18F: 1aeim, 4abc, 7

1a.) $y = \ln(7x) \rightarrow y' = \frac{7}{7x} = \boxed{\frac{1}{x}}$

1e.) $y = x^2 \ln x$ $u = x^2$ $v = \ln x$ $y' = 2x\ln x + \frac{x^2}{x}$

$u' = 2x$ $v' = \frac{1}{x}$

$\boxed{y' = 2x\ln x + x}$

1i.) $y = \sqrt{\ln x}$ $y = u^{\frac{1}{2}}$ $u = \ln x$

$y' = \frac{1}{2\sqrt{u}}$ $u' = \frac{1}{x}$

$\boxed{y' = \frac{1}{2x\sqrt{\ln x}}}$

1m.) $y = \frac{2\sqrt{x}}{\ln x}$ $u = 2x^{\frac{1}{2}}$ $v = \ln x$ $\therefore y' = \frac{\frac{\ln x}{\sqrt{x}} - \frac{2\sqrt{x}}{x}}{(\ln x)^2}$

$u' = x^{-\frac{1}{2}}$ $v' = \frac{1}{x}$

$u' = \frac{1}{\sqrt{x}}$

$\Rightarrow \frac{\ln x - 2}{\sqrt{x}} \cdot \frac{1}{(\ln x)^2}$

$\Rightarrow \boxed{y' \frac{\ln x - 2}{\sqrt{x}(\ln x)^2}}$

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4a.) $y = \ln\sqrt{1-2x}$ $\quad y = \ln u \quad u = \sqrt{1-2x} \quad y = \sqrt{u} \quad u = 1-2x$

$y' = \frac{1}{u} \quad u' = \frac{-1}{\sqrt{1-2x}} \quad y' = \frac{1}{2\sqrt{u}} \quad u' = -2$

$y' = \frac{-1}{\sqrt{1-2x}\cdot\sqrt{1-2x}}$

$y' = \frac{-1}{1-2x} \Rightarrow \boxed{\frac{1}{2x-1}}$

4b.) $y = \ln\left(\frac{1}{2x+3}\right)$ $\quad y = \ln u \quad u = (2x+3)^{-1} \quad y = u^{-1} \quad u = 2x+3$

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

$y' = \frac{-1}{u^2}$

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

$\Rightarrow \boxed{y' = \frac{-2}{2x+3}}$

4c.) $y = \ln(e^x\sqrt{x})$ $\quad y = \ln u \quad u = e^x\sqrt{x} \quad u = e^x \quad v = x^{\frac{1}{2}}$

$y' = \frac{1}{u} \quad u' = e^x\sqrt{x} + \frac{e^x}{2\sqrt{x}} \quad u' = e^x \quad v' = \frac{1}{2\sqrt{x}}$

$y' = \frac{1}{e^x\sqrt{x}} \cdot \left(e^x\sqrt{x} + \frac{e^x}{2\sqrt{x}}\right) \Rightarrow \frac{e^x\sqrt{x}}{e^x\sqrt{x}} + \frac{\cancel{e^x}}{2x\cancel{e^x}} \Rightarrow \boxed{1 + \frac{1}{2x}}$

7.) $f(x) = a\ln(bx^2)$ $\quad f(e) = 3 \quad f'(1) = 6$

$\therefore 3 = a\ln(be^2)$ $\quad f'(x) = \frac{2ab\cancel{x}}{(bx^{\cancel{2}})} \Rightarrow \frac{2a}{x}$

$\Rightarrow 3 = a[\ln b + \ln e^2]$

$\Rightarrow 3 = a[\ln b + 2]$ $\quad \therefore 6 = \frac{2a}{1} \Rightarrow 6 = 2a \Rightarrow \boxed{a = 3}$

plug in a

$\frac{3}{3} = \frac{\cancel{3}[\ln b + 2]}{\cancel{3}} \Rightarrow \ln b + 2 = 1 \quad \therefore e^{-1} = b$

$\ln b = -1 \quad \therefore \boxed{b = \frac{1}{e}}$

e