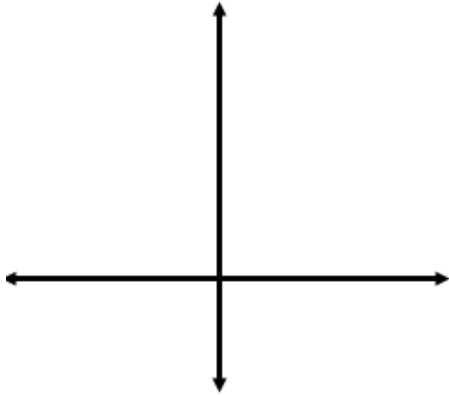
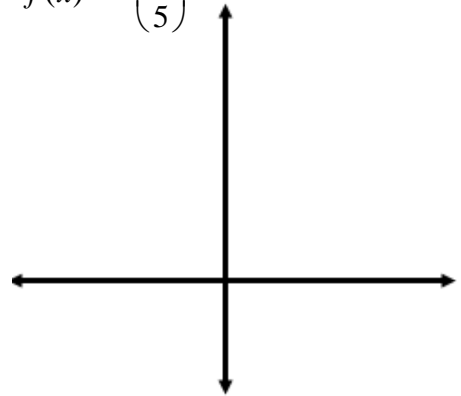


Graph:

1. (5 pts)  $f(x) = 3^x$



2. (5 pts)  $f(x) = -\left(\frac{1}{5}\right)^x$



3. (10 pts) Solve  $8 = 16^{2x+1}$

4. (10 pts) Write an exponential function to model the situation. Tell what each variable represents. A population of red ants is initially at 100,000 ants and grows (exponentially) at 20% per week.

5. (5 pts) Write the equation  $\log_x 27 = \frac{5}{7}$  in exponential form.

6. (5 pts) Evaluate  $\log_3\left(\frac{1}{243}\right)$ .

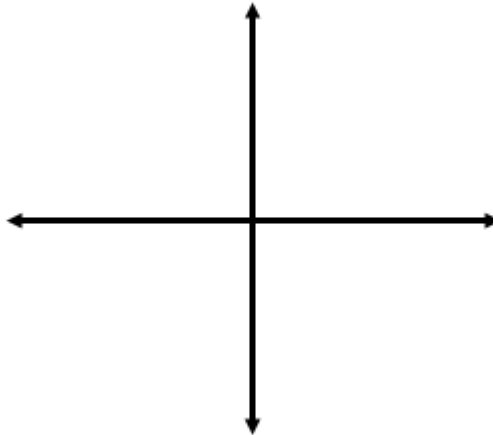
7. (10 pts) Express  $\log_7\left(\sqrt[5]{\frac{5x^3y^7}{z^{11}}}\right)$  in terms of logarithms of  $x$ ,  $y$ , and  $z$ .

8. (10 pts) Solve correct to four decimal places:  $4^x = 3^{2x-1}$

9. (5 pts) Solve:  $\log_2(x-7) = 4$

10. (5 pts) Find the value of the expression:  $\left(\frac{1}{8}\right)^{\log_2 7}$

11. (5 pts) Graph:  $\log_3(x+5)$



12. (5 pts) Write the following as the logarithm of a single expression. Assume that variables represent positive numbers.  $3\log_5(x+2) - 4\log_5(x-7) + \log_5 9$

13. (5 pts) The population (in millions of people) of Soretoothistan  $t$  years after 2000 is given by  $R(t) = 15e^{kt}$ . If there are 12 million people in Soretoothistan in 2005, find  $k$ .
14. Cobalt-60 is a radioactive substance that decays according to the model  $A(t) = A_0e^{-0.1308t}$ , where  $A = A(t)$  is the amount of cobalt-60 present at time  $t$  (in years).
- a. (5 pts) Find the half-life of cobalt-60. You may leave your final answer in terms of  $\ln\left(\frac{1}{2}\right)$ .
- b. (5 pts) To the nearest  $10^{\text{th}}$  of a year, what is the half-life of cobalt-60, according to this model? (Base your answer on your result from part a.)

15. (10 pts bonus) The half-life of carbon-14 is (approximately) 5730 years.

a. Find an exponential model  $A(t) = A_0 e^{kt}$  that gives the amount of radioactive carbon-14 present in a charcoal sample after  $t$  years.

b. How old is a sample from a neolithic fire pit if it is found that 30% of naturally-occurring carbon-14 is present in the sample?

16. (5 pts) Solve the equation:  $\log_3 x + \log_3(x - 24) = 4$ .