

Fundamental Theorem of Calculus

Let $f = \text{continuous on } [a, b]$
 1) If $g(x) = \int_a^x f(t) dt$, Then $g'(x) = f(x)$

2) $\int_a^b f(x) dx = F(b) - F(a)$, where F is any antiderivative of f
 $F'(x) = f(x)$

$$g(x) = \int_a^x f(t) dt = F(x) - F(a)$$

$$g'(x) = F'(x) - 0 = f(x)$$

$$\int_{-1}^3 x^2 dx = \left. \frac{x^3}{3} \right|_{-1}^3 = \frac{3^3}{3} - \frac{(-1)^3}{3} = 9 - \frac{-1}{3} = 9 + \frac{1}{3} = \frac{28}{3}$$

$$= \left(\frac{x^3}{3} + c \right) \Big|_{-1}^3 = \left(\frac{3^3}{3} + c \right) - \left(\frac{(-1)^3}{3} + c \right) = 9 + c - \frac{(-1)}{3} - c$$

$$g(x) = \int_a^x e^{-\sin(\sqrt{t^2})} \sec(\ln(t^2)) dt$$

$$g'(x) = e^{-\sin(\sqrt{x^2})} \sec(\ln(x^2))$$

$$g(x) = \int_x^5 e^{-\sin(\sqrt{t^2})} \sec(\ln(t^2)) dt = - \int_5^x e^{-\sin(\sqrt{t^2})} \sec(\ln(t^2)) dt$$

$$g'(x) = - e^{-\sin(\sqrt{x^2})} \sec(\ln(x^2)) \quad \int_x^5 f(t) dt = \underset{\uparrow}{F(5)} - \underset{\uparrow}{F(x)}$$

$$g(x) = \int_{\frac{3}{2}}^{\sin(x)} \sqrt{\frac{1}{t^2} - \cos(t^2)} \log_{12}(\tan(t)) dt$$

$$g'(x) = \left[\sqrt{\frac{1}{\sin^2(x)} - \cos(\sin^2(x))} \log_{12}(\tan(\sin(x))) \right] \cos(x)$$

$$g(x) = \int_{\ln(x)}^{\sqrt{x}} \csc^{2.7} \left(\sqrt{\ln(\tan^{-1}(\frac{5}{x+1}))} \right) dt$$

$$g'(x) = \csc^{2.7} \left(\sqrt{\ln(\tan^{-1}(\frac{5}{x+1}))} \right) \cdot \frac{1}{2\sqrt{x}} \cdot \frac{1}{\sqrt{x}} \cdot \csc^{2.7} \left(\sqrt{\ln(\tan^{-1}(\frac{5}{x+1}))} \right) \cdot \frac{1}{x}$$

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$$= \left. \left(\frac{x^3}{3} + c \right) \right|_{-1}^3 = \left(\frac{3^3}{3} + c \right) - \left(\frac{(-1)^3}{3} + c \right) = 9 + c - \frac{(-1)}{3} - c$$

$$g(x) = \int_0^x e^{-\sin(\sqrt{t})} \sec(\ln(7^t)) dt$$

$$g'(x) = e^{-\sin(\sqrt{x})} \sec(\ln(7^x))$$

$$g(x) = \int_x^5 e^{-\sin(\sqrt{t})} \sec(\ln(7^t)) dt = - \int_5^x e^{-\sin(\sqrt{t})} \sec(\ln(7^t)) dt$$

$$g'(x) = - e^{-\sin(\sqrt{x})} \sec(\ln(7^x)) \quad \int_x^5 f(t) dt = F(5) - F(x)$$

$$g(x) = \int_{\sin(x)}^{\sin(x)+1} \sqrt{t^4 - \cos(t^5)} \log_{12}(\tan(t)) dt$$

$$g'(x) = \left[\sqrt{\sin^4(x) - \cos(\sin^5(x))} \log_{12}(\tan(\sin(x))) \right] \cos(x)$$

$$g(x) = \int_{\ln(x)}^{\sqrt{x}} \csc^{23} \left(\sqrt{\ln(\tan^{-1}(\frac{5}{t+1}))} \right) dt$$

$$g'(x) = \csc^{23} \left(\sqrt{\ln(\tan^{-1}(\frac{5}{\sqrt{x}+1}))} \right) \frac{1}{2\sqrt{x}} \uparrow \csc^{23} \left(\sqrt{\ln(\tan^{-1}(\frac{5}{\ln(x)+1}))} \right) \frac{1}{x}$$