

Calculus I

Homework

Derivatives: linearity, product and quotient rules

1. Compute the derivative.

(a) $f(x) = 2^{2015}$.

(b) $f(x) = \pi^{2015}$.

(c) $f(x) = 2 - \frac{2}{3}x$.

(d) $f(x) = \frac{3}{4}x^8$.

(e) $f(x) = x^3 - 4x + 6$.

(f) $f(t) = \frac{1}{2}t^6 - 3t^4 + t$.

(g) $g(x) = x^2(1 - 2x)$.

(h) $h(x) = (x - 2)(2x + 3)$.

(i) $f(x) = 2x^{-\frac{3}{4}}$.

(j) $f(x) = cx^{-6}$.

(k) $A(x) = -\frac{12}{x^5}$.

2. (a) Given that $f(0) = 5$, $f'(0) = -1$, $g(0) = -4$, $g'(0) = 1$ and $h(x) = f(x)g(x)$, find the derivative $h'(0)$.

(b) Given that $f(2) = -3$, $f'(2) = 2$, $g(2) = 5$, $g'(2) = 1$ and $h(x) = f(x)g(x)$, find the derivative $h'(2)$.

(c) Given that $f(0) = 5$, $f'(0) = -1$, $g(0) = -4$, $g'(0) = 1$ and $h(x) = \frac{f(x)}{g(x)}$, find the derivative $h'(0)$.

(d) Given that $f(1) = 2$, $f'(1) = -1$, $g(1) = -3$, $g'(1) = 1$, $h(1) = 0$, $h'(1) = 1$ and $j(x) = f(x)g(x)h(x)$, find the derivative $j'(1)$.

3. Compute the derivative.

(a) $y = x^{\frac{5}{3}} - x^{\frac{2}{3}}$.

(b) $f(x) = \sqrt{x} - x$.

(c) $y = \sqrt{x}(x - 1)$.

(d) $f(x) = (2x + 1)^2$.

(e) $f(x) = 4\pi x^2$.

(f) $y = \frac{x^2 + 4x + 3}{\sqrt{x}}$.

(g) $y = \frac{\sqrt{x} + x}{x^2}$.

(h) $f(x) = (x + x^{-1})^3$.

(i) $f(x) = \sqrt{2x} + \sqrt{5x}$.

(j) $y = \sqrt[5]{x} + 4\sqrt{x^5}$.

(k) $y = \left(\sqrt{x} + \frac{1}{\sqrt[3]{x}}\right)^2$.

(l) $f(x) = (1 + 2x^2)(x - x^2)$.

(m) $f(x) = \frac{x^4 - 5x^3 + \sqrt{x}}{x^2}$.

(n) $f(x) = (2x^3 + 3)(x^4 - 2x)$.

(o) $f(x) = (1 + x + x^2)(2 - x^4)$.

(p) $g(y) = \left(\frac{1}{y^2} - \frac{3}{y^4}\right)(y + 5y^3)$.

(q) $f(x) = (x^3 - 2x)(x^{-4} + x^{-2})$.

(r) $f(x) = \frac{1 + 2x}{3 - 4x}$.

4. Compute the derivative (with respect to the implied variable).

(a) $f(x) = \frac{x - 3}{x + 3}$.

(b) $y = \frac{x^3}{1 - x^2}$.

(c) $y = \frac{x + 1}{x^3 + x - 2}$.

(d) $y = \frac{x - 1}{x^3 + x - 2}$.

(e) $f(x) = \frac{x + 1}{x^3 + 1}$.

(f) $y = \frac{x^3 - 2x\sqrt{x}}{x}$.

(g) $y = \frac{t}{(t - 1)^2}$.

(h) $y = \frac{t^2 + 2}{t^4 - 3t^2 + 1}$.

$$(i) \ g(t) = \frac{t - \sqrt{t}}{t^{\frac{1}{3}}}.$$

$$(j) \ y = ax^2 + bx + c.$$

$$(k) \ y = A + \frac{B}{x} + \frac{C}{x^2}.$$

$$(l) \ f(t) = \frac{2t}{2 + \sqrt{t}}.$$

$$(m) \ y = \frac{cx}{1 + cx}.$$

$$(n) \ y = \sqrt[3]{t}(t^2 + t + t^{-1}).$$

$$(o) \ y = \frac{u^6 - 2u^3 + 5}{u^2}.$$

$$(p) \ f(x) = \frac{ax + b}{cx + d}.$$

$$(q) \ f(x) = \frac{1 + x}{1 + \frac{2}{x}}.$$

$$(r) \ f(x) = \frac{1 + x}{1 + \frac{3}{x}}.$$

$$(s) \ f(x) = \frac{x}{x + \frac{c}{x}}.$$