1. (a) \( f'(x) = 5e^{5x} \ln(x^3 + 1) + \frac{3ax^2e^{5x}}{x^3 + 1} \)
(b) \( g_y(x, y) = \frac{80}{3} \left(x^2 + \frac{2}{3}y^4\right)^9 y^3 \)
(c) \( y = 2.125(x - 3) - 2 \).

2. (a) \( \frac{3}{2} \ln(x) - \frac{5}{3x} - \frac{3}{4}x^{4/3} + C \)
(b) \( \int_3^{36} 3000e^{0.04t} \, dt = 241, 552.19 \)

3. (a) \( x = 6 \) units and \( p = \$14 \)
(b) \$144
(c) \$36

4. (a) \( \frac{A(t + h) - A(t)}{h} = 2t + h - 4 \)
(b) \( t = 2 \) and \( h = 3 \) in part (a) gives \( \frac{A(5) - A(2)}{3} = 3 \) ft/min
(c) Letting \( h \to 0 \) in part (a) gives \( A'(t) = 2t - 4 \), so \( A'(5) = 6 \) ft/min

5. (a) i. \( x = 2 \) to \( x = 11 \)
   ii. \( x = 6.5 \)
(b) \( \int_0^5 (x + 7) - (x^2 - 4x + 7) \, dx = \frac{125}{6} = 20.8\bar{3} \)

6. (a) \( A(5) - A(0) = \int_0^5 A'(t) \, dt = 12.5 \), since \( A(0) = 60 \), we get \( A(5) = 72.5 \) feet.
(b) \( t = 4 \) to \( t = 15 \).
(c) \( t = 9 \) min, and Distance \( \approx 18 \) feet
(d) Using the same technique from part (a), you can deduce that \( B(12) = 66 \). Thus, you need to go 14 feet higher, meaning you need an area of 14. That will happen in 7 more minutes for an answer of \( t = 19 \) minutes.

7. (a) 100 thousand dollars
(b) 8.447 thousand Things (needs to be accurate to three digits)
(c) \( AC'(1) \approx -10.19 < 0 \), so \( AC(x) \) is decreasing at \( x = 1 \).

8. (a) i. \( A'(6) = f(6) = 2 \)
   ii. \( A''(6) = f'(6) = -1 \)
(b) \( \int_8^{20} f(t) \, dt = 6 \).
(c) \( m = 13 \)
(d) \( A(20) = 29 \)

9. (a) \( P_x(x, y) = 8 + 4y - 10x, P_y(x, y) = 4x - 2y \)
(b) \( P_x(3, 4) = -6, P_y(3, 4) = 4 \). Selling one more hat will yield an increase of about \$4\) dollars in profit (selling one more glove will yield a decrease of about \$6\) dollars in profit).
(c) \( (x, y) = (4, 8) \), max profit = 13 hundred dollars.