

For complete credit, show all work.

1. Calculate the following limits:

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

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

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

2. $f(x) = \frac{5x^3 + \ln(7x - 8)}{4x^{\frac{2}{3}} - 7}$

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

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

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

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.

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: $y^3 x^5 + 5x^6 = 2y + 4x^4 + 35$

13. Calculate the following:

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

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.