# Calculus Rules

**1. Chain Rule** $\frac{d}{dx}\left(u^n\right) = nu^{n-1} \times u'$

"BRING DOWN the POWER, LOWER the POWER, DIFF the INSIDE"

e.g. $(i)\ \ y = (2x+1)^2$

$$\frac{dy}{dx} = 2(2x+1)^1(2)$$
$$= 4(2x+1)$$

$(ii)\ \ y = (3x-4)^7$

$$\frac{dy}{dx} = 7(3x-4)^6(3)$$
$$= 21(3x-4)^6$$

$(iii)\ \ y = \left(x^2-10\right)^3$

$$\frac{dy}{dx} = 3\left(x^2-10\right)^2(2x)$$
$$= 6x\left(x^2-10\right)^2$$

$(iv)\ \ y = 5(4-2x)^6$

$$\frac{dy}{dx} = 30(4-2x)^5(-2)$$
$$= -60(4-2x)^5$$

$$\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$$

$(v)\quad y = \sqrt{x^2 - 3}$

$$= \left(x^2 - 3\right)^{\frac{1}{2}}$$

$$\frac{dy}{dx} = \frac{1}{2}\left(x^2 - 3\right)^{-\frac{1}{2}}(2x)$$

$$= x\left(x^2 - 3\right)^{-\frac{1}{2}}$$

$$= \frac{x}{\sqrt{x^2 - 3}}$$

$(vi)\quad x = 4t \qquad y = 2t^2$

$$\frac{dx}{dt} = 4 \qquad \frac{dy}{dt} = 4t$$

$$\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$$

$$= 4t \times \frac{1}{4}$$

$$= t$$

**Exercise 7E; 1adgj, 2behk, 3bd, 4adgj, 5ad, 6b, 7b, 8b, 10bdg, 11a, 13**