

General formulae for Der Page 282.

③

$$\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$f(x) = x^{100}$$

$$= \lim_{h \rightarrow 0} \frac{(x+h)^{100} - x^{100}}{h}$$

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Let  $y = x^{100}$

Soln:

$$\frac{dy}{dx} = 100 x^{99}$$

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$$y = 5x^{100}$$

$$= (100 \times 5) x^{99} = 500 x^{99}$$

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$$\frac{d}{dx}(u \pm v) = \frac{du}{dx} \pm \frac{dv}{dx}$$

$$y = x^7 + \sin(x)$$

$$\frac{dy}{dx} = 7x^6 + \cos(x)$$

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$$y = 3x^7 + x^{11}$$

$$\frac{dy}{dx} = 7(3x^6) + 11x^{10} = 21x^6 + 11x^{10}$$

$$y = e^{11} + \frac{3}{\sqrt{x}} + \tan(\pi)$$

(4)

$$= e^{11} + \frac{3}{x^{1/2}} + \tan(\pi)$$

$$y = e^{11} + 3x^{-1/2} + \tan(\pi)$$

$$\frac{dy}{dx} = e^{11} + -\frac{1}{2}(3)x^{-3/2} + \sec^2(\pi)$$

$$= e^{11} - \frac{3}{2}x^{-3/2} + \sec^2(\pi)$$

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$$s = 80t - t^2$$

$$v = \frac{ds}{dt} = 80 - 2t$$

$$s = t^3 - 12t^2 + 18t$$

$$\frac{ds}{dt} = 3t^2 - 24t + 18$$

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$$\frac{d}{dx}(kx) = k$$

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$$y = x^{3/2} + 5\cos(\pi)$$

$$\frac{dy}{dx} = \frac{3}{2}x^{1/2} - 5\sin(\pi)$$

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Chain Rule

$$y = (x^2 + 2)^{10} \text{ find } \frac{dy}{dx}$$

Let  $u = x^2 + 2$  then

$$y = u^{10}$$

$$\frac{dy}{du} = 10u^9$$

(5)

$$u = x^2 + 2$$

$$\frac{du}{dx} = 2x$$

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx} = 10u^9 (2x)$$

$$= 20x u^9$$

$$= 20x (x^2 + 2)^9$$

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$$y = \frac{(x^2 + 2)^{3/2}}{3} \quad \text{find } \frac{dy}{dx}.$$

Soln: Let  $u = x^2 + 2$  then

$$\frac{du}{dx} = 2x$$

$$y = \frac{u^{3/2}}{3}$$

$$\frac{dy}{du} = \frac{\cancel{3}}{2} \frac{u^{1/2}}{\cancel{3}} = \frac{u^{1/2}}{2}$$

$$\frac{dy}{dx} = \cancel{2x} \frac{u^{1/2}}{\cancel{2}} = x (x^2 + 2)^{1/2}$$

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If  $y = e^{x^2 - 2x}$  find  $\frac{dy}{dx}$ .

Soln: Let  $u = x^2 - 2x$

$$\frac{du}{dx} = 2x - 2$$

$$y = e^u$$

$$\frac{dy}{du} = e^u$$