For complete credit, show all work.

1. Calculate the following limits:

a.
$$\lim_{x \to +\infty} \frac{13x - 5}{2x + 11}$$

b.
$$\lim_{x \to 6} \frac{x^2 - x - 30}{x - 6}$$

In problems 2-5, find the derivative of the following functions.

$$f(x) = \frac{5x^3 + \ln(7x - 8)}{4x^3 - 7}$$

$$g(x) = (x^7 + 3x)e^{6+2x}$$

$$h(x) = (14x^4 - 35x^3)^8$$

5.
$$k(x) = 4x^{-5} + x^{2/7}$$

$$_{6.} m(x) = x \log_4(7x + 3)$$

7. Use limits to compute f'(3) where $f(x) = 5x^2 - 4x$.

8. Find the equation of the tangent line to the curve $y = f(x) = 6x^2 - x - 10$ at (2, 12).

9. An object is tossed up from the top of a building that is 600 feet tall. The distance the object is from the ground after *t* seconds is

$$s(t) = 600 - 16t^2 + 176t.$$

- a. Find the average velocity in the interval [0, 3] seconds.
- b. Find the instantaneous velocity at t = 3 seconds.

10. For $f(x) = x^3 + 3x^2 - 45x$,

a. find the intervals where f(x) is increasing and decreasing.

b. find the intervals where f(x) is concave up and concave down.

- c. find where f(x) has a relative max and relative min.
- d. find where f(x) has an inflection point.
- e. find the x and y intercepts of y = f(x).
- f. find the absolute maximum and absolute minimum of f(x) on [-1, 1].
- g. sketch the graph of y = f(x).

11. Find the dimensions of a rectangular box of maximum volume with a square base and an open top whose materials will cost of 96 cents. The base (bottom) costs 8 cents per square inch, and the sides cost 2 cents per square inch.

12. Find $\frac{dy}{dx}$ by implicit differentiation: $y^3x^5 + 5x^6 = 2y + 4x^4 + 35$

13. Calculate the following:

a.
$$\int \left(11x^4 - 3e^x\right) dx$$

b.
$$\int_{0}^{1} (5x^{7} + 11) dx$$

14. Find the area bounded by the following curves: $y = 3x^2 + 1$, x = -2, x = 1, and y = 0.

15. Find the area between the curves y = x + 1 and $y = x^2 - 1$.

16. Calculate the following:
$$\int \left(\left(\frac{16}{x+7} \right) (\ln(x+7))^5 \right) dx$$

17. Use differentials to estimate the cube root of 125.02.