Test Bank Exercises in

CHAPTER 6

Exercise Set 6.1

1. Show that the function $f(x) = 3x + 2$ is one to one and find the inverse of $f(x)$.

2. Show that the function $f(x) = x^3 + 1$ is one to one and find the inverse of $f(x)$.

3. Show that the function $f(x) = \sqrt{x}, x \geq 0$ is one to one and find the inverse of $f(x)$.

4. Show that the function f(x) = x5 is one to one and find the inverse of $f(x)$.

5. Find the inverse of the function $f(x) = \frac{x+1}{2}$.

6. Find the inverse of the function $f(x) = \frac{2}{3}x + 1$.

7. Find the inverse of the function $f(x) = 2x^3 - 3$.

8. Find the inverse of the function $f(x) = x^2 - 9, x \geq 0$.

9. Let $f(x) = x^2 - 1, x \geq 0$. Find $f(f^{-1}(2))$.

10. Let $f(x) = 2x^3 + 4$. Find $f^{-1}(f(-1))$.

11. Let $f(x) = x + 1$. Find $f^{-1}(x)$ and sketch the graph of both $f(x)$ and $f^{-1}(x)$ on the same coordinate axis.

12. Let $f(x) = 2x, x \geq 0$. Find $f^{-1}(x)$ and sketch the graph of both $f(x)$ and $f^{-1}(x)$ on the same coordinate axis.

13. Let $f(x) = \frac{x-1}{3}$. Find $f^{-1}(x)$ and sketch the graph of both $f(x)$ and $f^{-1}(x)$ on the same coordinate axis.

14. Let $f(x) = x + \frac{1}{2}$. Find $f^{-1}(x)$ and sketch the graph of both $f(x)$ and $f^{-1}(x)$ on the same coordinate axis.

15. Let $f(x) = \sqrt{x} + 3$. Find $f^{-1}(x)$ and sketch the graph of both $f(x)$ and $f^{-1}(x)$ on the same coordinate axis.

16. Let $f(x) = \frac{1}{x}$, $x \neq 0$. Find $f^{-1}(x)$ and sketch the graph of both $f(x)$ and $f^{-1}(x)$ on the same coordinate axis.

17. Let $f(x) = \frac{2x + 1}{5}$. Then $f^{-1}(x)$ is given by

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

(c) $f^{-1}(x) = \frac{5}{2x + 1}$ (d) None of the above.

18. Let $f(x) = \frac{x^2 + 1}{2}$, $x \geq 0$. Then $f^{-1}(x)$ is given by

(a) $f^{-1}(x) = \frac{x^2 - 1}{2}$ (b) $f^{-1}(x) = \sqrt{2x - 1}$, $x \geq \frac{1}{2}$

(c) $f^{-1}(x) = \frac{2}{x^2 + 1}$ (d) None of the above.

19. Let $f(x) = x^3 - 4$. Then $f^{-1}(x)$ is given by

(a) $f^{-1}(x) = \sqrt[3]{x + 4}$ (b) $f^{-1}(x) = x^{1/3} - 4$

(c) $f^{-1}(x) = \frac{1}{x^3 - 4}$ (d) None of the above.

20. Let $f(x) = \sqrt{x} - 1$, $x \geq 0$. Then $f^{-1}(x)$ is given by

(a) $f^{-1}(x) = 1 - \sqrt{x}$ (b) $f^{-1}(x) = (x + 1)^2$, $x \geq -1$

(c) $f^{-1}(x) = \frac{1}{\sqrt{x} - 1}$ (c) None of the above.

Exercise Set 6.2

1. Sketch the graph of the function $f(x) = 2^x + 1$.

2. Sketch the graph of the function $f(x) = (1/3)^x$.

3. Sketch the graph of the function $f(x) = 3^{2x-1}$.

4. Sketch the graph of the function $f(x) = 2^{-x+1}$.

5. Sketch the graph of the function $f(x) = e^{-x^2}$.

6. Sketch the graph of the function $f(x) = e^{-|x|}$.

7. Sketch the graph of the function $f(x) = e^{2x-1}$.

8. Solve for x the equation $2^{x-1} = 8^{1-x}$.

9. Solve for x the equation $e^{x^2} = e^{2x-1}$.

10. Solve for x the equation $3^{2x-5} = 9$.

11. Solve for x the equation $10^x = 1$.

12. \$15,000 is invested for 5 years in an account which earns 7% interest per year. Find the final amount if the interest is compounded quarterly.

13. \$10,000 is invested in an account which pays an annual interest rate of 5% compounded monthly. What is the value of the investment after 30 months?

14. \$12,500 is invested in an account earning interest at an annual rate of 9.5%. Find the final amount at the end of 8 years if the interest is compounded continously.

15. Find the interest received if \$7,500 is invested for 5 years at 7.5% interest compounded continuously.

16. The population of a town t years from now is given by $P(t) = 55{,}000e^{0.045t}$. What will be the population of this town after 12 years?

17. The number of bacteria in a culture after t hours is described by the exponential growth model $Q(t) = 1{,}500e^{0.195t}$. What is the number of bacteria in the culture after 10 hours?

18. The population of a town grows according to the law $Q(t) = Q_0e^{0.0263t}$, the time t measured in years. Assume that initially in 1970 the population was 35,000. What will be the population in the year 1992?

19. A radioactive substance loses its mass according to the law $Q(t) = Q_0e^{-0.00085t}$, the time t measured in years. Assume that there are 150 grams to start with. How many grams will be left after 750 years?

20. The amount of radioactive material, in grams, present after t years is given by $Q(t) = 250e^{-0.00375t}$. Find the amount present after 50 years.

Exercise Set 6.3

1. Determine the domain of the function $f(x) = ln(x - 1)$ and sketch its graph.

2. Determine the domain of the function $f(x) = ln(2x + 1)$ and sketch its graph.

3. Determine the domain of the function $f(x) = log(x + 1)$ and sketch its graph.

4. Determine the domain of the function $f(x) = log_2(x + 3)$ and sketch its graph.

5. Determine the domain of the function $f(x) = log(3x - 4) + 1$ and sketch its graph.

6. Write the logarithmic equation $log_3\frac{1}{27} = -3$ in the exponential form.

7. Write the logarithmic equation $\log(10000) = 4$ in the exponential form.

8. Write the logarithmic equation $log_{\frac{1}{3}}\left(\frac{1}{243}\right) = 5$ in the exponential form.

9. Express the exponential equation $16^{\frac{5}{2}} = 1024$ in the logarithmic form.

10. Express the exponential equation $\frac{1}{8} = 2^{-3}$ in the logarithmic form.

11. Express the exponential equation $4^4 = 256$ in the logarithmic form.

12. Express the exponential equation $81^{\frac{1}{2}} = 9$ in the logarithmic form.

13. Express the exponential equation $36^{\frac{3}{2}} = 216$ in the logarithmic form.

14. A bank pays 5% interest compounded continuously. How long will take a deposit to double its value?

15. An investment earns interest 6% per year compounded quarterly. How long will it take for an investment of 5000 dollars to grow to 12,500 dollars?

16. An investment earns interest 9.5% per year compounded continuously. How long will it take for an investment of 10,000 dollars to grow to 25,000 dollars?

17. An investment earns interest 4.75% per year compounded continuously. How long will it take for an investment of 7,500 dollars to grow to 15,000 dollars?

18. A radioactive substance loses its mass according to the law $Q(t) = Q_0e^{-0.00575t}$, where the time t is measured in years. Initially there are 250 grams of the substance to start with. After how many years will only 150 grams remain?

19. A radioactive substance loses its mass according to the law $Q(t) = Q_0e^{-0.00456t}$, where the time t is measured in years. Initially, there are 150 grams of the substance to start with. After how many years will only 55 grams remain?

20. A radioactive substance loses its mass according to the law $Q(t) = Q_0e^{-0.00125t}$, where the time t is measured in years. Initially, there are 100 grams of the substance to start with. After how many years will only 15 grams remain?

Exercise Set 6.4

1. Write $log_5 x - \frac{1}{2}[2\ log_5 y + 3\ log_5 z]$ as a single logarithm.

2. Write $\frac{1}{3}[ln(3x + 4) + ln(x^2 - 1)] - 4ln(2x + 5)$ as a single logarithm.

3. Express $\frac{2}{3}log(x + 1) - \frac{1}{2}log(x - 1) + \frac{1}{3}log(x)$ as a single logarithm.

4. Express $2log_2(x^3 - 1) - log_2(y^2) + 3log_2(z)$ as a single logarithm.

5. Express $2log(2x) - 3log(2y) + log(4z)$ as a single logarithm.

6. Express $log_3\frac{5x\sqrt{x^2 + 1}}{x^2 - 4}$ as a sum or difference of simpler logarithms.

7. Express $log\left[\frac{x^4z^5}{y^3}\right]$ as a sum or difference of simpler logarithms.

8. Express $log_5(\sqrt[3]{x^2y^6}\sqrt[4]{z^3})$ as a sum or difference of simpler logarithms.

9. Express $ln\sqrt{\frac{2x + 5}{(y^2 - 1)z^3}}$ as a sum or differences of simpler logarithms.

10. Express $ln\left[\frac{e^{x^2}(3x + 2)^3}{(x^2 + 1)^2}\right]$ as a sum or difference of simpler logarithms.

11. Use the change of base formula to evaluate $log_3\sqrt{11}$. Approximate your answer to three decimal places.

12. Use the change of base formula to evaluate $log_3(81)$. Approximate your answer to three decimal places.

13. Use definition or the change of base formula to evaluate $log_{\frac{1}{3}}(27)$.

14. Use the change of base formula to evaluate $log_{\frac{1}{5}}(85)$.

15. Use the change of base formula to evaluate $log_{\frac{3}{4}}(286)$.

16. Find the domain of the function $f(x) = log_7(x)$ and sketch its graph.

17. Find the domain of the function $f(x) = log_3(x + 1)$ and sketch its graph.

18. Find the domain of the function $log_{\frac{1}{3}}(x)$ and sketch its graph.

19. Find the domain of the function $f(x) = log_{\frac{1}{2}}\left(\frac{x}{2}\right)$ and sketch its graph.

20. Find the domain of the function $f(x) = log_2(x - 1)$ and sketch its graph.

Exercise Set 6.5

1. Solve for x the equation $4^{x-1} = 8$.

2. Solve for x the equation $3^{2x} = 27^{x-1}$.

3. Solve for x the equation $\left(\frac{2}{3}\right)^{3x+1} = \frac{9}{4}$.

4. Solve for x the equation $3^{2x-1} = 4^x$.

5. Solve for x the equation $2^x + 2^{x+1} = 4$.

6. Solve for x the equation $e^x + 9e^{-x} = 6$.

7. Solve for x the equation $1000e^{0.2x} = 2500$.

8. Solve for x the equation $150e^{-0.0032x} = 95$.

9. Solve for x the equation $100\left(\frac{1}{2}\right)^{0.019x} = 38$.

10. Solve for x the equation $log_5(x - 1) = \frac{1}{2}$.

11. Solve for x the equation $log_5(x) - log_5(5) = 3$.

12. Solve for x the equation $log_3(x^2 + 1) = 1$.

13. Solve for x the equation $log_2(x + 1) - log_2(x - 1) = 2$.

14. Solve for x the equation $log_3(x^2) = [\log_3(x)]^2$.

15. Solve for x the equation $log_2(x) + log_2(x - 1) = 1$.

16. The population of a town t years from now is given by $P(t) = 55{,}000e^{0.045t}$. How many years from now will its population be 100,000?

17. The population of a town t years from now is given by $P(t) = 35{,}000e^{0.0395t}$. How many years from now will its population be 65,000?

18. The population of a town t years from now is given by $P(t) = 150{,}000e^{0.0255t}$. How many years from now will its population be 210,000?

19. The quantity Q (in grams) of a radioactive substance that is present after t days of decay is given by $Q = 250e^{-kt}$. If $Q = 125$ when $t = 5$, find k, the decay constant.

20. A person on an assembly line produces P items per day after t days of training, where $P = 350(1 - e^{-t})$. How many days of training will it take this person to be able to produce 280 items per day?