Derivative Computation Question Bank

Topic 1 — power functions and sums

1. Find the derivative of $ax^p + 2bx^{-q/2} + cx + d$.
   
   $a, p = -3.3$, $q = 1.3$, $b = -2.2$, $c, d = 1.6$, $ab(p - 1) \neq 0$

Topic 2 — second derivatives

1. Find the second derivative of $f(x) = x^{p/2} - ax^q + bx$.
   
   $p = 1, 3, 5, 7$, $q = -4.1$, $a = 1.3$, $b = 1.10$

2. Find the second derivative of $y = x^p(x^q + a) + b\pi^2$.
   
   $p = 3.5$, $q = 1.4$, $a, b = 1.10$

Topic 3 — product rule

1. Suppose $f$ and $g$ are functions of $x$, with $f' = k$ and $g' = h$. What is the derivative of $fg$?
   
   $f, g, h, k =$ various

2. Find the derivative of $(ax + b)(cx^2 + dx - e)$.
   
   $a, e = 2, 4, \ldots, 18$, $b = -19, -17, \ldots, 19$, $c = 1, 3, \ldots, 9$, $d = 1.19$

3. Find the derivative of $(ax^n + bx)(cx^{-j} + d)$.
   
   $a, c, j, n = 2.8$, $b, d = -9.9$, $bd \neq 0$

4. Suppose $f$ is a function of $x$, with $f' = g$. What is the derivative of $(ax^n + b)f$?
   
   $a = 1.9$, $b = -9.9$, $b \neq 0$, $n = 2.5$

Topic 4 — quotient rule

1. Suppose $f$ and $g$ are functions of $x$, with $f' = k$ and $g' = h$. What is the derivative of $\frac{f}{g}$?
   
   $f, g, h, k =$ various

2. Find the derivative of $(ax^p + b)/(x^q + cx)$.
   
   $a, p, q = 2.4$, $b, c = -10, 10$, $d = 1.10$, $bc < 0$

3. Find the derivative of $(ax^p + bx)/(x^q + c)$ at $x = 0$.
   
   $a, p, q = 2.4$, $b = -10, 10$, $c = 1, 3, 5$, $b \neq 0$

Topic 5 — products with trig functions

1. Find the derivative of $(x^p + b)f(x)$.
   
   $p = 2.4$, $b = -9.9$, $f = \cos, \sin$

2. Find the derivative of $(ax + b)\tan(x)$.
   
   $a = 2.9$, $b = -9.9$, $f = \cos, \sin$

3. Find the derivative of $(x^n + ax)[b + f(x)]$.
   
   $a, b = -9.9$, $n = 2.5$, $ab \neq 0$, $f = \cos, \sin$
Topic 6 — quotients with trig functions
1. Find the derivative of \( f(x)/(ax^p + b + cx^q) \).
   \( a, c = 1.9 \quad b = -9.9 \quad b \neq 0 \quad p = 1.6 \quad q = -6.1 \quad f = \sin, \cos, \tan \)

2. Find the derivative of \( (x^p + bx)/[f(x) + 2c\sqrt{x}] \).
   \( p = 2.9 \quad b = -9.9 \quad c = -4.4 \quad bc \neq 0 \quad f = \sin, \cos, \tan \)

3. Find the derivative of \( [a + bf_1(x)]/[c + df_2(x)] \).
   \( b, d = 1.9 \quad a, c = -9.9 \quad ac \neq 0 \quad f_1, f_2 = \cos, \sin \quad f_1 \neq f_2 \)

Topic 7 — products with exp and log functions
1. Find the derivative of \( (a\theta^p + b\theta^q)(e^{\theta} + e^{k+m/n}) \).
   \( p = 2.6 \quad q = -6.1 \quad k = 1.5 \quad n = 2.5 \quad k \neq n, 2n \quad m = k + n \quad a = 1.9 \quad b, c = -9.9 \quad bc \neq 0 \quad \theta = \text{various} \)

2. Find the derivative of \( (ax^p + bx^q)(\ln x + cx^n) \).
   \( q = 2.4 \quad p = q + (1.3) \quad n = 2.5 \quad a = 1.9 \quad b, c = -9.9 \quad bc \neq 0 \)

3. Find the derivative of \( (ax^p + b)n^x \).
   \( p = 2.6 \quad n = 2.5 \quad a = 1.9 \quad b = -9.9 \quad b \neq 0 \)

Topic 8 — quotients with exp and log functions
1. Find the derivative of \( \ln x/(cx^n + de^x) \).
   \( c, d = 1.9 \quad n = 2.5 \)

2. Find the derivative of \( e^x/(cx^n + d\ln x) \).
   \( c, d = 1.9 \quad n = 2.5 \)

Topic 9 — chain rule
1. Find the derivative of \( (ax^n - b)^m \).
   \( a, b = 2.8 \quad n = 2.4 \quad m = 4.8 \)

2. Find the derivative of \( \sqrt{ax^2 + 2bx + c} \).
   \( a, c = 1.6 \quad b = -6.6 \quad b \neq 0 \)

Topic 10 — chain rule with trig functions
1. Find the derivative of \( f(ax^n + b) \).
   \( a = 2.9 \quad b = -9.9 \quad b \neq 0 \quad n = 2.5 \quad f = \sin, \cos, \tan \)

2. Find the derivative of \( af^n(x) \).
   \( a = 2.6 \quad n = 2.5 \quad f = \sin, \cos \)

3. Find the derivative of \( \sqrt{bx + f(x)} \).
   \( b = 2.6 \quad f = \sin, \cos \)
Topic 11 — chain rule with exp and ln

1. Find the derivative of $e^{ax}$.
   $a = -9 \ldots -1 \quad x = \{x", y", z", t", u", v", w\}$

2. Find the derivative of $\ln(ax^n + b)$.
   $a = 1 \ldots 9 \quad b = -9 \ldots 9 \quad b \neq 0 \quad n = 2 \ldots 5$

3. Find the derivative of $(bx + e^{-ax})^n$.
   $n = 2 \ldots 15$

4. Find the derivative of $(\ln x)^n$.
   $a, b = 1 \ldots 9 \quad n = 2 \ldots 5$

Topic 12 — repeated chain rule

1. Find the derivative of $f^m(ax^n + b)$.
   $a, b = 2 \ldots 6 \quad m, n = 2 \ldots 5 \quad f = \sin, \cos$

2. Find the derivative of $\ln(f(x^2 + bx + c))$.
   $b, c = 1 \ldots 9 \quad f = \sin, \cos$

3. Find the derivative of $f(e^{ax^n})$.
   $a = 2 \ldots 6 \quad n = 2 \ldots 5 \quad f = \sin, \cos$

4. Find the derivative of $f(\sqrt{2ax^n + b})$.
   $a = 1, 2 \quad b = -9, -7, \ldots, 9 \quad n = 2 \ldots 5 \quad f = \sin, \cos$

Topic 13 — chain rule with product rule

1. Find the derivative of $x^m e^{ax^n}$.
   $a = -6 \ldots 6 \quad a(a - 1)(a + 1) \neq 0 \quad m, n = 2 \ldots 5$

2. Find the derivative of $f(x^m e^{ax})$.
   $a = -6 \ldots 6 \quad a \neq 0 \quad n = 2 \ldots 6 \quad f = \sin, \cos$

3. Find the derivative of $e^{ax} / (x^m + c)^n$.
   $a = 1 \ldots 6 \quad c = -9 \ldots 9 \quad c \neq 0 \quad m, n = 2 \ldots 5$

4. Find the derivative of $\ln(x^n e^{-ax} + bf(x))$.
   $a, b, n = 2 \ldots 6 \quad f = \sin, \cos$

Topic 14 — implicit differentiation

1. Find $dy/dx$ if $bx^m + y^n = a\pi$.
   $a = -9 \ldots 9 \quad b, c = 2 \ldots 9 \quad n = 2 \ldots 5 \quad m = -5 \ldots 5 \quad am(m - 1) \neq 0$

2. Find $dy/dx$ if $x^m y^n + x^p = ay^q$.
   $a = 2 \ldots 9 \quad m, n, p, q = 2 \ldots 6$