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Saathi

Assignment-2

1. $$\int_{1/50}^{2} \frac{e^{2/\omega}}{\omega^2}\, d\omega$$

Let $t = e^{2/\omega}$

Diff w.r.t ω

$$\frac{dt}{dx} = -2e^{2/\omega} \cdot \frac{1}{\omega^2}$$

$$= \int_{1/50}^{2} \frac{t\omega^2}{-2\omega^2 e^{2/\omega}} \cdot dt$$

$$= \frac{-1}{2} \int_{1/50}^{2} dt$$

$$= \frac{-1}{2} [x]_{1/50}^{2}$$

$$= \frac{-1}{2} (2 - 0.02)$$

$$= \boxed{-0.99}$$

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2. $\displaystyle\int \frac{2t^3+1}{(t^4+2t)^3}\,dt$

Let $x = (t^4+2t)^3$

Diff w.r.t. t.

$$\frac{dx}{dt} = 3(t^4+2t)^2(4t^3+2)$$

$$= \int \frac{2t^3+1}{x(3)(t^4+\cancel{t})^2(4t^3+2)}\,dx.$$

$=$ ⊗ and ÷ by 2

$$= \int \frac{4t^3/t^2}{(x)(6)(4t^3/2)(x)^{2/3}}\,.dx$$

$$= \frac{1}{6}\int \cancel{x}^{-5/3}$$

$$= \frac{1}{6}\left(\frac{x^{-5/3+1}}{\frac{-5}{3}+1}\right)$$

$$= \frac{\cancel{3}\,1}{6(-2)}\,x^{-2/3} + C$$

$$= \frac{-1}{4}(t^4+2t)^{(-2)/3} + C$$

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Q3. $f'(x) = x^4 + 3x - 9$

$f(x) = \int f'(x)\,dx$

$f(x) = \int (x^4 + 3x - 9)\,dx$

$= \frac{x^5}{5} + \frac{3x^2}{2} - 9x + C$ //

5. 4. $\int 3(8y-1)e^{4y^2-y}\,dy$

$x = 4y^2 - y$

Diff w.r.t. x

$\frac{dx}{dy} = (e^{4y^2-y})(8y-1)$

$= \int \frac{3(8y-1)e^{4y^2-y}}{e^{4y^2-y}(8y-1)}\,dx$

$= 3x + C$

$= \boxed{3(e^{4y^2-y}) + C}$ //

4. $f(x) = \begin{cases} 6 & \text{if } x > 1 \\ 3x^2 & \text{if } x < 1 \end{cases}$

$= \int_{-2}^{3} f(x)\,dx$

$= \int^{\infty} 6\,dx + \int_{-\infty}^{1} 3x^2\,dx$

$= [6x]_{1}^{\infty} + \left[\frac{3x^3}{3}\right]_{-\infty}^{1}$

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$= -6+1$

$= -5$ //

9. $\frac{dv}{dt} = 9.8 - 0.196v.$

$= \int \frac{dv}{9.8-0.196v} = \int dt$

$= \log(9.8-0.196v)$

$= -0.196v + C$ //

12. $f(x) = x^3 - 10x^2 + 6$ $\qquad x=3$

$f(x) = x^3 - 10x^2 + 6$ $\qquad f(3) = 3^3 - 10(3)^2 + 6$

$=-57$

$f'(x) = 3x^2 - 20x$ $\qquad f'(3) = -33$

$f''(x) = 6x - 20$ $\qquad f''(3) = -2$

$f'''(x) = 6$ $\qquad f'''(3) = 6$

$f^{iv}(x) = 0$ $\qquad f^{iv}(3) = 0$

$x^3 - 10x^2 + 6 = -57 - 33(x-3) + \frac{2}{2!}(x-3)^2 + \frac{6}{3!}(x-3)^3 + 0$

$= -57 - 33(x-3) - (x-3)^2 + (x-3)$

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11. $\frac{dy}{dx} = \frac{xy^3}{\sqrt{1+x^2}}$ $y(0) = -1$

$\therefore \int \frac{1}{y^3} dy = \int \frac{x}{\sqrt{1+x^2}} dx$

$1+x^2 = t$

$2x \, dx = dt$

$dx = \frac{1}{2} dt$

$\therefore \frac{-1}{2y^2} = \frac{1}{2} \int \frac{1}{\sqrt{t}} \cdot dt$

$\therefore -\frac{1}{2} \cdot \frac{1}{y^2} = 2 \times \frac{1}{2} \sqrt{1+x^2} + C$

$-\frac{1}{2} \cdot \frac{1}{(-1)^2} = \sqrt{1+(0)^2} + C$

$\frac{-1}{2} = 1 + C$

$\frac{-3}{2} = C$

$\frac{-1}{2y^2} = \sqrt{1+x^2} = \frac{3}{2}$ //