

F.BF.B.5: Properties of Logarithms 1a

- 1 Which expression is *not* equivalent to $\log_b 36$?
 - 1) $6 \log_b 2$
 - 2) $\log_b 9 + \log_b 4$
 - 3) $2 \log_b 6$
 - 4) $\log_b 72 - \log_b 2$

- 2 The expression $\log 12$ is equivalent to
 - 1) $\log 6 + \log 6$
 - 2) $\log 3 + 2 \log 2$
 - 3) $\log 3 - 2 \log 2$
 - 4) $\log 3 \cdot \log 4$

- 3 The expression $\log 4x$ is equivalent to
 - 1) $\log x^4$
 - 2) $4 \log x$
 - 3) $\log 4 + \log x$
 - 4) $(\log 4)(\log x)$

- 4 The expression $\log 4m^2$ is equivalent to
 - 1) $2(\log 4 + \log m)$
 - 2) $2 \log 4 + \log m$
 - 3) $\log 4 + 2 \log m$
 - 4) $\log 16 + 2 \log m$

- 5 If $A = \pi r^2$, $\log A$ equals
 - 1) $2 \log \pi + \log r$
 - 2) $\log \pi + 2 \log r$
 - 3) $2 \log \pi + 2 \log r$
 - 4) $2\pi \log r$

- 6 If $2x^3 = y$, then $\log y$ equals
 - 1) $\log(2x) + \log 3$
 - 2) $3 \log(2x)$
 - 3) $3 \log 2 + 3 \log x$
 - 4) $\log 2 + 3 \log x$

- 7 If $L = \frac{x^2}{k}$, then $\log L$ is equal to
 - 1) $2 \log \frac{x}{k}$
 - 2) $2(\log x - \log k)$
 - 3) $2 \log x - \log k$
 - 4) $\frac{2 \log x}{\log k}$

- 8 The expression $\log \frac{b^3}{a}$ is equivalent to
 - 1) $3(\log b - \log a)$
 - 2) $\log 3b - \log a$
 - 3) $3 \log b - \log a$
 - 4) $\frac{3 \log b}{\log a}$

- 9 If $u = \frac{x}{y^2}$, which expression is equivalent to $\log u$?
 - 1) $\log x + 2 \log y$
 - 2) $2(\log x - \log y)$
 - 3) $2(\log x + \log y)$
 - 4) $\log x - 2 \log y$

- 10 If $T = \frac{10x^2}{y}$, then $\log T$ is equivalent to
 - 1) $(1 + 2 \log x) - \log y$
 - 2) $\log(1 + 2x) - \log y$
 - 3) $(1 - 2 \log x) + \log y$
 - 4) $2(1 - \log x) + \log y$

- 11 The expression $\log \sqrt{xy}$ is equivalent to
 - 1) $2 \log x \log y$
 - 2) $2(\log x + \log y)$
 - 3) $\frac{1}{2} \log x \log y$
 - 4) $\frac{1}{2} (\log x + \log y)$

12 If $x = (8^2)(\sqrt{5})$, which expression is equivalent to $\log x$?

- 1) $2 \log 8 + 2 \log 5$
- 2) $2(\log 8 + \frac{1}{2} \log 5)$
- 3) $2 \log 8 + \frac{1}{2} \log 5$
- 4) $(2 \log 8)(\frac{1}{3} \log 5)$

13 If $x = \frac{a\sqrt{b}}{c}$, then $\log x$ is equal to

- 1) $\log a + \frac{1}{2} \log b - \log c$
- 2) $\log a + 2 \log b - \log c$
- 3) $\log a - \frac{1}{2} \log b + \log c$
- 4) $\log a - 2 \log b - \log c$

14 $\text{Log} \frac{\sqrt{xy}}{z}$ is equal to

- 1) $\frac{1}{2} \log x + \frac{1}{2} \log y - \log z$
- 2) $\frac{1}{2} \log x + \log y - \log z$
- 3) $\frac{1}{2} (\log x + \log y - \log z)$
- 4) $\frac{\frac{1}{2} \log xy}{\log z}$

15 The expression $\log \frac{\sqrt{xy}}{w}$ is equivalent to

- 1) $\frac{2 \log xy}{\log w}$
- 2) $\log x + \log y - \log w$
- 3) $\frac{1}{2} (\log x + \log y) - \log w$
- 4) $\frac{1}{2} (\log xy - \log w)$

16 $\text{Log} \sqrt{\frac{a}{b}}$ is equivalent to

- 1) $\frac{1}{2} \log a - \log b$
- 2) $\frac{1}{2} (\log a - \log b)$
- 3) $\frac{1}{2} (\log a + \log b)$
- 4) $\frac{1}{2} \log a + \log b$

17 The expression $\log \left(\frac{x^n}{\sqrt{y}} \right)$ is equivalent to

- 1) $n \log x - \frac{1}{2} \log y$
- 2) $n \log x - 2 \log y$
- 3) $\log(nx) - \log \left(\frac{1}{2} y \right)$
- 4) $\log(nx) - \log(2y)$

18 The expression $\log \left(\frac{x^2 y^3}{\sqrt{z}} \right)$ is equivalent to

- 1) $\frac{(2x)(3y)}{\frac{1}{2} z}$
- 2) $2 \log x + 3 \log y + \frac{1}{2} \log z$
- 3) $\log 2x + \log 3y - \log \frac{1}{2} z$
- 4) $2 \log x + 3 \log y - \frac{1}{2} \log z$

19 The expression $\log \frac{\sqrt{x^2 y^3}}{z}$ is equivalent to

- 1) $\frac{1}{2}(2 \log x + 3 \log y - \log z)$
- 2) $\frac{1}{2}(2 \log x + 3 \log y) - \log z$
- 3) $2 \log x + 3 \log y - \log z$
- 4) $\frac{x^2 y^3}{z}$

20 The expression $\log \frac{\sqrt[3]{a}}{b}$ is equivalent to

- 1) $\frac{1}{3} \log a - \log b$
- 2) $\frac{1}{3} \log(a - b)$
- 3) $3 \log a - \log b$
- 4) $3 \log(a - b)$

21 If $r = \sqrt[3]{\frac{A^2 B}{C}}$, then $\log r$ can be represented by

- 1) $\frac{1}{6} \log A + \frac{1}{3} \log B - \log C$
- 2) $3(\log A^2 + \log B - \log C)$
- 3) $\frac{1}{3} \log(A^2 + B) - C$
- 4) $\frac{2}{3} \log A + \frac{1}{3} \log B - \frac{1}{3} \log C$

22 The equation $N = \frac{\sqrt[4]{x^2 y}}{z}$ is equivalent to

- 1) $\log N = \frac{1}{4}(2 \log x + \log y - \log z)$
- 2) $\log N = \frac{1}{4}(2 \log x + \log y) - \log z$
- 3) $\log N = \frac{1}{4} \log 2x + \frac{1}{4} \log y - \log z$
- 4) $\log N = \frac{2}{4} \log x + \frac{1}{4} \log(y - z)$

23 The expression $\log \sqrt[4]{\frac{a^2}{b}}$ is equivalent to

- 1) $\frac{1}{4} \left(\frac{\log a^2}{\log b} \right)$
- 2) $4(\log a^2 - \log b)$
- 3) $\frac{1}{2}(4 \log a - \log b)$
- 4) $\frac{1}{4}(2 \log a - \log b)$

24 If $\log x^2 - \log 2a = \log 3a$, then $\log x$ expressed in terms of $\log a$ is equivalent to

- 1) $\frac{1}{2} \log 5a$
- 2) $\frac{1}{2} \log 6 + \log a$
- 3) $\log 6 + \log a$
- 4) $\log 6 + 2 \log a$

25 $\log \cot A$ is equivalent to

- 1) $\log \sin A + \log \cos A$
- 2) $\log \sin A - \log \cos A$
- 3) $\log \cos A + \log \sin A$
- 4) $\log \cos A - \log \sin A$

26 The magnitude (R) of an earthquake is related to its intensity (I) by $R = \log \left(\frac{I}{T} \right)$, where T is the

threshold below which the earthquake is not noticed. If the intensity is doubled, its magnitude can be represented by

- 1) $2(\log I - \log T)$
- 2) $\log I - \log T$
- 3) $2 \log I - \log T$
- 4) $\log 2 + \log I - \log T$

- 27 The speed of sound, v , at temperature T , in degrees Kelvin, is represented by the equation

$v = 1087\sqrt{\frac{T}{273}}$. Which expression is equivalent to $\log v$?

- 1) $1087 + \frac{1}{2}\log T - \log 273$
 - 2) $1087\left(\frac{1}{2}\log T - \frac{1}{2}\log 273\right)$
 - 3) $\log 1087 + \frac{1}{2}\log T - \frac{1}{2}\log 273$
 - 4) $\log 1087 + 2\log(T + 273)$
- 28 A black hole is a region in space where objects seem to disappear. A formula used in the study of black holes is the Schwarzschild formula,

$R = \frac{2GM}{c^2}$. Based on the laws of logarithms, $\log R$

can be represented by

- 1) $2\log G + \log M - \log 2c$
 - 2) $\log 2G + \log M - \log 2c$
 - 3) $\log 2 + \log G + \log M - 2\log c$
 - 4) $2\log GM - 2\log c$
- 29 Banks use the formula $A = P(1 + r)^x$ when they compound interest annually. If P represents the amount of money invested and r represents the rate of interest, which expression represents $\log A$, where A represents the amount of money in the account after x years?

- 1) $x\log P + \log(1 + r)$
- 2) $\log P + x\log(1 + r)$
- 3) $\log P + x\log 1 + r$
- 4) $\log P + \log x + \log(1 + r)$

- 30 The equation used to determine the time it takes a swinging pendulum to return to its starting point is

$T = 2\pi\sqrt{\frac{\ell}{g}}$, where T represents time, in seconds, ℓ

represents the length of the pendulum, in feet, and g equals 32 ft/sec^2 . How is this equation expressed in logarithmic form?

- 1) $\log T = \log 2 + \log \pi + \log \sqrt{\ell - 32}$
- 2) $\log T = \log 2 + \log \pi + \frac{1}{2}\log \ell - \frac{1}{2}\log 32$
- 3) $\log T = \log 2 + \log \pi + \frac{1}{2}\log \ell - \log 16$
- 4) $\log T = 2 + \log \pi + \frac{1}{2}\log \ell - 16$

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Answer Section

1 ANS: 1

$$6 \log_b 2$$

$$\log_b 2^6$$

$$\log_b 64 \neq \log_b 36$$

REF: 010208b

2 ANS: 2

REF: 060029siii

3 ANS: 3

REF: 080022siii

4 ANS: 3

$$\log 4m^2 = \log 4 + \log m^2 = \log 4 + 2 \log m$$

REF: 061321a2

5 ANS: 2

REF: 010220siii

6 ANS: 4

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

REF: 061426a2

7 ANS: 3

REF: 068529siii

8 ANS: 3

REF: 060319siii

9 ANS: 4

REF: 089315siii

10 ANS: 1

$$\log T = \log \frac{10x^2}{y} = \log 10 + \log x^2 - \log y = 1 + 2 \log x - \log y$$

REF: 011615a2

11 ANS: 4

REF: 068122siii

12 ANS: 3

REF: 068918siii

13 ANS: 1

REF: 068023siii

14 ANS: 1

REF: 019025siii

15 ANS: 3

REF: 010124siii

16 ANS: 2

REF: 069519siii

17 ANS: 1

REF: 089718siii

18 ANS: 4

REF: 069917siii

19 ANS: 2

REF: 080122siii

20 ANS: 1

REF: 068821siii

21 ANS: 4

REF: 061120a2

22 ANS: 2

REF: 069420siii

23 ANS: 4

REF: 019619siii

24 ANS: 2

$$\log x^2 = \log 3a + \log 2a$$

$$2 \log x = \log 6a^2$$

$$\log x = \frac{\log 6}{2} + \frac{\log a^2}{2}$$

$$\log x = \frac{1}{2} \log 6 + \frac{2 \log a}{2}$$

$$\log x = \frac{1}{2} \log 6 + \log a$$

REF: 011224a2

25 ANS: 4

REF: 018625siii

26 ANS: 4

$$\log \frac{2I}{T} = \log 2 + \log I - \log T$$

REF: 060102b

27 ANS: 3

$$\begin{aligned} \log v &= \log 1087 \sqrt{\frac{T}{273}} \\ &= \log 1087 \cdot \left(\frac{T}{273}\right)^{\frac{1}{2}} \\ &= \log 1087 + \log \left(\frac{T}{273}\right)^{\frac{1}{2}} \\ &= \log 1087 + \frac{1}{2} \log \frac{T}{273} \\ &= \log 1087 + \frac{1}{2} \log T - \frac{1}{2} \log 273 \end{aligned}$$

REF: 010611b

28 ANS: 3

$$\log R = \log \frac{2GM}{c^2} = \log 2 + \log G + \log M - \log c^2 = \log 2 + \log G + \log M - 2 \log c$$

REF: 010717b

29 ANS: 2

$$\log A = \log P(1+r)^x = \log P + \log(1+r)^x = \log P + x \log(1+r)$$

REF: 080911b

30 ANS: 2

$$\begin{aligned}\log T &= \log\left(2\pi\sqrt{\frac{\ell}{32}}\right) \\ &= \log\left(2\pi\left(\frac{\ell}{32}\right)^{\frac{1}{2}}\right) \\ &= \log 2 + \log \pi + \log\left(\frac{\ell}{32}\right)^{\frac{1}{2}} \\ &= \log 2 + \log \pi + \frac{1}{2}\log \frac{\ell}{32} \\ &= \log 2 + \log \pi + \frac{1}{2}(\log \ell - \log 32) \\ &= \log 2 + \log \pi + \frac{1}{2}\log \ell - \frac{1}{2}\log 32\end{aligned}$$

REF: 080709b