

1. [5] TRUE/FALSE: Circle T in each of the following cases if the statement is *always* true. Otherwise, circle F.

T F  $x^2 + (y - 2)^2 = 9$  defines a circle with radius 9.

T F  $\log(x + y) = \log(x) + \log(y)$  for all  $x, y > 0$ .

T F  $\frac{\log(x)}{\log(y)} = \frac{x}{y}$  for all  $x, y > 0$

T F  $x^5 x^2 = x^{10}$

T F  $x^{-2} = \sqrt{x}$

Show all your work. Reasonable supporting work must be shown to earn credit.

2. [2] (Suggested§4.1 #39) Convert  $\frac{-7\pi}{4}$  from radians to degrees.
3. [2] (WebHW§4.1 #6) Draw the angle  $\frac{-7\pi}{4}$  radians.
4. [3] (Circle&AngleActivity #4) Find the point(s) that are both on the graph of the unit circle and the angle  $\frac{-7\pi}{4}$  radians.

5. We know that  $\log(x) = -2.5$ ,  $\log(z^2) = 6$ .

(a) [2] (§3.3 #16) Find  $z$

(b) [2] (Quiz3 #2) Find  $\log(xz^2)$ .

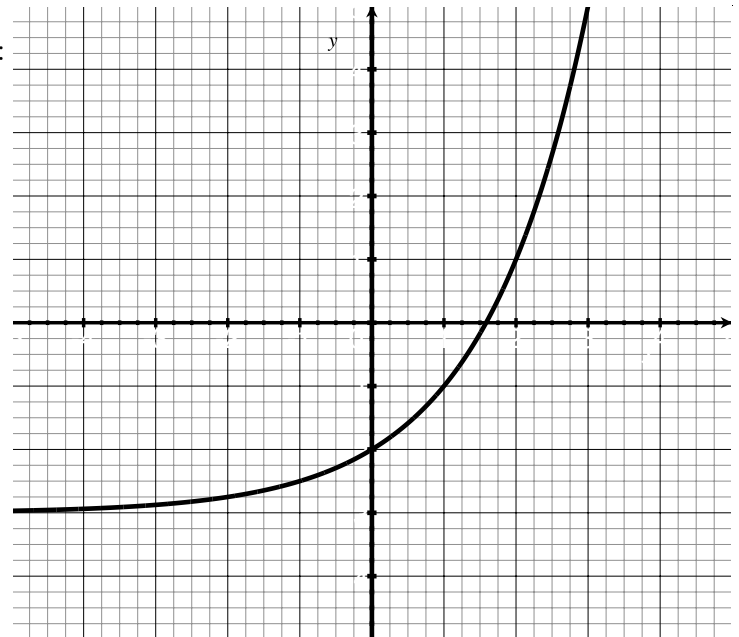
6. Let  $f$  be an exponential function (whose base is unknown!) that has been vertically shifted and graphed below.

(a) Estimate the following *if possible*:

i. [1] (Quiz3 #1)  $f(2)$

ii. [2] (WrittenHW§3.2 #56)  
Range of  $f$

iii. [1] (LogFunctionActivity#1)  
Find a point on the graph  
of  $f^{-1}$ .



iv. [1] all possible  $x$  such that  $f(x) = -1$ .

(b) [3] (LogFunctionsActivity #3) Find the formula/equation for  $f$ .

(c) [3] (WebHW3.1 #5) Graph  $\frac{1}{2}f(x + 1)$ .

7. Solve for  $x$ :

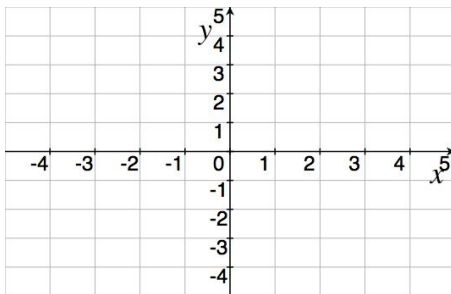
(a) [3] (§3.4 #34)

$$2 \cdot 3^{4x-5} - 6 = 8$$

(b) [3] (PracticeExam#8)

$$\log(x - 1) = 2 - \log(x - 16)$$

8. [4] (§3.1 #56) Provide a graph AND an algebraic rule/expression for: A logarithm function passing through  $(0, 0)$ .



9. Consider a family who just welcomed their daughter. Assume the interest in this problem is 7.5% (the average S&P annual return over the last 20 years) compounded monthly.

(a) [3] (WebHWApplications1 #2) How much should guardians invest at the time their daughter is born to provide her with \$100,000 at the age of 18?

(b) [4] (LogInPracticeActivity #1) If her guardians have \$50,000 now, how long until they can give their daughter \$100,000?

10. Choose *ONE* of the following. Clearly identify which of the two you are answering and what work you want to be considered for credit.

No, doing both questions will not earn you extra credit.

- (a) (Workshop) A number of people in community who became infected during an epidemic  $t$  weeks after its outbreak is modeled by the logistic function  $f(t) = \frac{30,000}{1 + ae^{-kt}}$ , where 30,000 people in the community are susceptible to the disease.
- i. [3] For a particular disease, contact tracers identify 5000 people initially infected and by the end of the fourth week there were 8280 people infected. Find the logistic function (the parameters  $a$  and  $k$ ) that model this particular epidemic.
  - ii. [2] Find the number of people who have been infected after six weeks.
  - iii. [2] When will 75% of the population have become infected?
- (b) (Worksheet#3) Entropy, denoted as  $S$ , is a function of the number of possible states  $W$ , that are accessible to a system with a given amount of energy. We can explicitly compute entropy by

$$S = k \ln(W)$$

where  $k$  is Boltzmann's constant which is approximately  $1.38065 \cdot 10^{-23} \text{m}^2 \text{kg s}^{-2} \text{K}^{-1}$ .

- i. [2] If a gas has  $2 \cdot 10^{9000}$  possible states, what is the entropy of the gas?
- ii. [4] If liquid A has 10,000,000,000,000 (so  $1 \cdot 10^{13}$ ) times more possible states than liquid B, which liquid has a higher entropy and what is the difference of the two entropys?