



AP Calculus AB – Unit 5

Problem Set 35: The Fundamental Theorem of Calculus

Evaluate the following expressions using the Fundamental Theorem of Calculus.

1. $\frac{d}{dx} \int_{-2}^x \sqrt{t} dt$

$$= \sqrt{x}$$

2. $\frac{d}{dx} \int_1^x (t^2 - 4t + 7) dt$

$$= x^2 - 4x + 7$$

3. $\frac{d}{du} \int_u^0 (3-v) dv$

$$= -\frac{d}{du} \int_0^u (3-v) dv$$

$$= -(3-v)$$

$$= -3 + v$$

4. $\frac{d}{dr} \int_0^{-r} s^{2/3} ds$

$$= (-r)^{2/3} \cdot (-1)$$

$$= -(-r)^{2/3}$$



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$$5. \frac{d}{dr} \int_0^{\sin(r)} \sec(t) dt$$

$$= \sec(\sin(r)) \cdot \cos(r)$$

$$6. \frac{d}{dx} \int_{e^{3x}}^1 (t^2 - 2)^3 dt$$

$$= - \frac{d}{dx} \int_1^{e^{3x}} (t^2 - 2)^3 dt$$

$$= - \left((e^{3x})^2 - 2 \right)^3 \cdot 3e^{3x}$$

$$= -3e^{3x} (e^{6x} - 2)^3$$

$$7. \frac{d}{dx} \int_{x-1}^{3x+5} \sqrt[3]{t} dt$$

$$= \sqrt[3]{3x+5} \cdot 3 - \sqrt[3]{x-1} \cdot 1$$

$$= 3\sqrt[3]{3x+5} - \sqrt[3]{x-1}$$

$$8. \frac{d}{dy} \int_{\sqrt{y}}^{\ln y} 6z dz \quad \sqrt{y} = y^{1/2}$$

$$= 6(\ln y) \cdot \frac{1}{y} - 6\sqrt{y} \cdot \frac{1}{2} y^{-1/2}$$

$$= \frac{6 \ln y}{y} - \frac{6\sqrt{y}}{2\sqrt{y}}$$

$$= \frac{6 \ln y}{y} - 3$$