Algebra 2 - Task 7.2 Name_____ ID: 1

Expanding and Condensing Logarithms

Date_____ Period____

Expand each logarithm. Justify each step by stating logarithm property used.

Level 2:

1) $\log_6 \frac{u}{v}$

2) $\log_5 \sqrt[3]{a}$

3) $\log_7 5^4$

4) $\log_4 u^6$

5) $\log (a \cdot b)$

6) $\log_5 \frac{6}{7}$

Level 3:

7) $\log_4 \sqrt{x^3}$

8) $\log_6 (3 \cdot 11)^6$

9) $\log_6 (ab^3)$

10) $\log_4 (a \cdot b \cdot c)$

11) $\log_5 (10 \cdot 11^3)$

12) $\log_7 (x \cdot y)^6$

Level 4:

13) $\log_2 (x^3 \cdot y)^3$

14) $\log_3 (z^4 \sqrt{x})$

15) $\log_9 (z\sqrt{x \cdot y})$

16) $\log_8 \left(\frac{a}{b^4}\right)^5$

17) $\log_8 (x^3 \cdot y)^2$

18) $\log_2 \left(\frac{a}{b^4}\right)^2$

Condense each expression to a single logarithm. Justify each step by stating the logarithm property used.

Level 2:

19) $6\log_5 10$

20) $\frac{\log x}{3}$

21) $\log_7 u - \log_7 v$

22) $\log_6 x - \log_6 y$

23) $\log_4 2 + \log_4 7$

24) $\log_3 a + \log_3 b$

Level 3:

25) $5\log_7 11 - \log_7 8$

26) $\log_3 x + 2\log_3 y$

27) $2\log_8 x$

28) $2\log_9 a$

29) $\log u + \log v + \log w$

30) $\log_2 12 + \log_2 7 + \log_2 5$

Level 4:

31) $\frac{\log_5 x}{2} + \frac{\log_5 y}{2} + \frac{\log_5 z}{2}$

32) $3\log_6 a - 6\log_6 b$

33) $\frac{\log_7 x}{3} + \frac{\log_7 y}{3} + \frac{\log_7 z}{3}$

34) $3\log_4 a - 3\log_4 b$

35) $3\log_3 u + 15\log_3 v$

36) $3\log_5 u + 12\log_5 v$

Alg 7.2 task 7.2 odds

① $\log_6 \frac{u}{v} = \log_6 u - \log_6 v$ Quotient Law

② $\log_7 s^4 = 4\log_7 s$ Power Rule

③ $\log(a \cdot b) = \log a + \log b$ Product Rule

⑦ $\log_4 \sqrt{x^3} = \log_4 x^{3/2}$ Exponent Laws

$= \boxed{\frac{3}{2}\log_4 x}$ Power Rule

⑨ $\log_6(ab^3) = \log_6 a + \log_6 b^3$ Product Rule

$= \boxed{\log_6 a + 3\log_6 b}$ Power Rule

⑪ $\log_5(10 \cdot 11^3) = \log_5 10 + \log_5 11^3$ Product Rule

$= \boxed{\log_5 10 + 3\log_5 11}$ Power Rule

But

$\log_5 10 = \log_5(5 \cdot 2)$

$= \log_5 5 + \log_5 2$

$= 1 + \log_5 2$

$= \log_5(5 \cdot 2) + 3\log_5 11$ Alg

$= \log_5 5 + \log_5 2 + 3\log_5 11$ Product

$= \boxed{1 + \log_5 2 + 3\log_5 11}$ log of a base

best form ↑

(13) $\log_2 (x^3 y)^3 = \log_2 x^9 y^3$ Exponent Laws

$= \log_2 x^9 + \log_2 y^3$ Product Law

$= \boxed{9\log_2 x + 3\log_2 y}$ Power Law

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(14) $\log_2 (x^3 y)^3 = 3\log_2 (x^3 y)$ Power Rule

$= 3[\log_2 x^3 + \log_2 y]$ Product Rule

$= 3[3\log_2 x + \log_2 y]$ Power Rule

$= \boxed{9\log_2 x + 3\log_2 y}$

(15.1) $\log_9 \left(z\sqrt{x \cdot y}\right) = \log_9 z (xy)^{1/2}$ Exponent laws

$= \log_9 z^1 x^{\frac{1}{2}} y^{\frac{1}{2}}$

$= \log_9 z + \log_9 x^{\frac{1}{2}} + \log_9 y^{\frac{1}{2}}$ Product Prop.

$= \boxed{\log_9 z + \frac{1}{2}\log_9 x + \frac{1}{2}\log_9 y}$ Power Prop

(15.2) $\log_9(z\sqrt{xy}) = \log_9 z(xy)^{\frac{1}{2}}$ Exponent Props

$= \log_9 z + \log_9 (xy)^{\frac{1}{2}}$ Product Prop.

$= \log_9 z + \frac{1}{2}[\log_9 (xy)]$ Power Prop

$= \log_9 z + \frac{1}{2}[\log_9 x + \log_9 y]$ Product Prop

$= \boxed{\log_9 z + \frac{1}{2}\log_9 x + \frac{1}{2}\log_9 y}$

(17.1) $\log_8 (x^3 y)^2 = \log_8 x^6 y^2$ Exponent laws

$= \log_8 x^6 + \log_8 y^2$ Product Prop

$= \boxed{6\log_8 x + 2\log_8 y}$ Power Prop

(17.2) $\log_8 (x^3 y)^2 = 2[\log_8 (x^3 y)]$ Power Prop

$= 2[\log_8 x^3 + \log_8 y]$ Product Prop

$= 2[3\log_8 x + \log_8 y]$ Power Prop

$= \boxed{6\log_8 x + 2\log_8 y}$

(19) $6\log_5 10 = \boxed{\log_5 10^6}$ ← Power Prop combined

But $\log_5 10^6 = \log_5 (5\cdot 2)^6$ exponent laws

$= \log_5 (5^6 2^6)$

$= \log_5 5^6 + \log_5 2^6$ Product Rule

$= 6\log_5 5 + 6\log_5 2$ Power Rule

$= 6(1) + 6\log_5 2$ log of base

$6\log_5 10 = \boxed{6 + 6\log_5 2}$ ← expanded

(21) $\log_7 4 - \log_7 1 = \log_7\left(\frac{4}{1}\right)$ Quotient Law

(23) $\log_4 2 + \log_4 7 = \log_4\left(\frac{2}{7}\right)$ Quotient Law

(25) $5\log_7 11 - \log_7 8 = \log_7 11^5 - \log_7 8$ Power Rule

$= \boxed{\log_7\left(\frac{11^5}{8}\right)}$ quotient Law

(27) $2\log_8 x = \boxed{\log_8 x^2}$ Power Rule

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(29) $\log u + \log v + \log w = \log(uvw)$

Product Prop

(31.1) $\frac{\log_5 x}{2} + \frac{\log_5 y}{2} + \frac{\log_5 z}{2} = \frac{1}{2}(\log_5 x + \log_5 y + \log_5 z$

$= \frac{1}{2}(\log_5 xyz)$ Product Product

$= \boxed{\log_5 \sqrt{xyz} = \log_5 (xyz)^{\frac{1}{2}}}$

Power Prop.

(31.2) $\frac{1}{2}\log_5 x + \frac{1}{2}\log_5 y + \frac{1}{2}\log_5 z$

$\log_5 x^{\frac{1}{2}} + \log_5 y^{\frac{1}{2}} + \log_5 z^{\frac{1}{2}}$ Power Rule

$\log_5 x^{\frac{1}{2}} y^{\frac{1}{2}} z^{\frac{1}{2}} = \log_5 (xyz)^{\frac{1}{2}}$ Product Rule

$= \log_5 \sqrt{xyz}$

(31) $\frac{\log_7 x}{3} + \frac{\log_7 y}{3} + \frac{\log_7 z}{3}$

$= \frac{1}{3}(\log_7 x + \log_7 y + \log_7 z)$

$= \frac{1}{3}(\log_7 (xyz))$ Product Prop

$= \boxed{\log_7 (xyz)^{\frac{1}{3}}}$ Power Prop

$= \boxed{\log_7 \sqrt[3]{xyz}}$

(332) $\frac{1}{3}\log_7 x + \frac{1}{3}\log_7 y + \frac{1}{3}\log_7 z$

$\log_7 x^{\frac{1}{3}} + \log_7 y^{\frac{1}{3}} + \log_7 z^{\frac{1}{3}}$ Power Rule

$\boxed{\log_7 (x^{\frac{1}{3}} y^{\frac{1}{3}} z^{\frac{1}{3}})}$ Product Rule

$\boxed{\log_7 \sqrt[3]{xyz}}$

(35) $3\log_3 4 + 15\log_3 V$

$\log_3 4^3 + \log_3 V^{15}$ Power Rule

$\boxed{\log_3 (4^3 V^{15})}$ Product Rule