a) $f(x) = 3x^4 - 2x^3 + x^2 + M$

$f'(x) = 12x^3 - 6x^2 + 2x = 2x(6x^2 - 3x + 1)$

b) $f(x) = \frac{5}{2}x^3 + \frac{1}{3}x + \frac{3}{4}$

$f'(x) = \frac{15}{2}x^2 + \frac{1}{3}$

c) $f(x) = \frac{1}{(4x-1)^5}$

$u = 1 \quad u' = 0$

$v = (4x-1)^5 \quad v' = 5(4x-1)^4 \cdot 4 = 20(4x-1)^4$

$f'(x) = \frac{-20(4x-1)^4}{(4x-1)^{10}} = \frac{-20}{(4x-1)^6}$

d) $f(x) = \sqrt{3x^2 - 4x}$

$u = 3x^2 - 4x$

$u' = 6x - 4 = 2(3x-2)$

$f'(x) = \frac{2(3x-2)}{2\sqrt{3x^2-4x}} = \frac{3x-2}{\sqrt{3x^2-4x}}$

e) $f(x) = (3x^2 - 5x)^3$

$u = 3x^2 - 5x \quad u' = 6x - 5$

$f'(x) = 3(3x^2-5x)^2(6x-5) = 3x^2(3x-5)^2(6x-5)$

f) $f(x) = (4x+1)^2(x-2)$

$u = (4x+1)^2$

$u' = 2(4x+1)\cdot 4 = 8(4x+1)$

$v = x-2$

$v' = 1$

$f'(x) = 8(4x+1)(x-2) + (4x+1)^2$

$= (4x+1)\left[8(x-2) + (4x+1)\right] = (4x+1)(12x-15) = 3(4x+1)(4x-5)$

g) $f(x) = \frac{x^2-3x}{x+1}$

$u = x^2 - 3x \quad u' = 2x - 3$

$v = x+1 \quad v' = 1$

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

$= \frac{(x+3)(x-1)}{(x+1)^2}$

h) $f(x) = \dfrac{4-x}{x^2}$ $\quad u = 4-x \quad u' = -1 \quad v = x^2 \quad v' = 2x$

$$f'(x) = \frac{-x^2 - 2x(4-x)}{x^4} = \frac{-x^2 - 8x + 2x^2}{x^4} = \frac{x^2 - 8x}{x^4} = \frac{x(x-8)}{x^4} = \underline{\frac{x-8}{x^3}}$$

i) $f(x) = (2x^2-3)^2$ $\quad u = 2x^2-3 \quad u' = 4x$

$$f'(x) = 2(2x^2-3)\cdot 4x = \underline{8x(2x^2-3)} \quad \left(= 8x(\sqrt{2}x+\sqrt{3})(\sqrt{2}x-\sqrt{3})\right)$$

j) $f(x) = (x+2)^2(x-1)^3$ $\quad u = (x+2)^2 \quad u' = 2(x+2) \quad v = (x-1)^3 \quad v' = 3(x-1)^2$

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

$$= (x+2)(x-1)^2\left[2(x-1) + 3(x+2)\right] = \underline{(x+2)(x-1)^2(5x+4)}$$