

Expand the following expressions:

1.  $\ln(3x)$

$$\ln 3 + \ln x$$

2.  $\ln(9x)$

$$\ln 9 + \ln x$$

3.  $\ln(x^3\sqrt{x-1})$

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

4.  $\ln 3x^{2/3}y^5$

$$\ln 3 + \frac{2}{3}\ln x + 5\ln y$$

5.  $\ln x^5$

$$5\ln x$$

6.  $\ln \frac{2\sqrt{x}}{y^3}$

$$\ln 2 + \frac{1}{2}\ln x - 3\ln y$$

7.  $\ln\left(\frac{6}{x}\right)$

$$\ln 6 - \ln x$$

8.  $\ln(x^4\sqrt{x+1})$

$$\ln x + \frac{1}{4}\ln(x+1)$$

9.  $\ln \frac{x^2}{yz^3}$

$$2\ln x - \ln y - 3\ln z$$

Condense the following expressions:

1.  $\ln 3 + \ln x - \ln y - 2\ln z$

$$\ln \frac{3x}{yz^2}$$

2.  $\ln 5 + \frac{1}{2}\ln x + 2\ln z$

$$\ln 5\sqrt{x}z^2$$
$$\ln 5z^2\sqrt{x}$$

3.  $\ln 4 + 3\ln x - 5\ln y$

$$\ln \frac{4x^3}{y^5}$$

4.  $\ln 9 + \frac{1}{2}\ln k + 2\ln p$

$$\ln 9\sqrt{k}p^2$$

5.  $\ln a - 2\ln b - 3\ln c$

$$\ln \frac{a}{b^2c^3}$$

6.  $\ln x + 2\ln y + 3\ln z - \ln 5$

$$\ln \frac{xy^2z^3}{5}$$