

INTEGRATION QUESTIONS - WEEK 7

NUTM Nexus Writing Team

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1 Differentiation of Integrals

1. Use the theorem of integration as inverse of differentiation (FTC) to find $\frac{dy}{dx}$ if:

(a) $y = \int_a^x (t^3 + 1) \, dt$

(b) $y = \int_{1+3x^2}^4 \frac{1}{2 + e^t} \, dt$

2. Find the derivatives:

(a) $\frac{d}{dt} \int_0^{t^4} \sqrt{u} \, du$

(b) $\frac{d}{dx} \int_0^{x^3} e^{-t} \, dt$

2 Evaluation of Definite Integrals

Evaluate the following definite integrals (numbering follows original presentation order):

1. $\int_{-2}^0 (2x + 5) \, dx$

2. $\int_{-3}^1 \left(5 - \frac{x}{2}\right) \, dx$

3. $\int_0^2 x(x - 3) \, dx$

4. $\int_{-1}^1 (x^2 - 2x + 3) \, dx$

5. $\int_0^4 \left(3x - \frac{x^3}{4}\right) \, dx$

6. $\int_{-2}^2 (x^3 - 2x + 3) \, dx$

7. $\int_0^1 (x^2 + \sqrt{x}) \, dx$

8. $\int_1^{32} x^{-6/5} \, dx$

9. $\int_1^{-1} (r+1)^2 \, dr$
10. $\int_{-\sqrt{3}}^{\sqrt{3}} (t+1)(t^2+4) \, dt$
11. $\int_{\sqrt{2}}^1 \left(\frac{u^7}{2} - \frac{1}{u^5} \right) \, du$
12. $\int_{-3}^{-1} \frac{y^5 - 2y}{y^3} \, dy$
13. $\int_1^{\sqrt{2}} \frac{s^2 + \sqrt{s}}{s^2} \, ds$
14. $\int_1^8 \frac{(x^{1/3} + 1)(2 - x^{2/3})}{x^{1/3}} \, dx$