1 Chain Rule

1. (i) $y = (3x^2 - 8)^4$, $\frac{dy}{dx} = 4(3x^2 - 8) \times 6x = 24x(3x^2 - 8)$.

   (ii) $y = e^{4x^5}$, $\frac{dy}{dx} = e^{4x^5} \times 4 \times 5x^4 = 20x^4 e^{4x^5}$.

   (iii) $y = \ln(5x^4 - 3x^2 - 1)$, $\frac{dy}{dx} = \frac{1}{5x^4 - 3x^2 - 1} \times (20x^3 - 6x) = \frac{20x^3 - 6x}{5x^4 - 3x^2 - 1}$.

   (iv) $y = \sqrt{x^2 + 7}$, $\frac{dy}{dx} = \frac{1}{2\sqrt{x^2+7}} \times 2x = \frac{2x}{2\sqrt{x^2+7}} = \frac{x}{\sqrt{x^2+7}}$.

   (v) $y = \sin(8x^3 - 5)$, $\frac{dy}{dx} = \cos(8x^3 - 5) \times 8 \times 3x^2 = 24x^2 \cos(8x^3 - 5)$.

   (vi) $y = \cos^3 x$, $\frac{dy}{dx} = -\sin(x^3) \times 3x^2 = -3x^2 \sin(x^3)$.

2. (i) $y = (2x^3 - 5)^8$, $\frac{dy}{dx} = 8(2x^3 - 5) \times 6x^2 = 48x^2(2x^3 - 5)$.

   (ii) $y = e^{4\sin x}$, $\frac{dy}{dx} = e^{4\sin x} \times 4\cos x = 4e^{4\sin x} \cos x$.

   (iii) $y = \ln(3x^3 - 5x^2 - 1)$, $\frac{dy}{dx} = \frac{1}{3x^3 - 5x^2 - 1} \times (9x^2 - 10x) = \frac{9x^2 - 10x}{3x^3 - 5x^2 - 1}$.

   (iv) $y = \sqrt{2x^3 + 9}$, $\frac{dy}{dx} = \frac{1}{2\sqrt{2x^3+9}} \times 6x^2 = \frac{6x^2}{2\sqrt{2x^3+9}} = \frac{3x^2}{\sqrt{2x^3+9}}$.

   (v) $y = \cos(4x^2 - x + 3)$, $\frac{dy}{dx} = -\sin(4x^2 - x + 3) \times (8x - 1) = -(8x - 1)\sin(4x^2 - x + 3)$.

   (vi) $y = \sin^3 x$, $\frac{dy}{dx} = 3\sin^2(x) \times \cos x = 3\cos x \sin^2 x$.