

1. Calculate derivatives of the following functions

(a) $f(x) = x^4 - x + 5$

(b) $f(x) = (x^{200} + x^{100} - 1)x^2$

(c) $f(x) = (x^2 - x + 1)e^x$

(d) $f(x) = 3e^x + e^{2x} - x$

(e) $f(x) = (e^x + 3x)(x^2 - x + 2)$

(f) $f(x) = e^{4x^2+x}$

(g) $f(x) = (x^3 - 3x + 1)(x + x + 5x^2)$

(h) $f(x) = e^{2x+3}e^{3x+2}$

2. Expand the derivatives of the following using the derivative rules:

(a) $f(g(x))h(x)$

(b) $f(g(x) + h(x))$

(c) $(f(x) + g(x))(h(x))$

(d) $(f(x))^2 + g(x)$

3. Suppose you know that $f(0) = 1$ and $f'(0) = -2$. Calculate $g'(0)$ for the following functions g :

(a) $g(x) = f(x)^3 - f(x) + 3x$

(b) $g(x) = e^x f(x)$

(c) $g(x) = f(x) - (e^x)^2$

(d) $g(x) = f(x)^5 - e^x f(x)$

4. A moss farm is trying to improve its efficiency. They know that moss grows at a rate of 2 square feet per 50 square feet of moss per hour (quite slowly). Ideally, the moss should be harvested as soon as it covers 4000 square feet.

Write a rate equation describing the growth of the moss, solve it, and then using a calculator estimate the best time to harvest.

5. You are seeking a \$15000 loan to renovate your kitchen. A bank offers you two choices: you can pay 10% interest, compounded annually for one year, OR you can pay 6% interest, but only compounded twice (in other words, you would have a total balance of $15000 \times 1.06 \times 1.06 = 16854$). Write a rate equation describing the first option, solve it, and then decide which of the two loan options you prefer.