

$$\frac{A^{-2+1}}{-2+1}$$

$$1) \int_{1/50}^2 \frac{e^{2/u}}{u^2} du \quad \frac{2}{u} = t \quad \frac{dt}{du} = -\frac{2}{u^2}$$

$$= \frac{1}{-2} \int e^t dt = \left[ -\frac{e^{2/u}}{2} \right]_{1/50}^2 \quad (\text{Ans})$$

$$2) \int \frac{2t^3 + 1}{(t^4 + 2t)^3} dt \quad \begin{aligned} t^4 + 2t &= A \\ 4t^3 + 2 &= dA/dt \\ (2t^3 + 1) dt &= dA/2 \end{aligned}$$

$$= \frac{1}{2} \int \frac{dA}{A^3} = -\frac{1}{4} (t^4 + 2t)^{-2} + C \quad (\text{Ans})$$

$$3) f'(x) = x^5 + 3x - 9$$

$$f(x) = \int f'(x) = \frac{x^6}{6} + \frac{3x^2}{2} - 9x + C \quad (\text{Ans})$$

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

$$\int_2^3 f(x) dx = \int_2^1 3x^2 dx + \int_1^3 6 dx = \left[ x^3 \right]_2^1 + \left[ 6x \right]_1^3$$

$$= 1 + 8 + 12 = 21$$

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

$$\begin{aligned} e^{4y^2-y} &= t \\ \frac{dt}{dy} &= e^{4y^2-y} (8y-1) \end{aligned}$$

$$= \int 3 dt = 3t + C$$

$$= 3(e^{4y^2-y}) + C \quad (\text{Ans})$$

$$6) f''(x) = 15\sqrt{x} + 5x^3 + 6 \quad f(1) = -5/4 \quad f(x) = 404$$

$$f'(x) = \int f''(x) dx = 10x^{3/2} + \frac{5x^4}{4} + 6x$$

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

$$7) f(n+iy) + g(n-iy) \\ \rightarrow f(y) + g(y) + if(y) - ig(y)$$

$$8) \frac{dx}{d\theta} = x^2 \quad x(1) = 2$$

$$\frac{-1}{x} = \log(\theta)$$

$$\left( x = \frac{-1}{\log(\theta)} \right)$$

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

$$\log(9.8 - 0.196v) = -0.196t + C$$

$$12) f(n) = n^3 - 10n^2 + 6 \quad n=3$$

$$f(3) = -57 \quad f'(3) = -33 \quad f''(3) = -2 \quad f'''(3) = 6$$

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

$$14) f(n) = \sqrt{1+n}$$

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

$$\sqrt{1+n} = \sqrt{1+n} + \left(\frac{1}{2}\right)(n) + \frac{n^2}{2} \left(-\frac{1}{4}\right) + \frac{n^3}{3!} \left(-\frac{3}{8}\right) + \dots$$

$$16) f(n) = \ln(3+4n)$$

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

$$f'''(0) = (-1)(-2)(3)^{-2}(4)^3$$

$$\ln(3+4n) = \ln(3) + \frac{n}{1} \left(\frac{4}{3}\right) + \frac{n^2}{2} (-1) (4)^2 (3)^{-2} + \dots$$