1. Differentiate: $f(x) = 10^{2-3x}$
2. Differentiate: $f(x) = 10^{4+2x}$
3. Differentiate: $f(x) = \log(5 - 3x - 2x^2 - 4x^3)$
4. Differentiate: $f(x) = \log_4(-1 + 4x)$
5. Differentiate: $f(x) = \sin(-1 - 4x - x^2 + 3x^3)$
6. Differentiate: $f(x) = 3^{-4x+5x^2-2x^3}$
7. Differentiate: $f(x) = \log_5(-5 - 3x + 4x^2 - 4x^3)$
8. Differentiate: $f(x) = \ln(-1 + x + x^2)$
9. Differentiate: $f(x) = \ln(-5 - 5x - x^3)$
10. Differentiate: $f(x) = \log(5 - 5x - 5x^2)$

Answers:

1. $f'(x) = (-3)(\ln 10)10^{2-3x}$
2. $f'(x) = (2)(\ln 10)10^{4+2x}$
3. $f'(x) = \dfrac{-3 - 4x - 12x^2}{(\ln 10)(5 - 3x - 2x^2 - 4x^3)}$
4. $f'(x) = \dfrac{4}{(\ln 4)(-1 + 4x)}$
5. $f'(x) = (-4 - 2x + 9x^2)\cos(-1 - 4x - x^2 + 3x^3)$
6. $f'(x) = (-4 + 10x - 6x^2)(\ln 3)3^{-4x+5x^2-2x^3}$
7. $f'(x) = \dfrac{-3 + 8x - 12x^2}{(\ln 5)(-5 - 3x + 4x^2 - 4x^3)}$
8. $f'(x) = \dfrac{1 + 2x}{-1 + x + x^2}$
9. $f'(x) = \dfrac{-5 - 3x^2}{-5 - 5x - x^3}$
10. $f'(x) = \dfrac{-5 - 10x}{(\ln 10)(5 - 5x - 5x^2)}$

Solutions:

1. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} f(x) = \frac{\mathrm{d}}{\mathrm{d}x} 10^{2-3x}$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} 10^{f(x)} = (\ln 10) 10^{f(x)} f'(x)$

$= \left((\ln 10) 10^{2-3x}\right) \frac{\mathrm{d}}{\mathrm{d}x}(2-3x)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} x^n = nx^{n-1}$

$= \left((\ln 10) 10^{2-3x}\right)(-3)$ ◀ Simplify, if necessary.

$\therefore \frac{\mathrm{d}}{\mathrm{d}x} 10^{2-3x} = (-3)(\ln 10) 10^{2-3x}$

2. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} f(x) = \frac{\mathrm{d}}{\mathrm{d}x} 10^{4+2x}$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} 10^{f(x)} = (\ln 10) 10^{f(x)} f'(x)$

$= \left((\ln 10) 10^{4+2x}\right) \frac{\mathrm{d}}{\mathrm{d}x}(4+2x)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} x^n = nx^{n-1}$

$= \left((\ln 10) 10^{4+2x}\right)(2)$ ◀ Simplify, if necessary.

$\therefore \frac{\mathrm{d}}{\mathrm{d}x} 10^{4+2x} = (2)(\ln 10) 10^{4+2x}$

3. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} f(x) = \frac{\mathrm{d}}{\mathrm{d}x} \log(5-3x-2x^2-4x^3)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} \log f(x) = \frac{1}{(\ln 10) f(x)} f'(x)$

$= \left(\frac{1}{(\ln 10)(5-3x-2x^2-4x^3)}\right) \frac{\mathrm{d}}{\mathrm{d}x}(5-3x-2x^2-4x^3)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} x^n = nx^{n-1}$

$= \left(\frac{1}{(\ln 10)(5-3x-2x^2-4x^3)}\right)(-3-4x-12x^2)$ ◀ Simplify, if necessary.

$\therefore \frac{\mathrm{d}}{\mathrm{d}x} \log(5-3x-2x^2-4x^3) = \frac{-3-4x-12x^2}{(\ln 10)(5-3x-2x^2-4x^3)}$

4. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} f(x) = \frac{\mathrm{d}}{\mathrm{d}x} \log_4(-1+4x)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} \log_b f(x) = \frac{1}{(\ln b) f(x)} f'(x)$

$= \left(\frac{1}{(\ln 4)(-1+4x)}\right) \frac{\mathrm{d}}{\mathrm{d}x}(-1+4x)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} x^n = nx^{n-1}$

$= \left(\frac{1}{(\ln 4)(-1+4x)}\right)(4)$ ◀ Simplify, if necessary.

$\therefore \frac{\mathrm{d}}{\mathrm{d}x} \log_4(-1+4x) = \frac{4}{(\ln 4)(-1+4x)}$

5. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} f(x) = \frac{\mathrm{d}}{\mathrm{d}x} \sin(-1-4x-x^2+3x^3)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} \sin f(x) = (\cos f(x)) f'(x)$

$= \left(\cos(-1-4x-x^2+3x^3)\right) \frac{\mathrm{d}}{\mathrm{d}x}(-1-4x-x^2+3x^3)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} x^n = nx^{n-1}$

$= \left(\cos(-1-4x-x^2+3x^3)\right)(-4-2x+9x^2)$ ◀ Simplify, if necessary.

$\therefore \frac{\mathrm{d}}{\mathrm{d}x} \sin(-1-4x-x^2+3x^3) = (-4-2x+9x^2)\cos(-1-4x-x^2+3x^3)$

6. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} f(x) = \frac{\mathrm{d}}{\mathrm{d}x} 3^{-4x+5x^2-2x^3}$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} b^{f(x)} = (\ln b) b^{f(x)} f'(x)$

$= \left((\ln 3) 3^{-4x+5x^2-2x^3}\right) \frac{\mathrm{d}}{\mathrm{d}x}(-4x+5x^2-2x^3)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} x^n = nx^{n-1}$

$= \left((\ln 3) 3^{-4x+5x^2-2x^3}\right)(-4+10x-6x^2)$ ◀ Simplify, if necessary.

$\therefore \frac{\mathrm{d}}{\mathrm{d}x} 3^{-4x+5x^2-2x^3} = (-4+10x-6x^2)(\ln 3)3^{-4x+5x^2-2x^3}$

7. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} f(x) = \frac{\mathrm{d}}{\mathrm{d}x} \log_5(-5-3x+4x^2-4x^3)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} \log_b f(x) = \frac{1}{(\ln b) f(x)} f'(x)$

$= \left(\frac{1}{(\ln 5)(-5-3x+4x^2-4x^3)}\right) \frac{\mathrm{d}}{\mathrm{d}x}(-5-3x+4x^2-4x^3)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} x^n = nx^{n-1}$

$= \left(\frac{1}{(\ln 5)(-5-3x+4x^2-4x^3)}\right)(-3+8x-12x^2)$ ◀ Simplify, if necessary.

$\therefore \frac{\mathrm{d}}{\mathrm{d}x} \log_5(-5-3x+4x^2-4x^3) = \frac{-3+8x-12x^2}{(\ln 5)(-5-3x+4x^2-4x^3)}$

8. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} f(x) = \frac{\mathrm{d}}{\mathrm{d}x} \ln(-1+x+x^2)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} \ln f(x) = \frac{1}{f(x)} f'(x)$

$= \left(\frac{1}{-1+x+x^2}\right) \frac{\mathrm{d}}{\mathrm{d}x}(-1+x+x^2)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} x^n = nx^{n-1}$

$= \left(\frac{1}{-1+x+x^2}\right)(1+2x)$ ◀ Simplify, if necessary.

$\therefore \frac{\mathrm{d}}{\mathrm{d}x} \ln(-1+x+x^2) = \frac{1+2x}{-1+x+x^2}$

9. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} f(x) = \frac{\mathrm{d}}{\mathrm{d}x} \ln(-5-5x-x^3)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} \ln f(x) = \frac{1}{f(x)} f'(x)$

$= \left(\frac{1}{-5-5x-x^3}\right) \frac{\mathrm{d}}{\mathrm{d}x}(-5-5x-x^3)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} x^n = nx^{n-1}$

$= \left(\frac{1}{-5-5x-x^3}\right)(-5-3x^2)$ ◀ Simplify, if necessary.

$\therefore \frac{\mathrm{d}}{\mathrm{d}x} \ln(-5-5x-x^3) = \frac{-5-3x^2}{-5-5x-x^3}$

10. $f'(x) = \frac{\mathrm{d}}{\mathrm{d}x} f(x) = \frac{\mathrm{d}}{\mathrm{d}x} \log(5-5x-5x^2)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} \log f(x) = \frac{1}{(\ln 10) f(x)} f'(x)$

$= \left(\frac{1}{(\ln 10)(5-5x-5x^2)}\right) \frac{\mathrm{d}}{\mathrm{d}x}(5-5x-5x^2)$ ◀ Apply: $\frac{\mathrm{d}}{\mathrm{d}x} x^n = nx^{n-1}$

$= \left(\frac{1}{(\ln 10)(5-5x-5x^2)}\right)(-5-10x)$ ◀ Simplify, if necessary.

$\therefore \frac{\mathrm{d}}{\mathrm{d}x} \log(5-5x-5x^2) = \frac{-5-10x}{(\ln 10)(5-5x-5x^2)}$