(1+e^{4x})} dx$$

12. Use Newton's Method to find the next guess for the solution of $x^4 = 25x + 3$ if the first guess is $x_0 = 3$

13. Find the area from x = -1 to x = 3 between the x-axis and the curve $y = e^{3x} + 2$.

14. Evaluate the Riemann Sum for $f(x) = \frac{10}{x} + 2$, $4 \le x \le 20$, with four subintervals, taking the sample points to be midpoints.

15. Find f(x) if $f''(x) = x^3 + 5x$ and f(0) = 2 and f'(0) = 4.

16. Find the average value of $f(x) = x + 6x^5$ on [0,2].

17. *a*. Calculate the area between the curves y = (3 - x)(x-7) and y = 3.

b. Rotate the area in (a) about the y-axis and give the integral that determines the value. Do not evaluate the integral.

c. Rotate the area in (a) about the x-axis and give the integral that determines the value. Do not evaluate the integral.

