This should be blank. This gets glued down!

PAP Precal **Log Properties**

$$\log_b x = y$$

Properties of Logarithms (only works when u > 0, v > 0, and a cannot equal 1)

	Logarithm with Base a	Natural Logarithm
Product Property:	$\log_a(uv) = \log_a u + \log_a v$	$\ln(uv) = \ln u + \ln v$
Quotient Propery:	$\log_a\left(\frac{u}{v}\right) = \log_a u - \log_a v$	$\ln\left(\frac{u}{v}\right) = \ln u - \ln v$
Power Property:	$\log_a u^n = n \log_a u$	$\ln u^n = n \ln u$
Identity:	$\log_a a=1$	$\ln e = 1$
	$\log_a 1=0$	$\ln 1 = 0$

Using Properties of Logarithms

Write each logarithm in terms of ln 2 and ln 5.

1) $\ln 10$

$\ln(2\cdot 5)$

$\boxed{\ln 2 + \ln 5}$

2) $\ln \frac{5}{32}$

$\ln 5 - \ln 32$

$\ln 5 - \ln 2^{5}$

$\boxed{\ln 5 - 5\ln 2}$

Find the exact value of each expression without using a calculator.

3) $\log_7 \sqrt[5]{7}$

$\log_7 (7)^{1/5}$

$\frac{1}{5} \cancel{\log_7 7}$ 1

$\frac{1}{5}(1) = \boxed{\frac{1}{5}}$

4) $3 \ln e^{4}$

$4 \cdot 3 \cancel{\ln e}$ 1

$\boxed{12}$

5) $\log_3 81^{-0.2}$

$\log_3 (3^{4})^{-0.2}$

$-0.8 \cancel{\log_3 3}$ 1

$\boxed{-0.8}$

* can't have (-) argument

6) $\log_2(-16)$

$\boxed{\text{undefined}}$

7) $\ln e^{12} + \ln e^5$

$\ln(e^{12} \cdot e^5)$

$\ln(e^{17})$

$17 \cancel{\ln(e)}$

$\boxed{17}$

8) $\log_4 2 + \log_4 32$

$\log_4(2 \cdot 32)$

$\log_4(64)$

$\log_4(4^3)$

$3 \cancel{\log_4 4}$

$\boxed{3}$

Rewriting Logarithmic Expressions

Expand each logarithmic expression.

9) $\log 3x^2y$

$\log 3 + \log x^2 + \log y$

$\boxed{\log 3 + 2\log x + \log y}$

10) $\ln \frac{\sqrt{4x+1}}{8}$

$\ln(4x+1)^{1/2} - \ln 8$

$\boxed{\frac{1}{2}\ln(4x+1) - \ln 8}$

11) $\log_6 \frac{1}{yz^3}$

$\log_6 1 - \log_6 yz^3$

$\log_6 1 - (\log_6 y + \log_6 z^3)$

$\log_6 1 - \log_6 y - 3\log z$

$0 - \log_6 y - 3\log z$

$\boxed{-\log_6 y - 3\log z}$

12) $\ln \sqrt{\frac{x^2}{y^3}}$

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

$\ln(x) - \ln(y^{3/2})$

$\boxed{\ln x - \frac{3}{2}\ln y}$

Condense each logarithmic expression. (Write as a single logarithm and simplify.)

13) $\frac{1}{3}\log x + 5\log(x-3)$

$\log x^{1/3} + \log(x-3)^5$

$\boxed{\log\left(\sqrt[3]{x} \cdot (x-3)^5\right)}$

14) $4\ln(x-4) - 2\ln x$

$\ln(x-4)^4 - \ln x^2$

$\boxed{\ln\left(\frac{(x-4)^4}{x^2}\right)}$

15) $\frac{1}{5}[\log_3 x + \log_3(x-2)]$

$\frac{1}{5}(\log_3(x(x-2)))$

$\frac{1}{5}\log_3(x^2-2x)$

$\boxed{\log_3\left(\sqrt[5]{x^2-2x}\right)}$

16) $\frac{1}{2}[\log_4(x+1) + 2\log_4(x-1)] + 6\log_4 x$

$\frac{1}{2}(\log_4((x+1)(x-1)^2)) + \log_4 x^6$

$\log_4((x+1)(x-1)^2)^{1/2} + \log_4 x^6$

$\log_4((x+1)^{1/2}(x-1)) + \log_4 x^6$

$\boxed{\log_4\left(\sqrt{x+1} \cdot (x-1)(x^6)\right)}$