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Calculus

Q.1) $$\int_{1/30}^{2} \frac{e^{2/\omega}}{\omega^2}\, d\omega.$$

let $t = e^{2/10}$

diff w.r.t ω.

$$\frac{dt}{d\omega} = -2e^{2/\omega}\frac{1}{\omega^2}.$$

$$= \int_{1/10}^{2} \frac{t\omega^2\, dt}{-2\omega^2\, e^{2}\omega}.$$

$$\frac{-1}{a}\int_{1/10}^{2} dt = \frac{-P}{2}\left(x^2\right)_{1/150}$$

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

$$= -0.99$$

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

let $x = (t^4 2t)^3$

diff. w.r.t t.

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

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

Multiply and divide by 2

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

$$= \frac{1}{6}\int x^{8}\, dx$$

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$$= \frac{1}{6} \frac{x^{-5/3+1}}{-5/3+1} \cdot \frac{3}{6_2(-2)} x^{-2/3} + C$$

$$8\left(-\frac{2}{3}\right)$$

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

Q. 3 $f'(x) \quad 2x^4 + 3x - 9 \qquad f(x) = \int f'(x)\,dx$

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

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

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

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

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

$$[x^3]_{-2}^{1} + [6x]_{1}^{3}$$

$$1 + 8 + 18 - 6 = 21$$

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

$x = e^{4y^2-y}$

dift w.r.t

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

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

$3x + C$

$3(e^{4y^2-y}) + C$.

Q.6) $f''(x) = 15\sqrt{x} + 5x^3 + 6$

$f'(x) = \int 15\sqrt{x} + 5x^3 + 6\,dx$.

$= \frac{15x^{3/2}}{3/2} + \frac{5x^4}{4} + 6x + k$

$f(x) = \int \frac{15x^{3/2}}{3/2} + \frac{5x^4}{4} + 6x + k\,dx$.

$f(x) = 4x^{5/2} + \frac{x^4}{4} + 3x^2 + kx + C$.

$f(1) = \frac{-5}{4} = 4 + \frac{1}{4} + 3 + k + C$.

$k + C = -8.5$

$f(4) = 404 = 4(4)^{5/2} + \frac{(4)^4}{4} + 3(4)^2 + 4k$

$4k + C = 164$.

$$4k + c = 164$$
$$-12 + c = 8.8$$

$$k = 57.5$$
$$c = -66$$

$$\therefore f(x) = 4x^{3/2} + \frac{x^4}{4} + 3x^2 + 57.5x - 66$$

Q.9. $\int \frac{dw}{9.8 - 0.196w} = \int dt$

$$\log(9.8 - 0.196w) = -0.196t + c.$$

Q.12) Talor series for $f(x) = x^3 - 10x^2 + 6x$

$f(x) = x^3 - 10x^2 + 6$ $\quad f(3) = -57$
$f'(x) = 3x^2 - 20x$ $\quad f'(3) = -33$
$f''(x) = 6x - 20$ $\quad f''(3) = -2$
$f'''(x) = 6.$ $\quad f'''(3) = 6$

$$f(x) = f(3) + (x-3)f'(x) + \frac{(x-3)^2}{\cancel{k}} f''(3) + \frac{(x-3)^3}{\lfloor 3} f'''(3) \ldots$$

$\lfloor 2$

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$x^3 - 10x^2 + 6c - 57 + (x-3) - 36 + \frac{(x-3)^2}{2}(-2) + \frac{6(x-3)^3}{\lfloor 3}$

Q.13) Maclaurin series for $(1+x)$

$f'(x) = n(1+x)^{n-1}$

$f''(x) = (n)(n-1)(1+x)^{n-2}$

$f'''(x) = -(n)(n-1)(n-2)(1+x)^{n-3}$

$f(x) = f(0) = \frac{x^1}{\lfloor 1} f'(0) + \frac{x^2}{\lfloor 2} f''(0) + \frac{x^3}{\lfloor 3} f'''(0)$

$(1+x)^n = 1 + n + (n-1)(n) + (n)(n-1)(n-2) \ldots$

Q.4.) $f(x) = \sqrt{1+x}$

$f'(x) = \frac{1}{2}(1+x)^{-1/2} \quad f'(0) = 1/2$

$f''(x) = \frac{-1}{4}(1+x)^{-3/2} \quad f''(0) = -1/4$

$f'''(x) = \frac{-3}{8}(1+x)^{-5/2} \quad f'''(0) = -3/8$

$\sqrt{1+x} = \sqrt{1+x} + \frac{x^1}{\lfloor 1}\left(\frac{1}{2}\right) + \frac{x^2}{\lfloor 2}\left(\frac{-1}{4}\right) + \frac{x^3}{\lfloor 3}\frac{-3}{8}$

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Taylor series.

Q.1) $f(x) = e^{-6x}$ $\quad x = -4$

$f(x) = e^{-6x}$. $\quad f(-4) = e^{+24}$

$f'(x) = e^{24}(6)^1$

$f'(x) = e^{-6x}(-6)$ $\quad f''(-4) = e^{24}(6)^2$

$f''(x) = (-6)e^{-6x}(-6)$ $\quad f'''(-4) = 6^{24}(6)^3$.

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

$$e^{-6x} = e^{+24} + (x+1)e^{24}(6 + \frac{(x-4)}{L2}^2 (2)^x (6)^2$$

$$+ \frac{(x-4)^4}{L3}(e^{x})(6)^3$$

Q.6) $f(x) = \ln(3+4x)$ $\quad x = 0 = (3)$

$f'(x) = \frac{4}{3+4x}$

$f'(0) = 4/3$

$f''(x) = -4(4x+3)^{-2}(4)$ $\quad f''(0) = -1(4)^2(3)^{-2}$

$f'''(x) = (+8)(4x+3)^{-3}(4)$ $\quad f'''(0) = (-1)(-2)(3)^{-3}$

$$\ln(3+4x) = \ln(3) + \frac{x}{L1}4/3 + \frac{x^2}{L2}(-1)(4)^2(3)^{-2}$$

$$+ \frac{x^3}{L3}(4)^3(2)(3)^2 \ldots$$