Differentiate:

1. $(x+2)^5(x-1)^3$

2. $\sin(x^2 + \sqrt{x})$

3. $\ln(1 + e^{2x})$

4. $\dfrac{x^3}{(x+1)^2}$

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1. $5(x+2)^4(x-1)^3 + (x+2)^5(3(x-1)^2) \quad = (x-1)^2(x+2)^4\left[5x-5+3x+6\right]$

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2. $\cos(x^2+\sqrt{x}) \cdot \left(2x + \dfrac{1}{2\sqrt{x}}\right) = \left(2x + \dfrac{1}{2\sqrt{x}}\right)\cos(x^2+\sqrt{x})$

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3. $\dfrac{1}{1+e^{2x}} \cdot e^{2x} \cdot 2 = \dfrac{2e^{2x}}{1+e^{2x}}$

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4. $\dfrac{3x^2(x+1)^2 - x^3(2(x+1))}{(x+1)^4} = \dfrac{3x^2(x+1) - 2x^3}{(x+1)^3}$

$= \dfrac{3x^3 + 3x^2 - 2x^3}{(\quad)^3} = \dfrac{x^3 + 3x^2}{(x+1)^3} = \dfrac{x^2(x+3)}{(x+1)^3}$