

Practice 5.5

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Homework

(1, 3, 9, 11, 15, 35) circled

$$\textcircled{1.} \quad f(x) = 5 \ln x$$

$$f'(x) = \boxed{\frac{5}{x}}$$

$$2. \quad f(x) = \ln(5x)$$

$$f'(x) = \frac{5}{5x} = \boxed{\frac{1}{x}}$$

$$\textcircled{3.} \quad f(x) = \ln(x+1)$$

$$f'(x) = \boxed{\frac{1}{(x+1)}}$$

$$4. \quad g(x) = \ln(2x+1)$$

$$g'(x) = \boxed{\frac{2}{(2x+1)}}$$

$$5. \quad f(x) = \ln x^8 = \frac{8x^7}{x^8} = \boxed{\frac{8}{x}}$$

$$6. \quad h(x) = \textcircled{2} \ln x^5$$

$$7. \quad f(x) = \ln(x)^{1/2}$$

$$h'(x) = 2 \left(\frac{5x^4}{x^5} + \ln x \left(\frac{5}{x} \right) \right)$$

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

$$h'(x) = \boxed{\frac{10}{x}}$$

$$8. \quad f(x) = \ln(x^{1/2} + 1)$$

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

$$= \boxed{\frac{1}{2(x + \sqrt{x})}} \text{ OR } = \boxed{\frac{1}{2\sqrt{x}(\sqrt{x} + 1)}}$$

$$\textcircled{9.} \quad f(x) = \ln \frac{1}{x^2} = \ln x^{-2}$$

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

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10. $f(x) = \ln\left(\frac{1}{2x^3}\right)$

$$f'(x) = \frac{\frac{1}{2}(x^{-3})}{\frac{1}{2x^3}} = \frac{-\frac{3}{2x^4}}{\frac{1}{2x^3}} = -\frac{3(2x^3)}{2x^4} = \left(-\frac{3}{x}\right)$$

11. $f(x) = \ln(4x^2 - 5x + 3)$

$$= \frac{8x - 5}{4x^2 - 5x + 3}$$

12. $f(x) = \ln(3x^2 - 2x + 1)$

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

13. $f(x) = \ln\left(\frac{2x}{x+1}\right)$

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

14. $f(x) = \ln\left(\frac{x+1}{x-1}\right)$

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

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35. $f(x) = \ln 2x$
 $f'(x) = \frac{2}{2x} = \frac{1}{x}$
 $f''(x) = -\frac{1}{x^2}$

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

37. $f(x) = \ln(x^2 + 2)$
 $f'(x) = \frac{2x}{x^2 + 2}$
 $f''(x) = \frac{(x^2 + 2)(2) - 2x(2x)}{(x^2 + 2)^2} = \frac{2x^2 + 4 - 4x^2}{(x^2 + 2)^2}$

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

39. $f(x) = x^2 \ln x$
 ~~$f'(x) = x^2 \left(\frac{1}{x}\right) + \ln x (2x)$~~
 ~~$f''(x) = 1 + \frac{2}{2x} = 1 + \frac{1}{x}$~~

$3 + 2 \ln x$

$f'(x) = x^{\cancel{2}} + \ln x (2x)$

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


41. ~~$\ln y = \ln(x+1)^2 (x+2)^3 \Rightarrow 2 \ln(x+1) + 3 \ln(x+2)$~~
 ~~$\frac{y'}{y} = 2 \left(\frac{1}{x+1}\right) + 3 \left(\frac{1}{x+2}\right)$~~
 ~~$y' = (x+1)^2 (x+2)^3 \frac{5}{(x+1)(x+2)} = 5(x+1)(x+2)^2$~~

on next page

41. cont.

41. ~~$(x+1)(5x+7)(x+2)^2$~~

answer



$$41. \quad y = (x+1)^2 (x+2)^3$$

$$\ln y = \ln \left[(x+1)^2 (x+2)^3 \right]$$

$$\ln y = 2 \ln (x+1) + 3 \ln (x+2)$$

$$\frac{y'}{y} = \frac{2}{x+1} + \frac{3}{x+2}$$

$$y' = (x+1)^2 (x+2)^3 \left[\frac{2}{x+1} + \frac{3}{x+2} \right]$$

$$= 2(x+1)(x+2)^3 + 3(x+1)^2 (x+2)^2$$

$$= (x+1)(x+2)^2 [2x+4 + 3x+3]$$

$$y' = (x+1)(x+2)^2 (5x+7)$$