#1   $f(x) = 3x - 4 \Rightarrow f'(x) = 3$

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

#3)  $f(x) = x^3 + x - \sqrt{x} \Rightarrow f'(x) = 3x^2 + 1 - \dfrac{1}{2\sqrt{x}}$

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

#5   $f(t) = 4\sqrt{t} - \dfrac{1}{4}t^4 + t + 1 + \dfrac{1}{t} \Rightarrow f'(t) = \dfrac{2}{\sqrt{t}} - t^3 + 1 - \dfrac{1}{t^2}$

#6   $f(x) = x^{.35} + x^{-\pi^2} + x^{\sqrt{7}} \Rightarrow f'(x) = .35x^{-.65} - \pi^2 x^{-\pi^2 - 1} + \sqrt{7}\, x^{\sqrt{7} - 1}$

#7   $f(x) = 4x^{5/3} + 6x^{-3/2} - 11x$
$f'(x) = \dfrac{20}{3}x^{2/3} - 9x^{-5/2} - 11$

#8   $f(x) = 2x^{5/4} + 4x^{-2} - 6x \Rightarrow f'(x) = \dfrac{5}{2}x^{1/4} - 8x^{-3} - 6$

#9   $f(t) = 7t^{-5/14} + 2t^{-6} + 6 \Rightarrow f'(t) = -\dfrac{5}{2}t^{-19/14} - 12t^{-7}$

#10  $f(x) = \sqrt[4]{x} + \sqrt[3]{x} + \sqrt{2}\, x^{\sqrt{2}}$

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

$= \dfrac{1}{4\sqrt[4]{x^3}} + \dfrac{1}{3\sqrt[3]{x^2}} + 2x^{\sqrt{2} - 1}$

#11  $f(x) = 6\sqrt{x} - \dfrac{1}{\sqrt{x}} \Rightarrow f'(x) = \dfrac{3}{\sqrt{x}} + \dfrac{1}{2x\sqrt{x}}$

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

$f'(x) = -6x^{-5/2} = \dfrac{-6}{x^2\sqrt{x}}$

#13  $f(x) = \dfrac{1 - 2x}{x^{1/2}} = x^{-1/2} - 2x^{1/2}$

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

$= \dfrac{-1}{2x\sqrt{x}} - \dfrac{1}{\sqrt{x}}$

#14   $f(y) = 16 y^{0.2} + 8 y^{-0.8}$

   $f'(y) = 3.2 y^{-.8} - 6.4 y^{-1.8}$

#15   $f(x) = (1 - 2x)(3x + 5)$

   $= 3x + 5 - 6x^2 - 10x$

   $= -6x^2 - 7x + 5$

   $f'(x) = -12x - 7$

#16   $f(x) = (2x + 1)(3x^2 + 2)$

   $= 6x^3 + 4x + 3x^2 + 2$

   $f'(x) = 18x^2 + 4 + 6x$

#17   $f(x) = (5x^3 + 3x + 1)(x^2 + 5) = 5x^5 + 20x^3 + 3x^3 + 15x + x^2 + 5$

   $= 5x^5 + 28x^3 + x^2 + 15x + 5$

   $f'(x) = 25x^4 + 84x^2 + 2x + 15$

   ② $f'(x) = (15x^2 + 3)(x^2 + 5) + (5x^3 + 3x + 1)(2x)$

   $= 15x^4 + 75x^2 + 3x^2 + 15 + 10x^4 + 6x^2 + 2x$

   $= 15x^4 + 84x^2 + 2x + 15.$

#18   $f(x) = (x^2 - 2)^2 = x^4 - 4x^2 + 4$

   $f'(x) = 4x^3 - 8x$

#19   $f(x) = \sqrt{x}(\sqrt{x} - 1) = x - \sqrt{x}$

   $f'(x) = 1 - \frac{1}{2\sqrt{x}}$

#20   $f(y) = \frac{y^2 - 1}{y - 1} = \frac{(y-1)(y+1)}{y-1} = y + 1$

   $f'(y) = 1.$

#21 $f(x) = \dfrac{x^3 - 6x^2 + 8x}{x^2 - 2x} = \dfrac{x^2 - 6x + 8}{x - 2} = \dfrac{(x-2)(x-4)}{x-2}$

$\qquad = x - 4$

$f'(x) = 1$

#22 $f(x) = \dfrac{x-a}{\sqrt{x} - \sqrt{a}} \cdot \dfrac{\sqrt{x} + \sqrt{a}}{\sqrt{x} + \sqrt{a}} = \dfrac{(x-a)(\sqrt{x} + \sqrt{a})}{x-a}$ ⎫ $u = x-a \quad N = \sqrt{x} - \sqrt{a}$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad u' = 1 \quad N' = \frac{1}{2\sqrt{x}}$

$\qquad = \sqrt{x} + \sqrt{a}$

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

(Or)

$f'(x) = \dfrac{\sqrt{x} - \sqrt{a} - \frac{1}{2\sqrt{x}}(x-a)}{(\sqrt{x} - \sqrt{a})^2}$

$\qquad = \dfrac{1}{2\sqrt{x}} \dfrac{2x - 2\sqrt{x}\sqrt{a} - x + a}{(\sqrt{x} - \sqrt{a})^2}$

$\qquad = \dfrac{1}{2\sqrt{x}} \dfrac{x - 2\sqrt{x}\sqrt{a} + a}{(\sqrt{x} - \sqrt{a})^2}$

$\qquad = \dfrac{1}{2\sqrt{x}} \dfrac{(\sqrt{x} - \sqrt{a})^2}{(\sqrt{x} - \sqrt{a})^2}$

$\qquad = \dfrac{1}{2\sqrt{x}}$

#23 $y = \dfrac{x^2 - 2ax + a^2}{x - a} = \dfrac{(x-a)^2}{x-a} = x - a$

$\qquad y' = 1$

#24 $y = \dfrac{x}{x+1} \Rightarrow y' = \dfrac{x+1 - x}{(x+1)^2} = \dfrac{1}{(x+1)^2}$

#25 $y = \dfrac{2x^2}{3x+1} \Rightarrow y' = \dfrac{4x(3x+1) - 6x^2}{(3x+1)^2} = \dfrac{6x^2 + 4x}{(3x+1)^2}$

#26 $f(x) = \dfrac{x^3 - 4x^2 + x}{x - 2}$

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

$\qquad = \dfrac{3x^3 - 6x^2 - 8x^2 - 10x + x - 2 - x^3 + 4x^2 - x}{(x-2)^2}$

$\qquad = \dfrac{2x^3 - 10x^2 - 10x - 2}{(x-2)^2}$

#27  $f(x) = \frac{x^2-1}{x^2+1}$

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

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

$= \frac{4x}{(x^2+1)^2}$

#28  $y = \frac{4x^3 + 3x + 1}{2x^5} = 2x^{-2} + \frac{3}{2}x^{-4} + \frac{1}{2}x^{-5}$

$y' = -4x^{-3} - 6x^{-5} - \frac{5}{2}x^{-6}$

$= \frac{-4}{x^3} - \frac{6}{x^5} - \frac{5}{2x^6}$

#29  $g(t) = 3t^2 + \frac{6}{t^7}$

$g'(t) = 6t - \frac{42}{t^8}$

$\left(\frac{1}{x^n}\right)' = \frac{-n}{x^{n+1}}$

#30  $g(x) = \frac{x(3-x)}{2x^2} = \frac{3x - x^2}{2x^2} = \frac{3}{2}\frac{1}{x} - \frac{1}{2}$     $\frac{3x}{2x^2} - \frac{x^2}{2x^2}$

$g'(x) = -\frac{3}{2x^2}$

#3.1/ $g(x) = \dfrac{(x-1)(2x^2-1)}{x^3-1}$

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

$$= \dfrac{2x^2-1}{x^2+x+1}$$

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

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

$$= \dfrac{2x^2+6x+1}{(x^2+x+1)^2}$$

#3.2/ $f(x) = (2+x^{-1})(x^{3/2}+1)$

$$= 2x^{3/2}+2+x^{1/2}+x^{-1}$$

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

#3.3/ $f(x) = \dfrac{x}{1+x^2}$

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

#3.4/ $f(x) = \dfrac{x+4}{x^2+x+1}$

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

$$= \dfrac{x^2+x+1 - 2x^2-8x-x-4}{(x^2+x+1)^2}$$

$$= \dfrac{-x^2-8x-3}{(x^2+x+1)^2}$$

#35/ $f(x) = \dfrac{x^{3/2}(x^2+1)}{x+1}$

$= \dfrac{x^{7/2} + x^{3/2}}{x+1}$

$f'(x) = \dfrac{\left(\frac{7}{2}x^{5/2} + \frac{3}{2}x^{1/2}\right)(x+1) - x^{7/2} - x^{3/2}}{(x+1)^2}$

$= \dfrac{1}{2} \dfrac{7x^{7/2} + 7x^{5/2} + 3x^{3/2} + 3x^{1/2} - 2x^{7/2} - 2x^{3/2}}{(x+1)^2}$

$= \dfrac{1}{2} \dfrac{5x^{7/2} + 7x^{5/2} + x^{3/2} + 3x^{1/2}}{(x+1)^2}$

#36/ $f(x) = \dfrac{x^2-4}{x-1} \cdot \dfrac{x^2-1}{x+2}$

$= \dfrac{(x-2)(x+2)}{x-1} \cdot \dfrac{(x-1)(x+1)}{x+2}$

$= (x-2)(x+1)$

$= x^2 - x - 2$

$f'(x) = 2x - 1$

#37/ $f(x) = \dfrac{x^9 + x^8 + 4x^5 - 7x}{x^4 - 3x^2 + 2x + 1}$

$u = x^9 + x^8 + 4x^5 - 7x$ $\quad N = x^4 - 3x^2 + 2x + 1$

$u' = 9x^8 + 8x^7 + 20x^4 - 7$

$N' = 4x^3 - 6x + 2$

$f'(x) = \dfrac{(9x^8 + 8x^7 + 20x^4 - 7)(x^4 - 3x^2 + 2x + 1) - (4x^3 - 6x + 2)(x^9 + x^8 + 4x^5 - 7x)}{(x^4 - 3x^2 + 2x + 1)^2}$

$= \dfrac{\begin{array}{l}9x^{12} - 27x^{10} + 18x^9 + 9x^8 + 8x^{11} - 24x^9 + 16x^8 + 8x^7 + 20x^8 - 60x^6 - 40x^5 \\ + 20x^4 - 7x^4 + 21x^2 - 14x - 7 - 4x^{12} - 4x^{11} - 16x^8 + 28x^4 + 6x^{10} + 6x^9 \\ + 24x^6 - 42x^2 - 2x^9 - 2x^8 - 8x^5 + 14x\end{array}}{(x^4 - 3x^2 + 2x + 1)^2}$

$= \dfrac{5x^{12} + 4x^{11} - 21x^{10} - 2x^9 - 27x^8 + 8x^7 - 36x^6 - 48x^5 + 41x^4 - 21x^2 - 7}{(x^4 - 3x^2 + 2x + 1)^2}$