

Q56:  $y = 4^x$

$$\ln|y| = \ln|4^x|$$

$$\ln|y| = x \ln|4|$$

$$\frac{1}{y} \frac{dy}{dx} = \ln|4|$$

$$\frac{dy}{dx} = \ln|4| \times y$$

$$= \ln|4| \times 4^x$$

$$= \underline{4^x \ln|4|}$$

Q57:  $y = 3^{x^2}$

$$\ln|y| = \ln|3^{x^2}|$$

$$\ln|y| = x^2 \ln|3|$$

$$\frac{1}{y} \frac{dy}{dx} = 2x \times \ln|3|$$

$$\frac{1}{y} \frac{dy}{dx} = 2 \ln|3| x$$

$$\frac{dy}{dx} = 2 \ln|3| x \times y$$

$$= 2 \ln|3| x \times 3^{x^2}$$

$$= \underline{(3^{x^2}) \cdot 2 \ln|3| x}$$

Q58:  $y = 2x^x$

$$\ln|y| = \ln|2x^x|$$

$$\ln|y| = x \ln|2x|$$

$$\frac{1}{y} \frac{dy}{dx} = \ln|2x| + x \times \frac{1}{x}$$

$$\begin{aligned} \frac{dy}{dx} &= (\ln|2x| + 1) \times y \\ &= \underline{\underline{(\ln|2x| + 1) 2x^x}} \end{aligned}$$

$$\begin{aligned} u &= x & v &= \ln|2x| \\ u' &= 1 & v' &= \frac{1}{2x} \cdot 2 \\ & & &= \frac{1}{x} \end{aligned}$$

Q59:  $y = \frac{(2x+3)^2}{\sqrt{x+1}}$

$$\ln|y| = \ln \left| \frac{(2x+3)^2}{(x+1)^{1/2}} \right|$$

$$\ln|y| = 2\ln|2x+3| - \frac{1}{2}\ln|x+1|$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{2}{2x+3} \cdot 2 - \frac{1}{2} \times \frac{1}{(x+1)}$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{4}{(2x+3)} - \frac{1}{2(x+1)}$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{8(x+1) - (2x+3)}{2(2x+3)(x+1)}$$

$$\frac{dy}{dx} = \left( \frac{8x+8-2x-3}{2(2x+3)(x+1)} \right) \times y$$

$$= \left( \frac{6x+5}{2(2x+3)(x+1)} \right) \times \frac{(2x+3)^2}{\sqrt{x+1}}$$

$$= \frac{(6x+5)(2x+3)}{2(x+1)^{3/2}}$$

$$= \frac{(6x+5)(2x+3)}{2\sqrt{(x+1)^3}}$$

Q60:  $y = \frac{2^x}{2x+1}$

$$\ln|y| = \ln\left|\frac{2^x}{2x+1}\right| = \ln|2^x| - \ln|2x+1|$$

$$\ln|y| = x \ln|2| - \ln|2x+1|$$

$$\frac{1}{y} \frac{dy}{dx} = \ln|2| - \frac{1}{(2x+1)} \cdot 2$$

$$\begin{aligned} \frac{dy}{dx} &= \left( \frac{\ln|2|}{1} - \frac{2}{(2x+1)} \right) \times y \\ &= \left( \frac{(2x+1)\ln|2| - 2}{(2x+1)} \right) \times \frac{2^x}{(2x+1)} \end{aligned}$$

$$= \frac{2^x \left( (2x+1)\ln|2| - 2 \right)}{(2x+1)^2}$$

Q61:  $y = \sqrt{\frac{3+x}{3-x}}$

$$\ln|y| = \ln \left| \frac{(3+x)^{1/2}}{(3-x)^{1/2}} \right|$$

$$\ln|y| = \ln(3+x)^{1/2} - \ln(3-x)^{1/2}$$

$$\ln|y| = \frac{1}{2} \ln|3+x| - \frac{1}{2} \ln|3-x|$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{1}{2(3+x)} - \frac{1}{2(3-x)} \cdot -1$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{1}{2(3+x)} + \frac{1}{2(3-x)}$$

$$\frac{dy}{dx} = \left( \frac{(3-x) + (3+x)}{2(3+x)(3-x)} \right) \times y$$

$$= \left( \frac{\cancel{6}3}{2(3+x)(3-x)} \right) \left( \frac{\sqrt{3+x}}{\sqrt{3-x}} \right)$$

$$\frac{dy}{dx} = \frac{3\sqrt{3+x}}{(3+x)(3-x)\sqrt{3-x}}$$

$$= \frac{3}{\sqrt{3+x} (3-x)^{3/2}}$$

OR

$$= \frac{3}{\sqrt{3+x} \sqrt{(3-x)^3}}$$

OR

$$= \frac{3}{\sqrt{(3+x)(3-x)^3}}$$

Q62:  $y = (1+x)(2+3x)(x-5)$

$$\ln|y| = \ln|(1+x)(2+3x)(x-5)|$$
$$\ln|y| = \ln|1+x| + \ln|2+3x| + \ln|x-5|$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{1}{(1+x)} + \frac{1}{(2+3x)} \cdot 3 + \frac{1}{(x-5)}$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{1}{(1+x)} + \frac{3}{(2+3x)} + \frac{1}{(x-5)}$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{(2+3x)(x-5) + 3(1+x)(x-5) + (1+x)(2+3x)}{(1+x)(2+3x)(x-5)}$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{\cancel{(2x-10+3x^2-15x)} + \cancel{3x-15+3x^2-15x} + 2+3x+7x+3x^2}{(1+x)(2+3x)(x-5)}$$

$$\frac{dy}{dx} = \left( \frac{9x^2 - 20x - 23}{(1+x)(2+3x)(x-5)} \right) \times \cancel{(1+x)(2+3x)(x-5)}$$

$$\therefore \frac{dy}{dx} = 9x^2 - 20x - 23$$

---

Q63:  $y = \frac{x^2 \sqrt{7x-3}}{1+x}$

$$\ln|y| = \ln|x^2| + \ln|(7x-3)^{1/2}| - \ln|1+x|$$

$$\ln|y| = 2\ln|x| + \frac{1}{2}\ln|7x-3| - \ln|1+x|$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{2}{x} + \frac{1}{2(7x-3)} \cdot 7 - \frac{1}{1+x}$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{4(7x-3)(1+x) + 7x(1+x) - 2x(7x-3)}{2x(7x-3)(1+x)}$$

$$\frac{dy}{dx} = \frac{(28x + 28x^2 - 12 - 12x) + 7x + 7x^2 - 14x^2 + 6x}{2x(7x-3)(1+x)} \times y$$

$$\frac{dy}{dx} = \left( \frac{21x^2 + 29x - 12}{2x(7x-3)(1+x)} \right) \times \frac{x^2 \sqrt{7x-3}}{1+x}$$

$$= \frac{x(21x^2 + 29x - 12)}{2\sqrt{7x-3}(1+x)^2}$$