Math 180 – Reviewing Chapter 4 Name_____

If the following defines a one–to–one function, find the inverse.

1) {(–13, 18), (15, 18), (–4, –12)}

Decide whether or not the functions are inverses of each other.

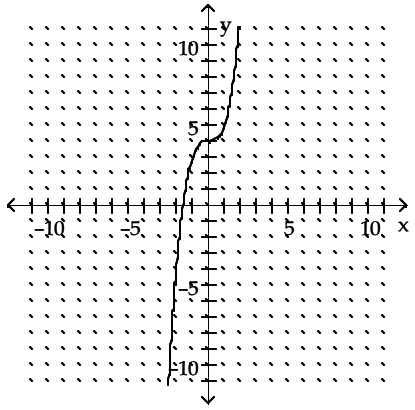
2) $f(x) = 4x + 7$; $g(x) = \frac{x}{4} - 7$

Determine the inverse of the given function.

3) {(–3, 4), (–1, 5), (0, 2), (2, 4), (5, 7)}

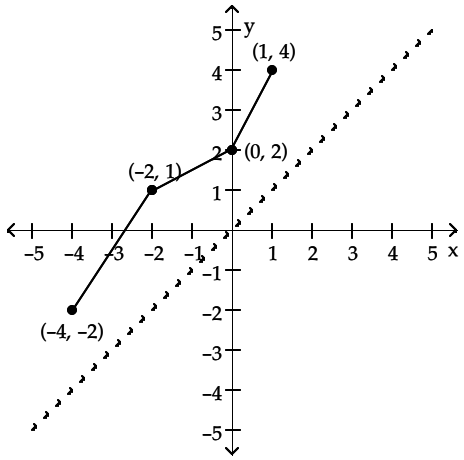
The graph of a one–to–one function f is given. Draw the graph of the inverse function f^{-1} as a dashed line or curve.

4) $f(x) = x^3 + 4$



Use the graph of the given one–to–one function to sketch the graph of the inverse function. For convenience, the graph of y = x is also given.

5)



The function f is one–to–one. Find its inverse.

6) $f(x) = 3x^2 + 2$; $x \le 0$

7) Determine the equation for the inverse function of $y = (x + 2)^3 - 8$.

Solve the problem.

8) The profit P for selling x items is given by the equation $P(x) = 2x - 500$. Express the sales amount x as a function of the profit P.

Approximate each value using a calculator. Express answer rounded to three decimal places.

9) 4.4^{π}

Solve the problem.

10) A rumor that there will be an open book test on chapter 4 has spread in our class of 28 students. The mathematical model for the situation is $N = 28(1 - e^{-0.16d})$ where N is the number of students who have heard the rumor and d is the number of hours that have elapsed since the rumor began.
a) How many students will have heard the rumor after 5 hours?
b) 21 students have heard the rumor. How many hours ago did the rumor began?

Graph the function.

11) Graph the function $f(x) = 2^{x-1} - 1$

Answer the question.

12) Define the number e.

A) The number approximately equal to 2.72.

B) The number defined by $e = \lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$ in Calculus.

C) The number that the expression, $\left(1 + \frac{1}{n}\right)^n$, approaches as $n \to \infty$.

D) All of the above.

Solve the equation.

13) $9^{2x} \cdot 27^{(3 - x)} = \frac{1}{9}$

14) $2^{(x^2 - 3)} = 64$

Use a graphing calculator to solve the equation. Round your answer to two decimal places.

15) $e^x - \ln x = 4$

Solve the given exponential equation. Round answer to three decimal places.

16) $5^{2x} + 5^{(x + 1)} - 24 = 0$

Change exponential expressions to logarithmic expression

17) $2.3^{x + 5} = 15$

Convert to logarithmic form.

18) $e^x = 15$

Convert to exponential form.

19) $\log_5 \frac{1}{25} = -2$

Change logarithmic expression to exponential expression.

20) $\log_b 49 = \frac{2}{3}$

Find the value of the expression.

21) $\log_9 \frac{1}{81}$

22) $\ln 1$

Solve the problem.

23) The number of men dying of AIDS (in thousands) since 1987 is modeled by $y = 17.3 + 10.06(\ln x)$, where x represents the number of years after 1987. Use this model to predict the number of AIDS deaths among men in 1994. Express answer rounded to the nearest hundred men.

24) Use the function from the previous problem to find its inverse.

Find the domain of the function.

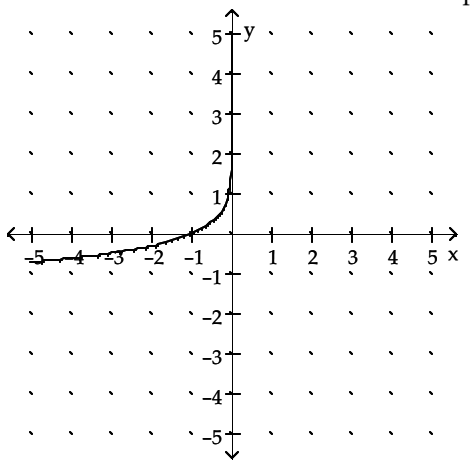
25) $f(x) = \log_{10} (x^2 - 17x + 72)$

26) Determine the domain of the function $f(x) = \log_{1/2}(x + 4)$.

Sketch the graph using the transformation concept.
Then sketch the graph using the calculator.

The graph of a logarithmic function is shown. Select the function which matches the graph.

27) Think on the transformations that took place.



A) $y = -\log(-x)$ B) $y = \log(x)$ C) $y = -\log(x)$ D) $y = \log(-x)$

Solve the problem.

28) $\log_x \left(\frac{8}{27}\right) = 3$

29) $\log_4 16 = x$

30) The Richter scale converts seismographic readings into numbers for measuring the magnitude of an earthquake according to this function

$M(x) = \log\left(\frac{x}{x_o}\right)$, where $x_o = 10^{-3}$.

What would be the readings x (to the nearest tenth) for magnitudes of 4.9 and 7.9?

31) The formula $D = 6e^{-0.04h}$ can be used to find the number of milligrams D of a certain drug in a patient's bloodstream h hours after the drug has been given. When the number of milligrams reaches 4, the drug is to be given again. What is the time between injections?

32) $pH = -\log_{10}[H^+]$ Find the $[H^+]$ if the pH = 2.4.

33) $pH = -\log_{10}[H^+]$ Find the pH if the $[H^+] = 5.7 \times 10^{-13}$.

Use the properties of logarithms to find the exact value of the expression. Do not use a calculator.

34) $\log 7 \quad 7^{10}$

35) $\log_4 24 - \log_4 6$

Using the properties of logarithms, evaluate the expression.

36) $2 \ln e^{4.2}$

Write as the sum and/or difference of logs. Do not use exponents.

37) $\log_{19} \frac{18\sqrt{r}}{s}$

Express as a single logarithm.

38) $(\log_a m - \log_a n) + 3 \log_a k$

Write expressions as a single logarithm.

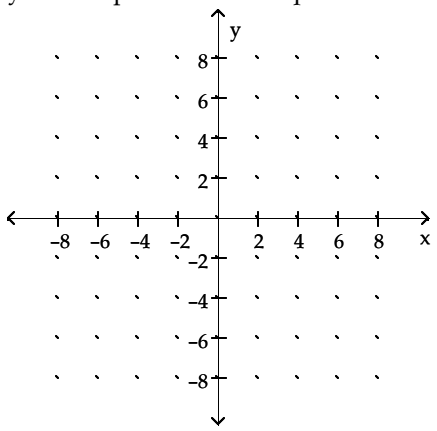
39) $\frac{3}{4}\ln 16 - \ln(4^2 - 3^2 - 2)$

Use the Change–of–Base Formula and a calculator to evaluate the logarithm. Round your answer to two decimal places.

40) Evaluate $\log_{(2/3)} 19$.

Graph the function using a graphing utility and the Change–of–Base Formula.

41) $y = \log_3(x - 3)$ Think on what transformation took place. Does it agree with the graph? Find x– and y–intercepts. Write the equation of the asymptote.



Solve the equation.

42) $\log 4x = \log 2 + \log (x - 1)$

43) $\log (3 + x) - \log (x - 4) = \log 2$

Solve the given logarithmic equation.

44) $\log_2(3x - 2) - \log_2(x - 5) = 4$

45) $2 + \log_3(2x + 5) - \log_3 x = 4$

Solve the given exponential equation.

46) $3 \cdot 5^{2t - 1} = 75$

Solve the equation. If necessary, round your answer to two decimal places.

47) $(\frac{1}{4})^{x} = 14$

Use a graphing calculator to solve the equation. Round your answer to two decimal places.

48) $\log_5 x + \log_2 x = 3$

Solve the problem.

49) The size P of a small herbivore population at time t (in years) obeys the function $P(t) = 500e^{0.17t}$ if they have enough food and the predator population stays constant. After how many years will the population reach 1500?

50) A culture of bacteria obeys the law of uninhibited growth. If 140,000 bacteria are present initially and there are 609,000 after 6 hours, how long will it take for the population to reach one million?

51) The half–life of silicon–32 is 710 years. If 40 grams is present now, how much will be present in 200 years? (Round your answer to three decimal places.)

52) A fossilized leaf contains 14% of its normal amount of carbon 14. How old is the fossil (to the nearest year)? Use 5600 years as the half–life of carbon 14.

53) Strontium 90 decays at a constant rate of 2.44% per year. Therefore, the equation for the amount P of strontium 90 after t years is $P = P_0 e^{-0.0244t}$. How long will it take for 15 grams of strontium to decay to 5 grams? Round answer to 2 decimal places.

54) The amount of a certain drug in the bloodstream is modeled by the function $y = y_0 e^{-0.40t}$, where y_0 is the amount of the drug injected (in milligrams) and t is the elapsed time (in hours). Suppose that 10 milligrams are injected at 10:00 A.M. If a second injection is to be administered when there is 1 milligram of the drug present in the bloodstream, approximately when should the next dose be given? Express your answer to the nearest quarter hour.

55) A thermometer reading 79°F is placed inside a cold storage room with a constant temperature of 35°F. If the thermometer reads 74°F in 13 minutes, how long before it reaches 57°F? Assume the cooling follows Newton's Law of Cooling:

$U = T + (U_o - T)e^{kt}$.

(Round your answer to the nearest whole minute.)

56) A cup of coffee is heated to 194°and is then allowed to cool in a room whose air temperature is 72°. After 11 minutes, the temperature of the cup of coffee is 140°. Find the time needed for the coffee to cool to a temperature of 102°.

57) The logistic growth model $P(t) = \frac{1240}{1 + 40.33e^{-0.325t}}$ represents the population of a bacterium in a culture tube after t hours. What was the initial amount of bacteria in the population?

58) The logistic growth model $P(t) = \frac{180}{1 + 44e^{-0.188t}}$ represents the population of a species introduced into a new territory after t years. When will the population be 80?

59) A life insurance company uses the following rate table for annual premiums for women for term life insurance. Use a graphing utility to fit an exponential function to the data. Predict the annual premium for a woman aged 70 years.

Age	35	40	45	50	55	60	65
Premium	$103	$133	$190	$255	$360	$503	$818

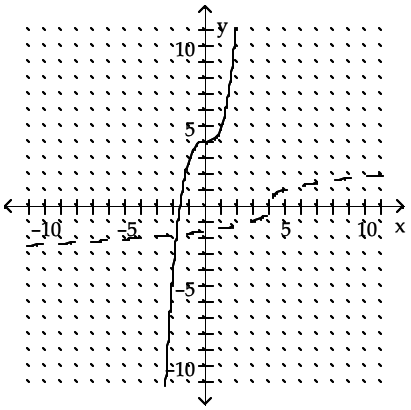
60) After introducing an inhibitor into a culture of luminescent bacteria, a scientist monitors the luminosity produced by the culture. Use a graphing utility to fit a logarithmic function to the data. Predict the luminosity after 20 hours.

Time, hrs	2	3	4	5	8	10	15
Luminosity	77.4	60.8	54.5	45.8	30.0	24.3	10.5

61) A mechanic is testing the cooling system of a boat engine. He measures the engine's temperature over time. Use a graphing utility to fit a logistic function to the data. What is the carrying capacity of the cooling system?

time, min	5	10	15	20	25
temperature, °F	100	180	270	300	305

1) Not a one–to–one function
2) No
3) {(4, –3), (5, –1), (2, 0), (4, 2), (7, 5)}
4)



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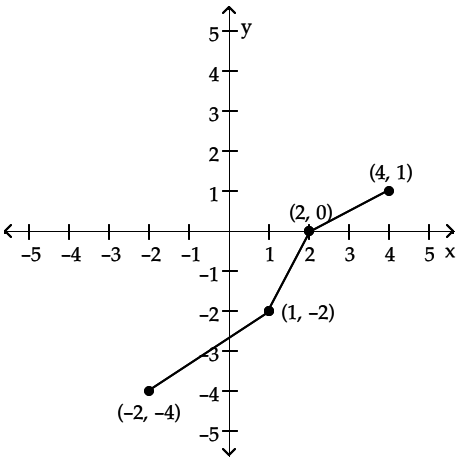
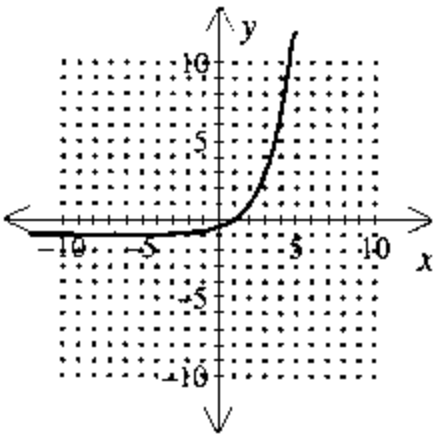


6) $f^{-1}(x) = -\sqrt{\frac{x-2}{3}}$
7) $y = \sqrt[3]{x+8} - 2$
8) $x(P) = \frac{1}{2}P + 250$
9) 105.067
10) 15 students, 9 hours

11)

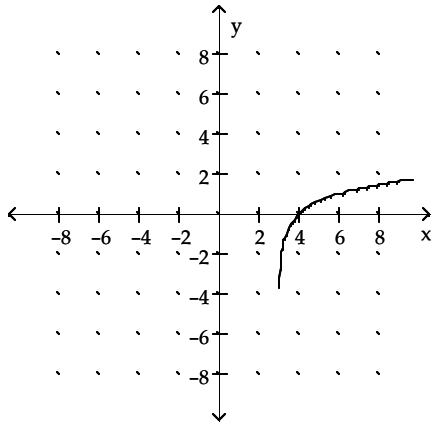


12) D
13) $x = -11$
14) $x = 3$ or $x = -3$
15) 1.48
16) $x = 0.683$
17) $\log_{2.3} 15 = x + 5$
18) $\ln 15 = x$
19) $5^{-2} = \frac{1}{25}$
20) $b^{2/3} = 49$
21) −2
22) 0
23) 36,900
24) $f^{-1}(x) = e^{\frac{x - 17.3}{10.6}}$
25) $(-\infty, 8) \cup (9, \infty)$
26) $(-4, \infty)$
27) A
28) $\{\frac{2}{3}\}$
29) {2}
30) 3.7 and 3.9
31) 10.14 hrs
32) 3.98×10^{-3}
33) 12.24
34) 10
35) 1
36) 8.4
37) $\log_{19} 18 + \frac{1}{2} \log_{19} r - \log_{19} s$
38) $\log_a \frac{mk^3}{n}$

39) $\ln(\frac{8}{5})$

40) −7.26

41)



42) {−1}

43) {11}

44) $x = 6$

45) $x = \frac{5}{7}$

46) $t = \frac{3}{2}$

47) {−1.90}

48) 4.28

49) 6.46 yrs

50) 8.024 hours

51) 32.905

52) 15,856

53) 45.03 years.

54) 3:45 P.M

55) 75 minutes

56) 26.4 minutes

57) 30

58) 18.94 years

59) $y = 8.94e^{0.068x}$, \$1044

60) $y = 98.75 - 32.66 \ln(x)$, 0.91

61) $y = \frac{314.79}{1 + 7.86e^{-0.246x}}$, 315°F