Calculus I
Homework Derivatives Basic Techniques
Lecture 9

1. **The problem is too easy to appear on a quiz or test.** 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) $f(x) = \left(x + x^{-1}\right)^3$.
(i) $f(x) = \sqrt{2}x + \sqrt{5x}$.
(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) $g(t) = \dfrac{t - \sqrt{t}}{t^{\frac{1}{3}}}$.

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

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

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

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

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

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

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

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

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

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