$$\boxed{\frac{-1}{4(t^4+2t)^2}}$$

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

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

$$\boxed{f(x) = \frac{x^5}{5} + \frac{3}{2}x^2 - 9x + C}$$

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

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

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

$$= \left[x^3\right]_{-2}^{1} + \left[6x\right]_{1}^{3}$$

$$= 9 + 12$$

$$\boxed{= 21}$$

(12) $f(x) = x^3 - 10x^2 + 6$ for $x = 3$

Sol^n

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

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

$f''(x) = 6x - 20$

$f'''(x) = 6$

$f(3) = 27 - 90 + 6 = -57$

$f'(3) = 3^3 - 20(3) = 27 - 60 = -33$

$f''(3) = 18 - 20 = -2$

$f'''(3) = 6$

$$x^3 - 10x^2 + 6 = (-57) + (x-3)(-33) - (x-3)^2(2) + (x-3)^3 \ldots$$

(13) Maclaurin series for $(1+x)^u$

Sol^n

$f(x) = (1+x)^u$

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

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

$f'''(x)\ u(u-1)(u-2)(1+x)^{u-3}$

$f(0) = 1$

$f'(0) = u$

$f''(0) = u(u-1)$

$f'''(0) = u(u-1)(u-2)$

$$f(x) = 1 + ux + u(u-1)\frac{x^2}{2} + u(u-1)(u-2)\frac{x^3}{6} + \ldots$$

$$\boxed{f(x) = 1 + \sum_{i=1}^{n} \frac{u\,u\,x^n (u-n)}{n!}}$$

(14) $f(x) = \sqrt{1+x}$, Maclaurian series

Sol^n

$f(x)\ \sqrt{1+x}$

$f'(x) = \dfrac{1}{2\sqrt{1+x}}$

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

$f'''(x) = \dfrac{+3}{8(1+x)^{5/2}}$

$f(0) = 1$

$f'(0) = 1/2$

$f''(0) = -1/4$

$f'''(0) = 3/8$

$$\boxed{f(x) = 1 + \frac{x}{2} + \frac{x^2}{8} + \frac{x^3}{16} + \dots\dots}$$

Taylor series for $f(x) = e^{-6x}$ for $x = -4$

$f(x) = e^{-6x}$ $\qquad$ $f(-4) = e^{24}$

$f'(x) = (-6)e^{-6x}$ $\qquad$ $f'(x) = -6e^{24}$

$f''(x) = 36e^{-6x}$ $\qquad$ $f''(x) = 36e^{24}$

$$\boxed{f(x) = e^{24} - (x+4)6e^{24} + (x+4)^2 \times 18e^{24} + \dots\dots}$$

Taylor series for $f(x) = \ln(3+4x)$ for $x = 0$

$f(x) = \ln(3+4x)$ $\qquad$ $f(0) = \ln(3)$

$f'(x) = \frac{1}{3+4x}$ $\qquad$ $f'(0) = \frac{1}{3}$

$f''(x) = \frac{-4}{(3+4x)^2}$ $\qquad$ $f''(0) = -\frac{4}{9}$

$f'''(x) = \frac{8}{(3+4x)^3}$ $\qquad$ $f'''(0) = \frac{8}{27}$

$$f(x) = \ln(3) + \frac{x}{3} - \frac{4x^2}{2 \times 9} + \frac{8x^3}{27 \times 6} +$$

$$\boxed{f(x) = \ln(3) + \frac{x}{3} - \frac{2x^2}{9} + \frac{4x^3}{81} + \dots}$$

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

Sol^n let $4y^2-y = t$

$(8y-1)\,dy = dt$

$= 3\int e^t\,dt$

$= \boxed{3e^{4y-y^2} + c}$

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

Sol^n $f(x) = \iint (15\sqrt{x} + 5x^3 + 6)\,dx\,dx$

$= \int \left(\frac{15 \times x^{3/2}}{3/2} + \frac{5}{4}x^4 + 6x\right) dx$

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

$= \frac{2 \times 10}{5} x^{5/2} + \frac{5}{4} \cdot \frac{x^5}{5} + \frac{6x^2}{2} + c$

$= 4x^{5/2} + \frac{x^5}{4} + 3x^2 + c$