

- c 5 The exponential function for the following data set is

x	y
2	9
3	27
4	81
5	243

∵ x=1 is not given try...

$$\sqrt{9} = \pm 3$$

$$\sqrt[3]{27} = +3$$

$$\sqrt[4]{81} = \pm 3$$

$$\sqrt[5]{243} = +3$$

a. $y = 9^x$

c. $y = 3^x$

b. $y = \left(\frac{1}{9}\right)^x$

d. $y = \left(\frac{1}{3}\right)^x$

- d 6 Another way of writing $y = x^a$ is

a. $\log_a x = y$

b. $\log_a y = x$

c. $\log_x a = y$

d. $\log_x y = a$

base is x

The exponent is a

- c 7 Another way of writing $b = \log_2 8$ is

a. $b^2 = 8$

b. $8^b = 2$

c. $2^b = 8$

d. $8^b = 2$

base is 2

- d 8 Another way of writing $a = \log_2 \frac{1}{16}$ is

a. $a^2 = \frac{1}{16}$

b. $\left(\frac{1}{16}\right)^a = 2$

c. $a^{\frac{1}{16}} = 2$

d. $2^a = \frac{1}{16}$

- b 9 Evaluate $\log 0.00001 = \log(10^{-5}) = -5 \log(10) = -5$

a. -4

b. -5

c. 4

d. 5

b 10 Evaluate $\log \frac{1}{10^3}$. = $\log(10^{-3}) = -3 \log(10) = -3$

- a. -4
b. -3
c. 3
d. 4

b 11 Evaluate $\log_7 7$.

- a. 0
b. 1
c. 7
d. does not exist

b Evaluate $\log_5 25^2$. = $2 \log_5 25 = 2 \log_5 5^2 = (2)(2) \log_5 5 = 4$

- a. 25
b. 4
c. 10
d. 5

a 13 Evaluate $\log_2 \left(\frac{1}{16}\right)^3$. = $3 \log_2 \left(\frac{1}{16}\right) = 3 \log_2 \left(\frac{1}{2^4}\right)$

= $3 \log_2 2^{-4} = 3(-4) \log_2 2 = -12$

- a. -12
b. 8
c. 6
d. -4

a 14 The equation of the vertical asymptote for the function $y = 3 \log(x+4)$ is

- a. $x = -4$
b. $x = 3$
c. $x = 4$
d. $x = 0$

Shift
to the left
4 units

c 15 The equation of the vertical asymptote for the function $y = -2 \log(x+1) - 3$ is

- a. $x = -3$
b. $x = -2$
c. $x = -1$
d. $x = 0$

Shift left
1 unit

b 16 The x-intercept of the function $y = -\log(x-3)$ is

- a. -4
b. 4
c. -3
d. 3

$0 = -\log(x-3)$

$1 = \log(x-3)^{-1}$

$10^0 = (x-3)^{-1}$

$1 = (x-3)^{-1}$

$1 = \frac{1}{x-3}$

$x-3 = 1$

$x = 4$

- a 17 The function $y = -2 \log(3x + 1)$ is
- a. reflected in the x-axis
 b. reflected in the y-axis
 c. translated down 1 unit
 d. translated left 3 units
- reflection in x-axis*
 $3(x + \frac{1}{3})$
 shift left $\frac{1}{3}$ units

- a 18 The function $y = \log 4x - 3$ is
- a. compressed horizontally by a factor of $\frac{1}{4}$
 b. stretched horizontally by a factor of $\frac{1}{4}$
 c. translated right 3 units
 d. translated left 3 units
- shift left 3 units*
 $y = \log 4x - 3$
 $= \log 4(x - 12)$
 horizontal compression $\frac{1}{4}$ shift right 12 units

- b 19 Evaluate $\log_3 25^2$. $= \log_3 (5^2)^2 = \log_3 5^4 = 4 \log_3 5 = 4$
- a. 25
 b. 4
 c. 10
 d. 5

- a 20 Evaluate $\log_2 \left(\frac{1}{16}\right)^3$. $= 3 \log_2 \left(\frac{1}{16}\right) = 3 \log_2 \left(\frac{1}{2^4}\right) = 3 \log_2 2^{-4} = (3)(-4) \log_2 2 = -12$
- a. -12
 b. 8
 c. 6
 d. -4

- b 21 Evaluate $\log_3 27^2$. $= 2 \log_3 3^3 = 6 \log_3 3 = 6$
- a. 3
 b. 6
 c. 9
 d. 4

- a 22 Evaluate $\log_5 \sqrt{625}$. $= \log_5 (625)^{\frac{1}{2}} = \log_5 (5^4)^{\frac{1}{2}} = \log_5 5^2 = 2 \log_5 5 = 2$
- a. 2
 b. 5
 c. 25
 d. 4

- d 23 Evaluate $\log_2 (1024)^{\frac{1}{10}}$. $= \log_2 (2(512))^{\frac{1}{10}} = \frac{1}{10} \log_2 (2(2)(256)) = \frac{1}{10} \log_2 (2^3(128))$
 $= \frac{1}{10} \log_2 (2^4(64))$
 $= \frac{1}{10} \log_2 (2^{10}) = \frac{10}{10} \log_2 (2)$
 $= 1$
- a. 20
 b. 100
 c. 10
 d. 1

c 24 Evaluate $\log_{\frac{3}{4}} \left(\frac{1024}{243} \right)^{-2}$. $= \log_{\frac{3}{4}} \left(\frac{4^5}{3^5} \right)^{-2} = \log_{\frac{3}{4}} \left(\frac{3^5}{4^5} \right)^2$

a. $\frac{9}{16}$ c. 10 $= \log_{\frac{3}{4}} \left(\left(\frac{3}{4} \right)^5 \right)^2$

b. -10 d. -5 $= \log_{\frac{3}{4}} \left(\frac{3}{4} \right)^{10}$

$= 10 \log_{\frac{3}{4}} \left(\frac{3}{4} \right)$

$= 10$

d 25 Evaluate $\log_{\frac{1}{9}} \left(\sqrt[3]{81} \right)^2$. $= 2 \log_{\frac{1}{9}} (81)^{\frac{1}{3}} = \frac{2}{3} \log_{\frac{1}{9}} (9^2) = \frac{2}{3} \log_{\frac{1}{9}} (9) = -2 \left(\frac{2}{3} \right) \log_{\frac{1}{9}} \left(\frac{1}{9} \right)$

a. -9 c. -2 $= -\frac{4}{3}$

b. $-\frac{1}{81}$ d. $-\frac{4}{3}$

b 26 Solve for x , to two decimal places.

$200 = 4(5)^x \rightarrow \frac{200}{4} = 5^x \rightarrow 50 = 5^x \rightarrow \log_5(50) = x = \frac{\log 50}{\log 5} \approx 2.43$

a. 10.00 c. 12.15

b. 2.43 d. 1.87

b 27 Solve for x .

$x = 9^{\log_9 81}$ $x = 9^{\log_9 9^2} = 9^{2 \log_9 9} = 9^{2(1)} = 9^2 = 81$

a. $x = 18$ c. $x = 6561$

b. $x = 81$ d. $x = 36$

a 28 Evaluate $\log_2 24$, to three decimal places.

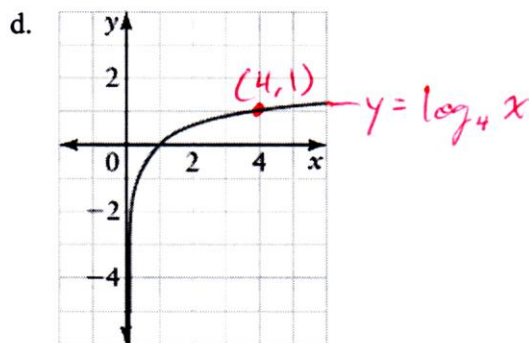
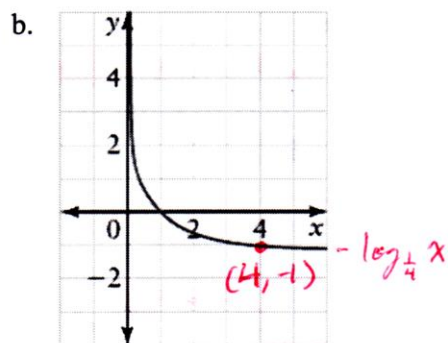
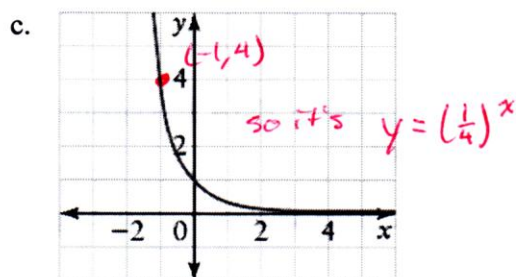
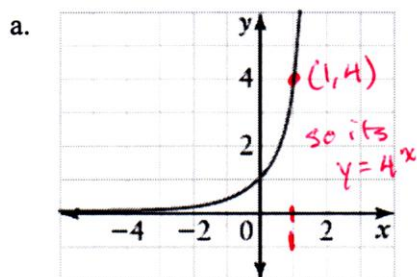
$\log_2 24 = \frac{\log 24}{\log 2} \approx 4.585$

a. 4.585 c. 19.000

b. 0.218 d. 3.974

Matching

Match each graph with its function.



a 29. $y = 4^x$

c 30. $y = \left(\frac{1}{4}\right)^x$

d 31. $y = \log_4 x$

b 32. $y = \log_{\frac{1}{4}} x$

Note: Just like the last assignment, question #33-41 involve short/long answer responses. Some of these questions may take up a whole page to write out (especially if you write out your answers out **neatly**). Please write your answers in a **neat** and **legible** fashion so that not only can I mark it, but you will also be able to refer back to it as study material.

I will provide you paper, just like the last assignment. **FEEL FREE TO USE UP THE WHOLE PAGE** even if it's just for one question. There is no need to feel frugal and try to cram as many answers as possible in one page. Space out your answers.

Just like before, if I see your solutions written on many of my paper in a **neat** fashion, I will give you a bonus mark of 1 in each achievement category (K/I/C/A) on this assignment. I hope this encourages both the reuse of old paper AND you write out your solutions **clearly, neatly, and legibly**.

TL;DR - USE RECYCLED PAPER, WRITE YOUR ANSWERS NEATLY AND SPACED OUT!

33

$$y = -3 \log[-2(x-1)] + 4$$

$$y = a f(k(x-d)) + c$$

means y values $\times (-3)$ } a is negative, so ^{the function} ~~y~~ is reflected about the x -axis
 $a = 3$, so the function is vertically stretched by a factor of 3

means x values $\times (-\frac{1}{2})$ } k is negative, so the function is reflected about the y -axis
 $k = 2$, so the function is horizontally compressed by a factor of $\frac{1}{2}$

means x values $+1$ } $d = 1$, so the function is shifted 1 unit to the right

means y values $+4$ } $c = 4$, so the " " shifted 4 units up

34

$$\log_2 64 + \log_3 27 \times \log_4 \left(\frac{1}{256}\right)$$

$$= \log_2 2^6 + \log_3 3^3 \times \log_4 \left(\frac{1}{4^4}\right)$$

$$= 6 \log_2 2 + 3 \log_3 3 \times (-4) \log_4 4$$

$$= 6(1) + 3(1) \times (-4)(1)$$

$$= 6 - 12$$

$$= -6$$

35

$$\log_2 \sqrt[4]{32} = \log_2 (32)^{\frac{1}{4}} = \log_2 (2^5)^{\frac{1}{4}} = \log_2 (2)^{\frac{5}{4}} = \frac{5}{4} \log_2 2$$

$$= \frac{5}{4}$$

36

$$\begin{aligned}\log_3 81^2 &= \log_3 (3^4)^2 = \log_3 3^8 = 8 \log_3 3 = 8(1) \\ &= 8\end{aligned}$$

37

$$\log 7 = 0.8451 \quad \log 2 = 0.3010$$

$$\log 28 = \log (7 \times 4) = \log 7 + \log 4$$

$$= \log 7 + \log 2^2$$

$$= \log 7 + 2 \log 2$$

$$= 0.8451 + 2(0.3010)$$

$$= 0.8451 + 0.602$$

$$= \mathbf{1.4471}$$

38

$$\log_2 14$$

$$\log_2 7 = 2.8074$$

$$\log_2 (7 \times 2) = \log_2 7 + \log_2 2$$

$$= 2.8074 + 1$$

$$= 3.8074$$

39)

$$B = 4 (7.07)^t \quad t = 24 \text{ hours}$$

$$B = 4 (7.07)^{24} \\ = 9.73 \times 10^{20} \text{ mould spores}$$

$\therefore 9.73 \times 10^{20}$ mould spores would be present after 24 hours.

40

$$M = 3.1 = \log \left(\frac{I}{I_0} \right)$$

$$10^{3.1} = \frac{I}{I_0} \approx 1258.93$$

\therefore The earthquake measured 3.1 on the Richter scale is 1258.93 times as intense as a standard earthquake.

41

$$[H^+] = 1.6 \times 10^{-4}$$

$$pH = -\log(1.6 \times 10^{-4}) = 3.796$$

\therefore The pH for a solution with a hydronium ion concentration of 1.6×10^{-4} mol/L is approximately 3.8

Short Answer

33. List the steps and explain the effect of each transformation to graph the function $y = -3\log[-2(x-1)] + 4$.

[C: 5 marks]

34. Evaluate $\log_2 64 + \log_3 27 \times \log_4 \frac{1}{256}$ Without using a calculator. You must show your work to earn full marks.

[I: 3 marks]

35. Evaluate $\log_2 \sqrt[4]{32}$ without a calculator. You must show your work to earn full marks.

[I: 3 marks]

36. Evaluate $\log_3 81^2$ without a calculator. You must show your work to earn full marks.

[I: 3 marks]

37. Given $\log 7 = 0.8451$ and $\log 2 = 0.3010$, find the value of $\log 28$ without a calculator. You must show your work to earn full marks.

[I: 3 marks]

38. Given $\log_2 7 = 2.8074$, find the value of $\log_2 14$ without a calculator. You must show your work to earn full marks.

[I: 3 marks]

39. A culture of a certain type of mould growth is modelled by the function $B = 4(7.07)^t$, where B is the total number of spores and t is the time, in hours. How many mould spores would there be after 24 h? [A: 3 marks]

40. How many times as intense as a standard earthquake is an earthquake measuring 3.1 on the Richter scale?

[A: 3 marks]

41. Determine the pH of a solution with a hydronium ion concentration of 1.6×10^{-4} mol/L. [A: 3 marks]

Application Multiple Choice

C 42. A jackhammer has a decibel level of 107 dB, while city traffic has a decibel level of 69 dB. How many times as intense as the sound of the city traffic is the sound of a jackhammer?

a. 1.43

$$107 - 69 = 10 \log_{10} \left(\frac{I_1}{I_0} \right)$$

$$10^{107-69} = \left(\frac{I_1}{I_0} \right)^{10} = 6309.57$$

c. 6309.57

$$\text{Use } B_2 - B_1 = 10 \log_{10} \left(\frac{I_1}{I_0} \right)$$

b. 2.33

d. 627 281.18

b 43. A sound is 600 times as intense as a sound you can just hear (0 dB). What is the sound level of the sound, in decibels?

a. 60.00 dB

$$B_2 - B_1 = 10 \log_{10} (600)$$

$$\Delta B = 27.78$$

c. 6.00 dB

b. 27.78 dB

d. 34.71 dB

- d 44. While standing inside his house with the front door open, a man measured the sound level of a police siren blaring down the street to be 95 dB. With the front door closed, the sound level is 80 dB. How many times as intense as the sound of the siren with the door closed is the same sound with the door open?

- a. 1.50 d. 31.62
b. 57.66 c. 31.62

$$95 - 80 = 10 \log_{10} \left(\frac{I}{I_0} \right) \\ \frac{15}{10} = \log_{10} \left(\frac{I}{I_0} \right) \quad \text{so} \quad \frac{I}{I_0} = 10^{\frac{3}{2}} = 31.62$$

- a 45. The pH of a solution with a hydronium ion concentration of 2.17×10^{-4} mol/L is

- a. 3.66 c. 2.31
b. 1.00 d. 4.34

$$\text{pH} = -\log [H^+] = \\ -\log (2.17 \times 10^{-4}) = 3.66$$

- c 46. The hydronium ion concentration of a solution with a pH of 9.26 is approximately

- a. 9.26×10^{-10} mol/L c. 5.50×10^{-10} mol/L
b. 0.966 mol/L d. 2.15×10^{-10} mol/L

$$\text{pH} = -\log [H^+] \quad \text{so} \\ [H^+] = 10^{-\text{pH}} = 10^{-9.26} = 5.45 \times 10^{-10}$$

- d 47. The ratio of intensities of two sounds is 4261. If the quieter sound has a decibel level of 104 dB, what is the decibel level of the other sound?

- a. 67.7 dB c. 110.7 dB
b. 152.6 dB d. 140.3 dB

- c 48. What is the magnitude of an earthquake 1410 times as intense as a standard earthquake?

- a. 2.96 c. 3.15
b. 2.61 d. 3.74

$$M = \log \left(\frac{I}{I_0} \right) = \log (1410) \\ = 3.149$$

- a 49. An earthquake measured 1.7 on the Richter scale. How many times as intense as a standard earthquake was this one?

- a. 50.12 c. 23.04
b. 201.60 d. 174.90

$$\text{Use } M = \log \left(\frac{I}{I_0} \right) \\ 1.7 = \log \left(\frac{I}{I_0} \right) \\ 10^{1.7} = \frac{I}{I_0} = 50.12$$

50. Choose a question from #33-49 that you are confident in answering correctly. You will teach how to solve this question in front of the entire class. [C: 10 marks]

[2 marks for correct solution, 2 marks for clarity in voice, 2 marks for clarity in writing, 2 marks for extemporaneous quality, 2 marks for paying attention to other classmates' presentation]