Extra Derivative Practice: Find the 1st derivative of the following functions

1. $f(x) = \frac{2}{x^3} + 3\sqrt{x}$

2. $g(t) = 176 + 14t$

3. $f(s) = 2x^4 + 7x^2 + 5x$

4. $h(x) = 13\pi^8$

5. $f(x) = \frac{1}{\sqrt{x}} + \frac{7}{x}$

6. $g(x) = 19x^{-1} + \frac{2}{x^4}$

7. $h(x) = \frac{1}{(2x-1)^3}$

8. $h(x) = \sqrt{3x^2 + 4x}$

9. $f(x) = (\sqrt{x} + x^2)^3$

10. $g(t) = \frac{1}{2}at^2 + vt + p$

11. $f(x) = \dfrac{9}{x} + \dfrac{7}{x}$

12. $g(x) = 4x^{-2} + \dfrac{8}{\sqrt{x}}$

13. $f(x) = 3 + 2x^2 + x^3$

14. $g(x) = 9\sqrt{x + 1/x^2}$

15. $h(x) = \dfrac{12}{(5x+2)^3}$

16. $f(x) = \dfrac{12}{(5x+2)^3} + 3 + 2x^2 + x^3$

17. $f(x) = \dfrac{12}{(5x+2)^3} + 9\sqrt{x + 1/x^2}$

18. $f(x) = \dfrac{3}{2x+1} + 2\sqrt{x^2+7}$

19. $f(x) = x + \dfrac{1}{\sqrt{x^2+1}} + \dfrac{3}{x^2}$

20. $f(x) = 4\sqrt{x} + 4\sqrt{x^3+2x}$

Solutions

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

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

$= -6x^{-4} + \frac{3}{2}x^{-1/2}$

$$\boxed{f'(x) = \frac{-6}{x^4} + \frac{3}{2\sqrt{x}}}$$

② $\boxed{g'(t) = 14}$

③ $\boxed{f'(s) = 8x^3 + 14x + 5}$

④ $\boxed{h'(x) = 0}$

⑤ $f(x) = x^{-1/2} + 7x^{-1}$

$f'(x) = -\frac{1}{2}x^{-3/2} - 7x^{-2}$

$$\boxed{f'(x) = \frac{-1}{2x^{3/2}} - \frac{7}{x^2}}$$

6. $g(x) = 19x^{-1} + 2x^{-4}$

$g'(x) = -19x^{-2} - 8x^{-5}$

$\boxed{g'(x) = -\frac{19}{x^2} - \frac{8}{x^5}}$

7. $h(x) = (2x-1)^{-3}$

$h'(x) = -3(2x-1)^{-4}\frac{d}{dx}(2x-1)$

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

$\boxed{h'(x) = \frac{-6}{(2x-1)^4}}$

8. $h(x) = (3x^2+4x)^{1/2}$

$h'(x) = \frac{1}{2}(3x^2+4x)^{-1/2}\frac{d}{dx}(3x^2+4x)$

$= \frac{1}{2}(3x^2+4x)^{-1/2}(6x+4)$

$\boxed{h'(x) = \frac{6x+4}{2\sqrt{3x^2+4x}}}$

(9) $f'(x) = 3(\sqrt{x} + x^2)^2 \frac{d}{dx}(\sqrt{x} + x^2)$

$$= \boxed{3(\sqrt{x} + x^2)^2 \left(\frac{1}{2\sqrt{x}} + 2x\right)}$$

(10) $\boxed{g'(t) = at + v}$

(11) $f(x) = \frac{16}{x} = 16x^{-1}$

$$f'(x) = -16x^{-2} = \boxed{-\frac{16}{x^2}}$$

(12) $g(x) = 4x^{-2} + 8x^{-1/2}$

$$g'(x) = 4(-2)x^{-3} + 8(-1/2)x^{-3/2}$$

$$= -8x^{-3} - 4x^{-3/2}$$

$$\boxed{g'(x) = \frac{-8}{x^3} - \frac{4}{x^{3/2}}}$$

(13) $\boxed{f'(x) = 4x + 3x^2}$

(14) $g(x) = 9(x + x^{-2})^{1/2}$

$$g'(x) = 9(1/2)(x + x^{-2})^{-1/2} \frac{d}{dx}(x + x^{-2})$$

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

(15) $h(x) = 12(5x+2)^{-3}$

$$h'(x) = 12(-3)(5x+2)^{-4}\frac{d}{dx}(5x+2)$$

$$= \frac{-36}{(5x+2)^4}(5) = \boxed{\frac{-180}{(5x+2)^4}}$$

(16) Hint: Use #15 and #13

$$\boxed{f'(x) = \frac{-180}{(5x+2)^4} + 4x + 3x^2}$$

(17) Hint: Use #15 and #14

$$\boxed{f'(x) = \frac{-180}{(5x+2)^4} + \frac{9}{2\sqrt{x + 1/x^2}}\left(1 - 2/x^3\right)}$$

(18) $f(x) = 3(2x-1)^{-1} + 2(x^2+7)^{1/2}$

$$f'(x) = -3(2x-1)^{-2}(2) + 2(1/2)(x^2+7)^{-1/2}(2x)$$

$$= -6(2x-1)^{-2} + (x^2+7)^{-1/2}(2x)$$

$$\boxed{f'(x) = \frac{-6}{(2x-1)^2} + \frac{2x}{\sqrt{x^2+7}}}$$

19 $f(x) = x + (x^2+1)^{-1/2} + 3x^{-2}$

$f'(x) = 1 + (-1/2)(x^2+1)^{-3/2}(2x) - 6x^{-3}$

$$\boxed{f'(x) = 1 - \frac{x}{(x^2+1)^{3/2}} - \frac{6}{x^3}}$$

20 $f(x) = 4x^{1/2} + 4(x^3+2x)^{1/2}$

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

$$\boxed{f'(x) = \frac{2}{\sqrt{x}} + \frac{6x^2+4}{\sqrt{x^3+2x}}}$$