I. ① $y = \frac{5}{x^3} = 5x^{-3}$ $\quad y' = 5(-3)x^{-4} = \boxed{-15x^{-4}}$

either one

② $y = \sqrt[3]{x^{10}} = (x^{10})^{\frac{1}{3}} = x^{10/3}$ $\quad y' = \frac{10}{3}x^{\frac{10}{3}-\frac{3}{3}} = \boxed{\frac{10}{3}x^{7/3}} = \frac{10\sqrt[3]{x^7}}{3}$

③ $y = \frac{1}{5x^3} = \frac{1}{5}\cdot\frac{1}{x^3} = \frac{1}{5}x^{-3}$ $\quad y' = \frac{1}{5}(-3)x^{-4} = \boxed{-\frac{3}{5}x^{-4}} = \frac{-3}{5x^4}$

④ $y = \frac{7}{6\sqrt[5]{x^8}} = \frac{7}{6}\cdot\frac{1}{(x^8)^{\frac{1}{5}}} = \frac{7}{6}\cdot\frac{1}{x^{8/5}} = \frac{7}{6}x^{-8/5}$ $\quad y' = \frac{7}{6}\left(\frac{-8}{5}\right)x^{\frac{-8}{5}-\frac{5}{5}} = \boxed{\frac{-56}{30}x^{-13/5}}$

II. ⑤ $y = \frac{x^3 - 3x^2 + 5x + 2}{x^2} = \frac{x^3}{x^2} - \frac{3x^2}{x^2} + \frac{5x}{x^2} + \frac{2}{x^2} = x - 3 + 5x^{-1} + 2x^{-2}$

$y' = 1 - 0 + 5(-1)x^{-2} + 2(-2)x^{-3} = \boxed{1 - 5x^{-2} - 4x^{-3}}$

⑥ $y = x^2\left(x^3 + \sqrt{x} - \frac{1}{x^9} + 15\right) = x^2(x^3 + x^{\frac{1}{2}} - x^{-9} + 15) = x^5 + x^{5/2} - x^{-7} + 15x^2$

$\boxed{y' = 5x^4 + \frac{5}{2}x^{3/2} + 7x^{-8} + 30x}$

don't forget to add exponents.
$2 + \frac{1}{2} = \frac{4}{2} + \frac{1}{2} = \frac{5}{2}$

III. ⑧ $y = (3x^2 + 2x - 3)(5x^7 + 4x^3 - 2x + 1)$ ← use the product rule "do not simplify"

$\boxed{y' = (3x^2 + 2x - 3)(35x^6 + 12x^2 - 2) + (5x^7 + 4x^3 - 2x + 1)(6x + 2)}$

⑨ $y = \frac{8x^4 + 17}{7x^3 + 2x - 1}$ $\quad \boxed{y' = \frac{(7x^3 + 2x - 1)(32x^3) - (8x^4 + 17)(21x^2 + 2)}{(7x^3 + 2x - 1)^2}}$

IV. ⑩ $y = \frac{5}{\sqrt[7]{3x-5}} = \frac{5}{(3x-5)^{\frac{1}{7}}} = 5(3x-5)^{-\frac{1}{7}}$ (no x's in the numerator, so this is the best form.)

$y' = 5\left(\frac{-1}{7}\right)\underbrace{(3x-5)^{-\frac{1}{7}-\frac{7}{7}}}_{\text{power rule}}\underbrace{(3)}_{\text{inside}} = \boxed{\frac{-15}{7}(3x-5)^{-8/7}}$

constant stays

⑪ $y = (x^3 + 6)^{23}$ $\quad y' = \underbrace{23(x^3+6)^{22}}_{\text{power rule}}\underbrace{(3x^2)}_{\text{inside}} = \boxed{69x^2(x^3+6)^{22}}$

⑫ $y = ((x^2+1)^4 + 3)^6 + 5x + 10$

$\boxed{y' = 6((x^2+1)^4 + 3)^5 \cdot 4(x^2+1)^3 \cdot 2x + 5}$

V. (13) (a) $h(x) = \sqrt{f(x)+g(x)} = (f(x)+g(x))^{\frac{1}{2}}$ ← deriv. with respect to x first

$h'(x) = \underbrace{\tfrac{1}{2}(f(x)+g(x))^{-\frac{1}{2}}}_{\text{power rule}} \cdot \underbrace{[f'(x)+g'(x)]}_{\text{inside}}$

next, read values from the given table

$h'(2) = \tfrac{1}{2}(f(2)+g(2))^{-\frac{1}{2}}\,[f'(2)+g'(2)]$

$= \tfrac{1}{2}(5+4)^{-\frac{1}{2}}(7-3) = \tfrac{1}{2}\cdot 9^{-\frac{1}{2}}(4) = \dfrac{2}{\sqrt{9}} = \boxed{\dfrac{2}{3}}$

(b) $h(x) = f(g(x))$

$h'(x) = f'(g(x))\cdot g'(x)$ outside function is f; differentiate it first. then multiply by deriv. of inside function.

$h'(2) = f'(g(2))\cdot g'(2) = f'(4)\cdot(-3) = 9(-3) = \boxed{-27}$

(14) (a) $h(x) = f(x+g(x)) \Rightarrow h'(x) = \underbrace{f'(x+g(x))}_{\text{outside}} \cdot \underbrace{(1+g'(x))}_{\text{inside}}$

$h'(2) = f'(2+g(2))\cdot(1+g'(2))$

$= f'(2+-1)\cdot(1+(-4)) = f'(1)\cdot(-3) = (-7)(-3)$

$= \boxed{21}$

(b) $h(x) = \dfrac{f(x)+4g(x)}{(3x+1)^2}$. use quotient rule!

$h'(x) = \dfrac{(3x+1)^2[f'(x)+4g'(x)] - (f(x)+4g(x))\cdot \overbrace{2(3x+1)}^{\text{power rule}}\cdot\overbrace{3}^{\text{inside}}}{((3x+1)^2)^2}$

$h'(1) = \dfrac{(3+1)^2(f'(1)+4g'(1)) - (f(1)+4g(1))\cdot 2(3+1)\cdot 3}{(3+1)^4}$

$= \dfrac{4^2(-7+4(\frac{1}{2})) - (6+4\cdot 1)\cdot 2(4)(3)}{4^4}$

$= \dfrac{4^2(-7+2) - (10)(24)}{256} = \dfrac{16(-5)-240}{256} = \dfrac{-320}{256} = \boxed{\dfrac{-5}{4}}$