

## Problems for Gateway #4: The Chain Rule

1. Find the derivative of:  $f(x) = (1 + 3 \cdot x + x^2)^{17}$ .
2. Find the derivative of:  $g(t) = (1 + t^{12})^{1/2}$ .
3. Find the derivative of:  $p(x) = 9 \cdot (1 + x)^9$ .
4. Find the derivative of:  $u(z) = 1 + (2 + z)^7 + (3 + z)^{10}$ .
5. Find the derivative of:  $w(x) = 8 \cdot (1 + x^3 + x^5)^{12}$ .
6. Find the derivative of:  $q(s) = (1 + s^2)^{-3}$ .
7. Find the derivative of:  $j(t) = 2 \cdot (t^2 - 9)^{12}$ .
8. Find the derivative of:  $k(x) = (1 + 2 \cdot x^2 + 3 \cdot x^4)^{10}$ .
9. Find the derivative of:  $m(z) = 4 \cdot (1 - z^4)^7$ .
10. Find the derivative of:  $f(y) = (1 + y^2)^2 + (1 + y^4)^4$ .
11. Find the derivative of:  $f(x) = (1 + 2^x)^{10}$ .
12. Find the derivative of:  $q(x) = 2^{3x}$ .
13. Find the derivative of:  $p(x) = 3^{(2x + \ln(x))}$ .
14. Find the derivative of:  $w(z) = 10^{\sqrt{z}}$ .
15. Find the derivative of:  $q(x) = e^{x^2}$ .
16. Find the derivative of:  $u(t) = (2 + 3^t)^{17}$ .
17. Find the derivative of:  $w(s) = (1 + e^s)^{10}$ .
18. Find the derivative of:  $k(y) = 10^{2y+4}$ .
19. Find the derivative of:  $j(s) = 7^{7s}$ .
20. Find the derivative of:  $g(x) = e^x + (e^x + 1)^2$ .
21. Find the derivative of:  $f(x) = \ln(1 + x^2)$ .
22. Find the derivative of:  $g(t) = \ln(1 + 2 \cdot t + t^2)$ .
23. Find the derivative of:  $k(x) = \ln(x^2 + x^3 + 1)$ .
24. Find the derivative of:  $p(t) = \ln(1 + \sqrt{t})$ .

25. Find the derivative of:  $q(x) = (3 + x + \ln(1 + x))^{10}$ .
26. Find the derivative of:  $r(t) = (1 + \ln(t))^4$ .
27. Find the derivative of:  $m(x) = (x^2 + \ln(x))^6$ .
28. Find the derivative of:  $j(y) = (2 \cdot y + \ln(y))^8$ .
29. Find the derivative of:  $q(t) = \ln(t^2 + 2^t)$ .
30. Find the derivative of:  $g(x) = e^{\ln(x)}$ .

**ANSWERS:**

1.  $f'(x) = 17 \cdot (1 + 3x + x^2)^{16} \cdot (3 + 2x)$ .
2.  $g'(t) = 0.5 \cdot (1 + t^{12})^{-1/2} \cdot 12t^{11}$ .
3.  $p'(x) = 81 \cdot (1 + x)^8$ .
4.  $u'(z) = 7 \cdot (2 + z)^6 + 10 \cdot (3 + z)^9$ .
5.  $w'(x) = 96 \cdot (1 + x^3 + x^5)^{11} \cdot (3x^2 + 5x^4)$ .
6.  $q'(s) = -3 \cdot (1 + s^2)^{-4} \cdot (2s)$
7.  $j'(t) = 24 \cdot (t^2 - 9)^{11} \cdot (2t)$ .
8.  $k'(x) = 10 \cdot (1 + 2x^2 + 3x^4)^9 \cdot (4x + 12x^3)$ .
9.  $m'(z) = 28 \cdot (1 - z^4)^6 \cdot (-4z^3)$ .
10.  $f'(y) = 2 \cdot (1 + y^2) \cdot 2y + 4 \cdot (1 + y^4)^3 \cdot 4y^3$ .
11.  $f'(x) = 10 \cdot (1 + 2^x)^9 \cdot \ln(2) \cdot 2^x$ .
12.  $q'(x) = \ln(2) \cdot 2^{3x} \cdot 3$ .
13.  $p'(x) = \ln(3) \cdot 3^{(2x + \ln(x))} \cdot (2 + 1/x)$ .
14.  $w'(z) = \ln(10) \cdot 10^{1/z} \cdot (1/2) \cdot z^{-1/2}$ .
15.  $q'(x) = e^{x^2} \cdot 2x$ .
16.  $u'(t) = 17 \cdot (2 + 3^t)^{16} \cdot \ln(3) \cdot 3^t$ .
17.  $w'(s) = 10 \cdot (1 + e^s)^9 \cdot e^s$ .
18.  $k'(y) = \ln(10) \cdot 10^{2y+4} \cdot 2$ .

19.  $j'(s) = \ln(7) \cdot 7^{7s} \cdot 7.$
20.  $g'(x) = e^x + 2 \cdot (e^x + 1) \cdot e^x.$
21.  $f'(x) = \frac{2x}{1+x^2}.$
22.  $g'(t) = \frac{2+2t}{1+2t+t^2}.$
23.  $k'(x) = \frac{2x+3x^2}{x^2+x^3+1}.$
24.  $p'(t) = \frac{\frac{1}{2}t^{-1/2}}{1+\sqrt{t}}.$
25.  $q'(x) = 10 \cdot (3 + x + \ln(1 + x))^9 \cdot (1 + 1/(1 + x)).$
26.  $r'(t) = 4 \cdot (1 + \ln(t))^3 \cdot (1/t).$
27.  $m'(x) = 6 \cdot (x^2 + \ln(x))^5 \cdot (2x + 1/x).$
28.  $j'(y) = 8 \cdot (2y + \ln(y))^7 \cdot (2 + 1/y).$
29.  $q'(t) = \frac{2t + \ln(2) \cdot 2^t}{t^2 + 2^t}.$
30.  $g'(x) = e^{\ln(x)} \cdot \frac{1}{x}.$