

**You should be able to solve the following without a calculator**

[1] Find the domains of the following functions.

[a]  $f(x) = 4^x$

[b]  $f(x) = \log_3 x$

[c]  $f(x) = \log_5(12 - 6x)$

[2] Find the ranges of the following functions.

[a]  $f(x) = 5^x$

[b]  $f(x) = \log_7 x$

[3] Evaluate the following. Write “UNDEFINED” if the value does not exist.

[a]  $\log_3 81$

[b]  $\log_6 36$

[c]  $\log_5 125$

[d]  $\log_7 0$

[e]  $\log_8 -8$

[f]  $\log_6 1$

[g]  $\log_2 64$

[h]  $\log 10000$

[i]  $\log_4 4^6$

[j]  $\log_8 8^{-3}$

[k]  $3^{\log_3 7}$

[l]  $6^{\log_6 0}$

[m]  $5^{\log_5 -10}$

[n]  $10^{\log 5}$

[4] Find the exact solutions of the following equations. **Check your answers.**

[a]  $3^{2-x} = 81$

[b]  $8^{3x-7} = 4^{6-x}$

[c]  $1 + 2 \log_4(5x + 9) = 7$

[d]  $\log_3(x^2 - 7) - \log_3(1 - x) = 1$

[e]  $\log_2(10x - 2) - \log_2(x + 1) = 3$

[f]  $\log(2x + 6) + \log(x - 2) = 2$

[5] Write as the logarithm of a single quantity. Simplify your answer.

[a]  $\log 8 + \log 6 - \log 2$

[b]  $\log 48 - \log 6 - \log 2$

[c]  $5 \log 2$

[d]  $3 \log x + 2 \log y$

[e]  $2 \log x - \log y + \log z$

[f]  $\log z - 2 \log y - \log x$

[g]  $2 \log y + 3 \log z - \log x$

[h]  $4 \log z + \log x + 3 \log y$

[6] Write as the sums and/or differences and/or multiples of logarithms of numbers or single variables.

[a]  $\log(7 \times 11)$

[b]  $\log\left(\frac{13}{5}\right)$

[c]  $\log 3^8$

[d]  $\log r^4 s$

[e]  $\log \frac{a^5}{b^2}$

[f]  $\log \frac{m}{n^2 p^3}$

[g]  $\log \frac{x^2}{\sqrt{yz}}$

[7] **MULTIPLE CHOICE**

[a] The graph of  $f(x) = 3 \log(x + 4)$  has an asymptote at

[i]  $x = 4$

[ii]  $x = -4$

[iii]  $y = -4$

[iv]  $y = 4$

[v]  $y = 3$

[b] The graph of  $f(x) = -5 \cdot 2^{x-3}$  has an asymptote at

[i]  $x = 3$

[ii]  $x = 0$

[iii]  $y = -5$

[iv]  $y = 3$

[v]  $y = 0$

[c] For the logarithm curve  $f(x) = \log_2 x$ , as the value of  $x \rightarrow \infty$ , the value of  $y \rightarrow$

[i]  $\infty$

[ii]  $-\infty$

[iii]  $0$

[iv]  $1$

[v]  $-1$

[d] For the logarithm curve  $f(x) = \log_5 x$ , as the value of  $x \rightarrow 0$ , the value of  $y \rightarrow$

[i]  $\infty$

[ii]  $-\infty$

[iii]  $0$

[iv]  $1$

[v]  $-1$

[e] For the exponential curve  $f(x) = \left(\frac{5}{3}\right)^x$ , as the value of  $x \rightarrow \infty$ , the value of  $y \rightarrow$

[i]  $\infty$                       [ii]  $-\infty$                       [iii] 0                      [iv] 1                      [v] -1

[f] For the exponential curve  $f(x) = \left(\frac{5}{3}\right)^x$ , as the value of  $x \rightarrow -\infty$ , the value of  $y \rightarrow$

[i]  $\infty$                       [ii]  $-\infty$                       [iii] 0                      [iv] 1                      [v] -1

[g] For the exponential curve  $f(x) = \left(\frac{5}{7}\right)^x$ , as the value of  $x \rightarrow \infty$ , the value of  $y \rightarrow$

[i]  $\infty$                       [ii]  $-\infty$                       [iii] 0                      [iv] 1                      [v] -1

[h] For the exponential curve  $f(x) = \left(\frac{5}{7}\right)^x$ , as the value of  $x \rightarrow -\infty$ , the value of  $y \rightarrow$

[i]  $\infty$                       [ii]  $-\infty$                       [iii] 0                      [iv] 1                      [v] -1

[8] Find the domains of the following functions.

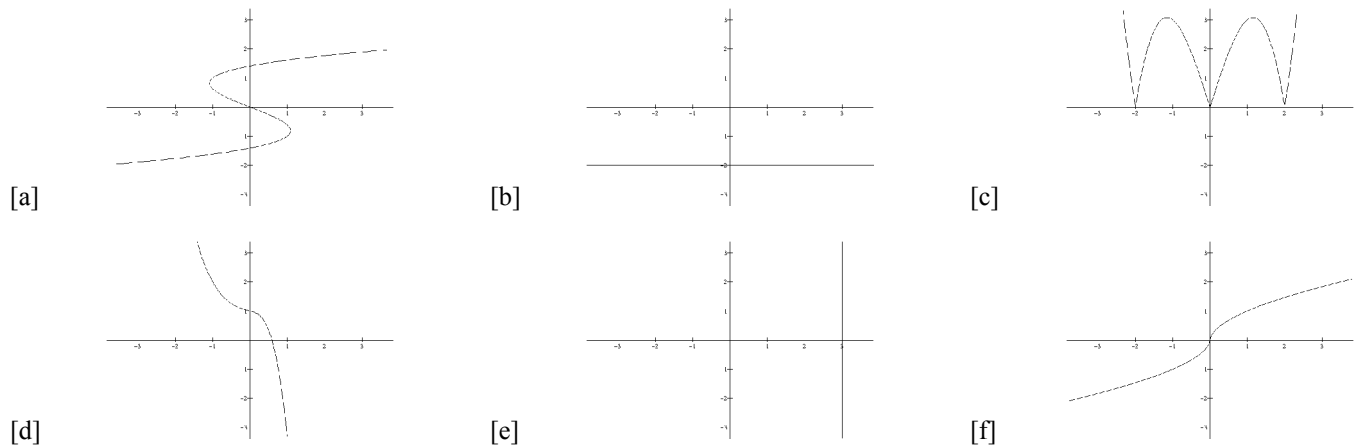
[a]  $f(x) = x^2 + 3x$                       [b]  $f(x) = \frac{5}{2x-3} - 1$

[c]  $f(x) = \sqrt{8-x} - 6$

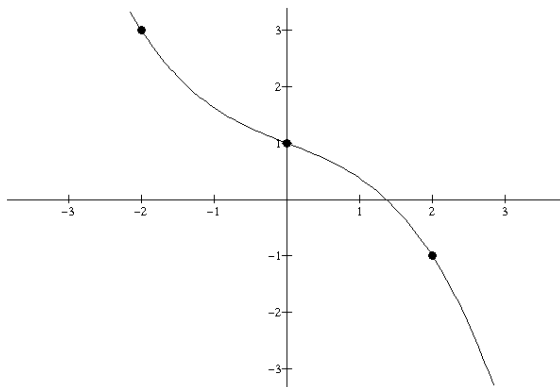
[9] Find the ranges of the following functions.

[a]  $f(x) = \frac{2}{x+5} - 4$                       [b]  $f(x) = 7 - \sqrt{x+9}$

[10] Which of the following graphs represent one-to-one functions ?



[11] Sketch the graph of the inverse of the following function.



[12] Find the inverses of the following functions.

[a]  $f(x) = \frac{9}{2} - \frac{3}{4}x$

[b]  $f(x) = 4 - \sqrt{3 + 2x}$

**You may use a non-graphing calculator for the following**

[13] Draw the graph of  $f(x) = -3 \cdot 2^{-x-1}$  using the process in the handout on my website. **LABEL ALL ASYMPTOTES CLEARLY.**

[14] Draw the graph of  $f(x) = 2 \log_2 \left( \frac{x+3}{2} \right)$  using the process in the handout on my website.

**LABEL ALL ASYMPTOTES CLEARLY.**

[15] **Without using your calculator,** find the exact solution of the equation  $6^{x-2} = 4^{x+1}$ .  
Then, use your calculator to convert your exact solution into a decimal answer, rounded to 4 decimal places.  
**Check your answer.**

[16] The number of bacteria in a colony is given by  $B(t) = 1.3(2.1)^t$ .

- [a] How many bacteria were there at time  $t = 4$  ? Round your answer to 1 decimal place.  
[b] At what time were there at least 41 bacteria ? Round your answer to 2 decimal places.

[17] [a] Find the intensity (in microns) of an earthquake with a Richter magnitude of 5.6.  
[b] Find the Richter magnitude of an earthquake of intensity 56,000,000 microns.

[18] [a] You take out a loan for \$21,000 at 5.35% interest compounded monthly, and you make no payments on it. how much do you owe 3 years later ?  
[b] You take out a loan for \$21,000 at 5.35% interest compounded weekly, and you make no payments on it. How many years later will the total amount you owe be \$30,000 ? Round your answer to 2 decimal places.  
[c] How much should you deposit into an account that grows 5.35% compounded quarterly, if you want the value of the account 4 years later to be \$30,000 ?  
[b] You take out a loan for \$21,000 with interest compounded every 4 months. You make no payments on it, and 5 years later, you owe a total of \$30,000. What is the annual interest rate on the account ? Round your answer to 2 decimal places.

**ANSWERS**

- |     |          |  |           |                                       |           |                          |                         |
|-----|----------|--|-----------|---------------------------------------|-----------|--------------------------|-------------------------|
| [1] | [a]      | all real numbers                                     | [b]       | $\{x > 0\}$                           | [c]       | $\{x < 2\}$              |                         |
| [2] | [a]      | $\{y > 0\}$  | [b]       | all real numbers                      |           |                          |                         |
| [3] | [a]      | 4  | [b]       | 2                                     | [c]       | 3                        | [d] UNDEFINED           |
|     | [e]      | UNDEFINED  | [f]       | 0                                     | [g]       | 6                        | [h] 4                   |
|     | [i]      | 6  | [j]       | -3                                    | [k]       | 7                        | [l] UNDEFINED           |
|     | [m]      | UNDEFINED  | [n]       | 5                                     |           |                          |                         |
| [4] | [a]      | -2   | [b]       | 3                                     | [c]       | 11                       | [d] -5                  |
|     | [e]      | 5  | [f]       | 7                                     |           |                          |                         |
| [5] | [a]      | $\log 24$  | [b]       | $\log 4$                              | [c]       | $\log 32$                | [d] $\log x^3 y^2$      |
|     | [e]      | $\log \frac{x^2 z}{y}$                               | [f]       | $\log \frac{z}{y^2 x}$                | [g]       | $\log \frac{y^2 z^3}{x}$ | [h] $\log z^4 xy^3$     |
| [6] | [a]      | $\log 7 + \log 11$                                   | [b]       | $\log 13 - \log 5$                    | [c]       | $8 \log 3$               | [d] $4 \log r + \log s$ |
|     | [e]      | $5 \log a - 2 \log b$                                | [f]       | $\log m - 2 \log n - 3 \log p$        |           |                          |                         |
|     | [g]      | $2 \log x - \frac{1}{2} \log y - \frac{1}{2} \log z$ |           |                                       |           |                          |                         |
| [7] | [a]-[ii] |  | [b]-[v]   |                                       | [c]-[i]   |                          | [d]-[iii]               |
|     | [e]-[i]  |  | [f]-[iii] |                                       | [g]-[iii] |                          | [h]-[i]                 |
| [8] | [a]      | all real numbers                                     | [b]       | $\left\{ x \neq \frac{3}{2} \right\}$ | [c]       | $\{x \leq 8\}$           |                         |

- [9]

[a]

$\{y \neq -4\}$

[b]

$\{y \leq 7\}$
- [10]

[a]

no

[b]

no

[c]

no

[d]

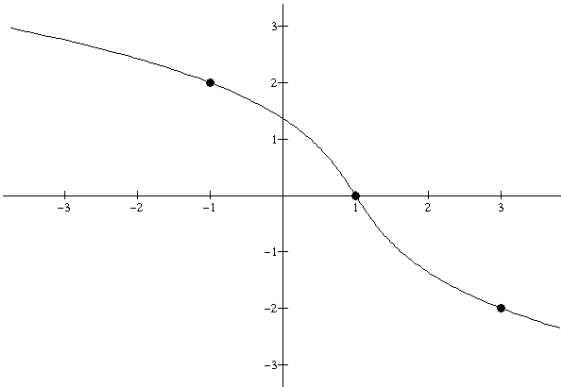
yes

[e]

no

[f]

yes
- [11]



- [12]

[a]

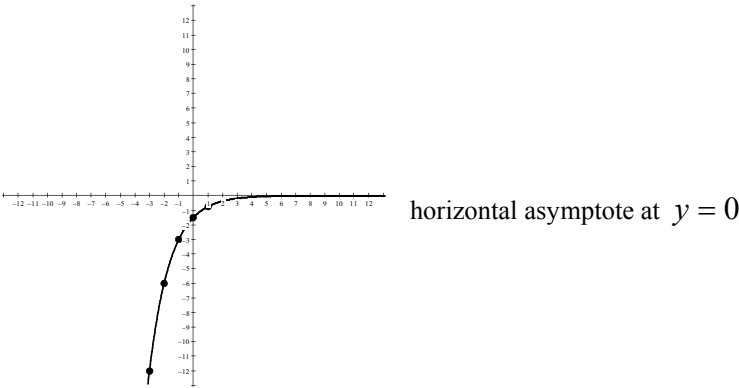
$f^{-1}(x) = 6 - \frac{4}{3}x$

[b]

$f^{-1}(x) = \frac{(4-x)^2 - 3}{2}$

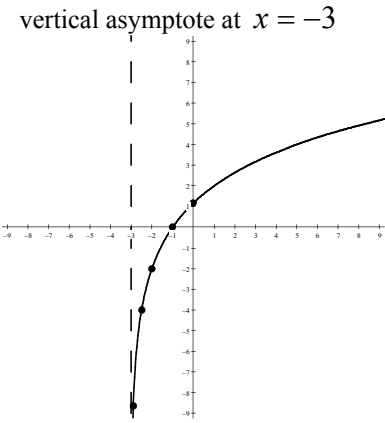
[13]

$x$	-3	-2	-1	0	1
$f(x)$	-12	-6	-3	-1.5	-0.75



[14]

$x$	-2.9	-2.5	-2	-1	0
$f(x)$	-8.6	-4	-2	0	1.2



[15]

$$\frac{2\log 6 + \log 4}{\log 6 - \log 4} \approx 12.2571$$

- [16]

[a]

25.3 bacteria

[b]

4.65 units of time
- [17]

[a]

398107 microns

[b]

7.748
- [18]

[a]

\$24647.26

[b]

6.67 years

[c]

\$24254.83

[d]

7.22%