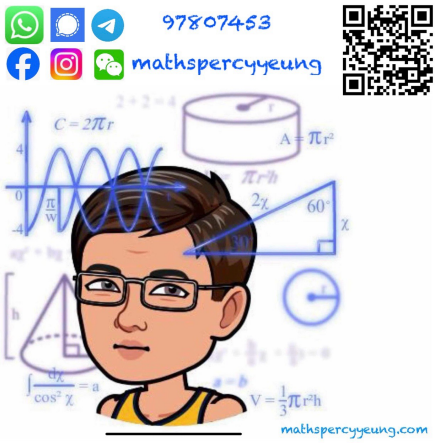
Logarithmic Functions
Multiple Choice Questions

[20-21]

1. [20-21 S.5 Mid-year #15]



Which of the following is the least in value?

A. 2345^{2020}

B. 3456^{1920}

C. 4567^{1820}

D. 6789^{1720}

2. [20-21 S.4 Final Exam #15]

Which of the following is the greatest?

A. 4680^{1721}

B. 3579^{1821}

C. 2468^{1921}

D. 1357^{2021}

3. [20-21 S.4 Final Exam #16]

If $\log 2 = a$ and $\log 3 = b$, express $\log 75$ in terms of a and b.

A. $2 + 2a + b$

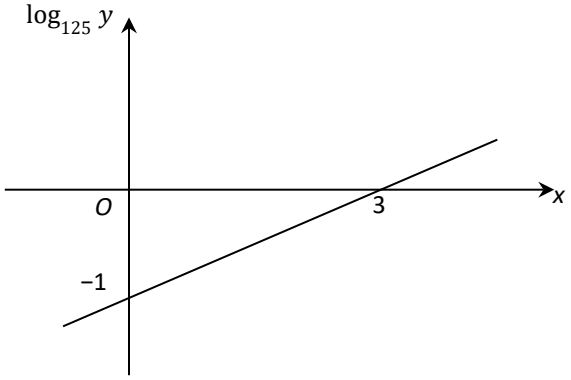
B. $2 + 2a - b$

C. $2 - 2a + b$

D. $2 - 2a - b$

4. [20-21 S.5 Final Exam #32]

The graph in the figure shows the linear relation between x and $\log_{125} y$. If $y = ab^x$, then $b =$



A. −1.

B. $\frac{1}{125}$.

C. 5.

D. 125.

5. [20-21 S.5 Final Exam #44]

If $\begin{cases} (\log y)^2 = x - 4 \\ \log y^2 = x - 7 \end{cases}$, then $y =$

A. $\frac{1}{10}$ or 1000.

B. −1 or 3.

C. 5 or 13.

D. 10 or 10^9.

[21-22]

6. [21-22 Final Exam, #20]

Which of the following is the greatest?

A. $\left(\frac{1}{89}\right)^{123}$

B. $\left(\frac{3}{97}\right)^{321}$

C. 87^{-231}

D. $(-0.789)^{312}$

7. [21-22 Final Exam, #21]

α and β are roots of $(\log x)^2 - \log x^3 - 4 = 0$, find $\alpha\beta$.

A. 1 000

B. 4

C. 0.0001

D. – 4

8. [21-22 S.5 Mid-year, #27]

Solve $\log_2 x + \log_4 x^2 = 8$.

A. 4

B. 6

C. 8

D. 16

9. [21-22 S.5 Final Exam, #24]

It is given that $\log_3 y$ is a linear function of $\log_3 x$. The intercepts on the vertical axis and on the horizontal axis of the graph of the linear function are 2 and – 4 respectively. Which of the following must be true?

A. $xy^2 = 81$

B. $x^2 y = 81$

C. $\frac{y^2}{x} = 81$

D. $\frac{y}{x^2} = 81$

10. [21-22 S.6 Mock, #34]

It is given that $\log_5 y$ is a linear function of $\log_{25} x$. The intercepts on the vertical axis and on the horizontal axis of the graph of the linear function are 2 and $-\frac{2}{3}$ respectively. Which of the following is a constant?

A. $x^3 - y^2$
B. $x^3 y^2$
C. $\frac{x^3}{y^2}$
D. $(xy)^6$

[22-23]

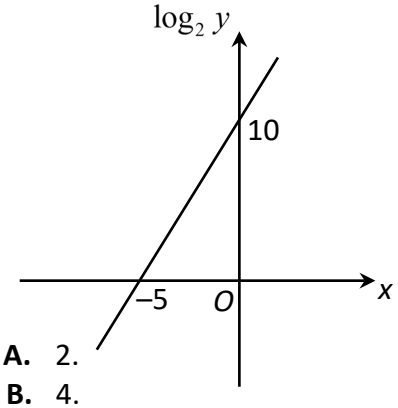
11. [S.4 22-23 Standardized Test,#3]

Let f(x) = (x – 3)(ax – b)(3x + 1). When f(x) is divided by x – 1, the remainder is 4. Find a – b.

A. –2
B. $-\frac{1}{2}$
C. $\frac{1}{2}$
D. 2

12. [S.4 22-23 Standardized Test,#8]

The graph in the figure shows the linear relation between x and $\log_2 y$. If $y = mn^x$, then n =



A. 2.
B. 4.
C. 25.
D. 1024.

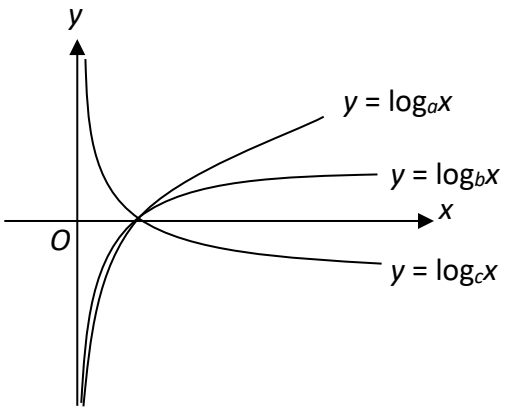
13. [S.4 22-23 Final,#20]

The figure below shows the graphs of three logarithmic functions, where *a*, *b* and *c* are positive constants. Which of the following are true?

I. The three curves all pass through the point $(1,0)$.

II. $b > a > c$

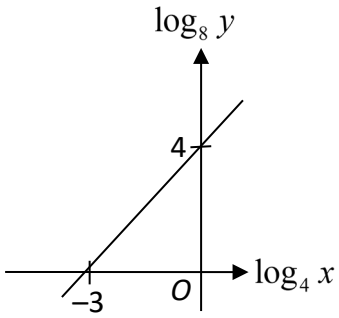
III. If $\log_b x + \log_c x = 0$ for $x > 1$, then $bc = 1$.



A. I and II only
B. I and III only
C. II and III only
D. I, II and III

14. [S.5 22-23 Mid-year,#30]

The graph in the figure shows the linear relation between $\log_4 x$ and $\log_8 y$. Which of the following must be true?



A. $y^3 = 12x^4$
B. $y = 12x^2$
C. $x^2 y = 4096$
D. $y = 4096x^2$

15. [S.5 22-23 Final,#32]

It is given that $\log_8 y$ is a linear function of $\log_4 x$. The intercepts on the vertical axis and the horizontal axis of the graph of the linear function are 3 and 5 respectively. Which of the following is a constant?

A. $x^3 y^5$
B. $x^5 y^3$
C. $x^9 y^{10}$
D. $x^{10} y^9$

16. [S.6 22-23 Timed Practice 2,#33]

It is given that $\log_8 y$ is a linear function of $\log_4 x$. The intercepts on the vertical axis and on the horizontal axis of the graph of the linear function are –3 and 4 respectively. Which of the following must be true?

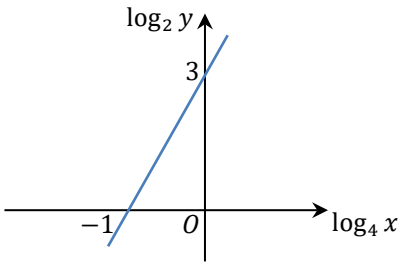
A. $y^8 = 2^{72} x^9$
B. $x^9 = 2^{72} y^8$
C. $y^{11} = 2^{72} x^{10}$
D. $x^{10} = 2^{72} y^{11}$

17. [S.6 22-23 Timed Practice 2,#41]
Solve the equation $\log_3 x = 4 - \log_x 81$.

A. $x = \frac{1}{3}$ or 81
B. $x = 9$ or 81
C. $x = 81$
D. $x = 9$

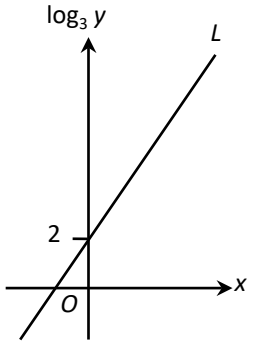
18. [S.6 22-23 Timed Practice 4,#32]
The graph in the figure shows the linear relation between $\log_2 y$ and $\log_4 x$. Which of the following must be true?

A. $y = 64x$
B. $y = 8x^3$
C. $y^2 = 3x^3$
D. $y^2 = 64x^3$



19. [S.6 22-23 Timed Practice 5,#33]
In the figure, the straight line L shows the relationship between x and $\log_3 y$. The slope and the y-intercept of L are 1 and 2 respectively. If $y = ka^x$, then $a + k =$

A. 3.
B. 9.
C. 12.
D. 15.



20. [S.6 22-23 Timed Practice 6,#32]
It is given that $\log_8 y$ is a linear function of $\log_4 x$. If the slope and the intercept on the horizontal axis of the graph of the linear function are 5 and 2 respectively, then

A. $y^2 = 2^{12}x^{15}$.
B. $y^2 = \frac{x^{15}}{2^{60}}$.
C. $x^{15}y^2 = 2^{12}$.
D. $x^{15}y^2 = 2^{60}$.

21. [22-23 S6 Mock,#34]

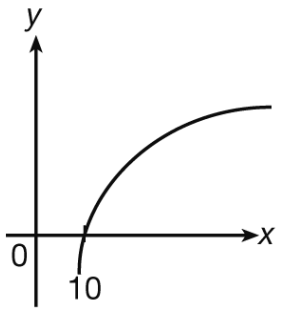
It is given that $\log_9 y$ is a linear function of $\log_3 x$. The intercepts on the vertical axis and on the horizontal axis of the graph of the linear function are 6 and 2 respectively. Which of the following must be true?

A. $xy^6 = 3^6$
B. $x^3y^2 = 3^6$
C. $x^2y^3 = 3^{12}$
D. $x^6y = 3^{12}$

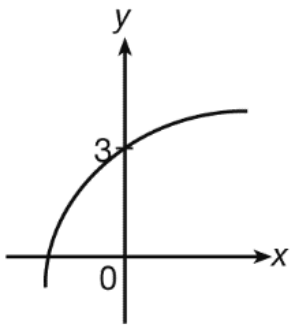
22. [22-23 S6 Mock,#38]

Which of the following may be the graph of $y = \log(x-10)+3$?

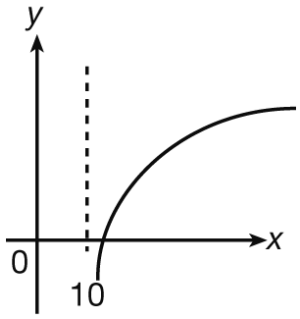
A.



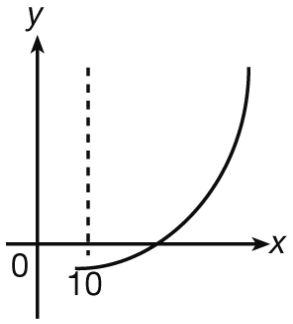
B.



C.



D.



[23-24]

23. [S.4 23-24 Standardized Test,#7]

If $\begin{cases} 2x+1 = \log y \\ x - \log y^2 = 1 \end{cases}$, then $y =$

A. -1.
B. 0.1.
C. 1.
D. 10.

24. [S.4 23-24 Final,#26]

Let *a*, *b* and *c* be constants where $a > b > c > 1$. On the same rectangular coordinate system, the graph of $y = a^x$ and the graph of $y = b^x$ cut the straight line $y = c$ at the points *P* and *Q* respectively. If the coordinates of *R* are (0, *c*), then $\frac{PR}{QR} =$

A. $\log_a b$.
B. $\log_c b$.
C. $\log_b a$.
D. $\log_c a$.

25. [S.5 23-24 Mid-year,#29]

Solve $\log(x+4) + \log(x-5) = 1$.

A. $x = -4$ or $x = 5$
B. $x = 5$
C. $x = 6$
D. $x = 6$ or $x = -5$

26. [S.5 23-24 Mid-year,#30]

It is given that $\log_2 y$ is a linear function of $\log_4 x$. The intercepts on the vertical axis and the horizontal axis of the graph of the linear function are 3 and 2 respectively. Which of the following must be true?

A. $xy^3 = 2^{12}$
B. $x^3 y = 2^{12}$
C. $x^3 y^4 = 2^{12}$
D. $x^4 y^3 = 2^{12}$

27. [S.5 23-24 Final,#33]

It is given that $\log_k y$ is a linear function of $\log_{k^2} x$, where $k \neq 0$. If the graph of the linear function passes through $(3, -3)$ and cuts the horizontal axis at 6. Which of the following must be true?

A. $\frac{x}{y^2} = k^{12}$
B. $\frac{x^2}{y} = k^6$
C. $xy^2 = k^3$

28. [S.5 23-24 Final,#39]

Let *a*, *b* and *c* be constants where $a > b > c > 1$. On the same rectangular coordinate system, the graph of $y = \log_a x$ and the graph of $y = \log_b x$ cut the straight line $x = c$ at the points *P* and *Q* respectively. If the coordinates of *R* are (*c*, 0), then $\frac{PR}{QR} =$

A. $\log_a b$.
B. $\log_a c$.
C. $\log_b a$.
D. $\log_b c$.

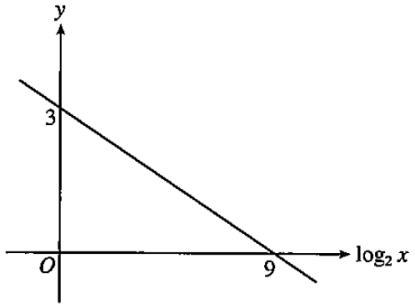
29. [S.6 23-24 Timed Practice 2,#25]

If $x + \log y = x^2 + \log y^2 - 8 = 5$, then $y =$

A. 10^2.
B. 10^2 or 10^5.
C. 10 or 10^6.
D. 10^2 or 10^6.

30. [S.6 23-24 Timed Practice 4,#33]

The graph in the figure shows the linear relation between *y* and $\log_2 x$. If $y = m\log_4 x + c$, then *m* =



A. 3.
B. $\frac{1}{3}$.
C. $-\frac{1}{3}$.
D. $-\frac{2}{3}$.

31. [S.6 23-24 Timed Practice 6,#33]

If $x^{\log x} - 10\,000 = 0$, then $x^2 =$

A. $\frac{1}{100\,000\,000}$ or 25.
B. $\frac{1}{10\,000}$ or 10 000.
C. 10 000.
D. 4.

~End~

Logarithmic Functions
Conventional Questions

[20-21]

1. [20-21 S.4 Final Exam #12]

Simplify $\dfrac{\log_9 a^3}{\log_3 a^2}$. **(3 marks)**

2. [20-21 S.4 Final Exam #13b]

Solve the following equations.

$\log(5x + 59) - \log(3x) = 2.$ **(3 marks)**

3. [20-21 S.4 Final Exam #15]

The population of city A is given by $500\,000(1.004)^{t+1}$, where t is the number of years after 2021.

(a) Find the population of city A two years after 2021. **(2 marks)**

(b) In which year will the population of city A first exceed 530 000? **(3 marks)**

(Give your answers correct to the nearest integer.)

[21-22]

4. [21-22 Final, #7c]

Solve the following equations.

$$\frac{1}{2}\log_2 x - 1 = \log_2 4x$$

(4 marks)

5. [21-22 S.5 Final Exam, #14]

Solve $\log_4(x + 3) = \log_2 x + 1.$ **(3 marks)**

[22-23]

6. [S.4 22-23 Standardized Test,#5]

Solve $\begin{cases} \log_2(4x + y) = 3 \\ 3\log_8 x = \log_2 \sqrt{5 - y} \end{cases}$. **(4 marks)**

7. [S.4 22-23 Standardized Test,#6]

It is given that $f(x) = 3(\log_a x)^2 + \log_a x^b$ where a and b are constants. If the equation $f(x) = b + 3$ has equal roots, express x in terms of a. **(3 marks)**

8. [S.4 22-23 Final,#14]

Solve the following equations.

(a) $x^4 - 2x^2 - 3 = 0$ **(2 marks)**

(b) $4(\log x)^2 + 3\log x^2 + 2 = 0$ **(2 marks)**

9. [S.4 22-23 Final,#15]

It is given that y is a linear function of $\log x$. The slope and the intercept on the horizontal axis of the graph are 2 and –3 respectively. Express the relation between x and y in the form $x^k = 10^{y+A}$, where k and A are constants. **(3 marks)**

[23-24]

10. [S.4 23-24 Standardized Test,#6]

Solve $\log_4(x+1) = \log_{16}(31+x)$. **(3 marks)**

11. [S.4 23-24 Final,#14]

Solve $\log_2(x-8) = \log_4 x + 1$. **(4 marks)**

12. [S.6 23-24 Timed Practice 5,#8]

Let a and b be constants. Denote the graph of $y = a + \log_b(x+16)$ by G. The x-intercept and the y-intercept of G are –12 and 1 respectively. Express x in terms of y. **(4 marks)**

13. [S.6 23-24 Timed Practice 7,#9]

Let α and β be real numbers such that $\begin{cases} 3^{\beta-\alpha} = 81 \\ \log_4(2\alpha+\beta) = 2 \end{cases}$.

(a) Find α and β. **(2 marks)**

(b) The 1st term and the 2nd term of an arithmetic sequence are $\log\alpha$ and $\log\beta$ respectively. Find the least value of n such that the sum of the first n terms of the sequence is greater than 1000. **(5 marks)**

~End~