

1. Let  $f(x) = 2x^2 + 1$  and let  $g(x) = x + 3$ . Find the composite function  $(f \circ g)(x)$ .

- (a)  $2x^2 + 18$  (d)  $2x^2 + 12x + 19$   
 (b)  $2x^2 + 19$  (e) None of these  
 (c)  $2x^2 + 12x + 18$

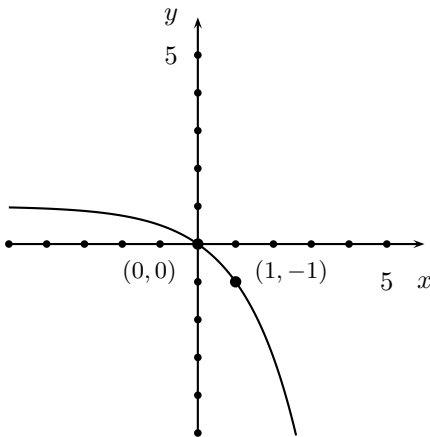
2. Which answer describes the graph of the exponential function  $f(x) = e^x$ ?

- (a) The graph goes through  $(0, e)$  and increases as  $x$  increases.  
 (b) The graph goes through  $(0, e)$  and decreases as  $x$  increases.  
 (c) The graph goes through  $(0, 1)$  and increases as  $x$  increases.  
 (d) The graph goes through  $(0, 1)$  and decreases as  $x$  increases.  
 (e) The graph is a straight line through  $(1, e)$ .

3. Which answer describes the graph of the logarithmic function  $f(x) = \ln x$ ?

- (a) The graph goes through  $(0, 1)$  and has  $x = 0$  as a vertical asymptote.  
 (b) The graph goes through  $(1, 0)$  and has  $x = 0$  as a vertical asymptote.  
 (c) The graph goes through  $(0, 1)$  and has  $y = 0$  as a horizontal asymptote.  
 (d) The graph goes through  $(1, 0)$  and has  $y = 0$  as a horizontal asymptote.  
 (e) The graph is a straight line through  $(0, 1)$  and  $(e, 1)$ .

4. Which exponential function is represented by this graph?



- (a)  $f(x) = -2x^2 + x$  (d)  $f(x) = 1 + 2^x$   
 (b)  $f(x) = 1 - 2^{-x}$  (e)  $f(x) = 1 + e^x$   
 (c)  $f(x) = 1 - 2^x$

5. Find the horizontal asymptote of the graph of  $f(x) = 2 - e^{x/2}$ .

- (a)  $y = -2$  (d)  $x = 0$   
 (b)  $y = 0$  (e) None of these  
 (c)  $x = -2$

6. The function  $f(x) = 3x - 2$  is a one-to-one function. Find the inverse function  $f^{-1}$ .

- (a)  $f^{-1}(x) = \frac{1}{3x - 2}$  (d)  $f^{-1}(x) = \frac{1}{3}x + \frac{2}{3}$   
 (b)  $f^{-1}(x) = \frac{1}{2}x + \frac{3}{2}$  (e) None of these  
 (c)  $f^{-1}(x) = \frac{1}{2}x - \frac{3}{2}$

7. The function  $f(x) = \frac{2}{x+3}$  is a one-to-one function. Find the inverse function  $f^{-1}$ .

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

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

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

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

(e) None of these

8. Find the range of the function  $f(x) = \frac{2}{x+3}$ . (See the previous problem.)

(a)  $\{y \mid y \neq 0\}$

(d) All real numbers

(b)  $\{y \mid y \neq 2/3\}$

(e) None of these

(c)  $\{y \mid y \neq 1/2\}$

9. Find the domain of  $f \circ g$  if  $f(x) = \frac{1}{2x-1}$  and  $g(x) = \frac{1}{x+1}$ .

(a)  $\{x \mid x \neq 1\}$

(b)  $\{x \mid x \neq -1\}$

(c)  $\{x \mid x \neq 1 \text{ and } x \neq -1\}$

(d)  $\{x \mid x \neq 1/2\}$

(e) None of these

10. If  $f(x) = 2x^2 + 1$  and  $g(x) = x + a$ , find  $a$  so that the  $y$ -intercept of  $f \circ g$  is 9.

(a)  $a = 2$

(b)  $a = \pm 2$

(c)  $a = 9$

(d)  $a = \pm 9$

(e) There is no solution

11.  $\ln \sqrt{e} =$

(a)  $-1$

(b)  $.5$

(c)  $1.359$

(d)  $2.718$

(e) None of these

12. Solve for  $x$ :  $\sqrt{3}^{x+2} = \frac{1}{9}$

(a)  $x = -4$

(b)  $x = -5$

(c)  $x = -6$

(d)  $x = -3/2$

(e) None of these

13. If  $f(x) = \log_5(x)$ , what is  $f^{-1}(x)$ ?

(a)  $f^{-1}(x) = -\log_5(x)$

(d)  $f^{-1}(x) = 5^x$

(b)  $f^{-1}(x) = \frac{1}{\log_5(x)}$

(e)  $f^{-1}$  does not exist

(c)  $f^{-1}(x) = \log_{\frac{1}{5}}(x)$

14. The domain of  $f(x) = \log(1 - 5x)$  is

(a)  $(\frac{1}{5}, \infty)$

(d)  $(-\infty, \frac{1}{5}]$

(b)  $[\frac{1}{5}, \infty)$

(e) None of these

(c)  $(-\infty, \frac{1}{5})$

15.  $\log\left(\frac{x^3\sqrt{x+1}}{(x-2)^2}\right) =$

(a)  $3\log x + \frac{1}{2}\log(x+1) - 2\log(x-2)$

(d)  $3\log x + \log(x+1) + \log(x-2)$

(b)  $3\log x + \frac{1}{2}\log(x+1) + 2\log(x-2)$

(e) None of these

(c)  $3\log x + \log(x+1) - \log(x-2)$

16. Express  $y$  as a function of  $x$  (the constant  $C$  is positive).  $\ln y = 3x + \ln C$

(a)  $y = \ln(3x) + C$

(d)  $y = e^{3x} + C$

(b)  $y = Ce^{3x}$

(e) None of these

(c)  $y = C^{3x}$

17. Solve for  $x$ :  $\ln(x+1) + \ln(x) = \ln(6)$

(a)  $x = 1/5$

(d)  $x = 2$

(b)  $x = -3$

(e) None of these

(c)  $x = -3$  or  $x = 2$

18. Solve for  $x$ :  $2^{x+1} = 6$

(a)  $x = \ln 3$

(d)  $x = \frac{\ln 6}{\ln 2} - 1$

(b)  $x = \ln 4$

(e) None of these

(c)  $x = \ln 4 - \ln 2$

19.  $(\log_3 6)(\log_6 9) =$

(a)  $x = 2$

(d)  $x = \log_3(3/2)$

(b)  $x = 3$

(e) None of these

(c)  $x = \log_6 3$

20. Solve for  $x$ :  $5^x = 3^{1-2x}$

(a)  $x = 3/7$

(d)  $\frac{1}{\ln 5 + 2\ln 3}$

(b)  $x = 11/7$

(e) None of these

(c)  $\frac{\ln 3}{\ln 5 + 2\ln 3}$

Questions 1–20 were given as Exam 4 on 2/28/05. Numbers 17, 18, and 20 are from Section 5.6.

21. (5.1 #9) Let  $f(x) = 2x$  and  $g(x) = 3x^2 + 1$ . Find the composite function  $(f \circ g)(4)$ .  
 (a) 337    (b) 193    (c) 98    (d)  $24x^3 + 8x$     (e) None of these
22. (5.1 #9) Let  $f(x) = 2x$  and  $g(x) = 3x^2 + 1$ . Find the composite function  $(g \circ f)(x)$ .  
 (a)  $12x^2 + 1$     (b)  $6x^2 + 2$     (c)  $6x^2 + 1$     (d)  $6x^3 + 2x$     (e)  $6x^3 + 1$
23. (5.1 #29) Let  $f(x) = 3x + 1$  and  $g(x) = x^2$ . Find the composite function  $(g \circ f)(x)$ .  
 (a)  $x^2 + 3x + 1$     (b)  $9x^2 + 1$     (c)  $3x^3 + x^2$     (d)  $9x^2 + 6x + 1$     (e) None of these
24. (5.1 #19) Let  $f(x) = \frac{3}{x-1}$  and  $g(x) = \frac{2}{x}$ . Find  $(f \circ g)(x)$ .  
 (a)  $\frac{3x}{2-x}$     (b)  $\frac{6}{x^2-x}$     (c)  $\frac{2x-2}{3}$     (d)  $3x$     (e) None of these
25. (5.1 #33) Let  $f(x) = \frac{3}{x-1}$  and  $g(x) = \frac{2}{x}$ . Find the domain of  $f \circ g$ .  
 (a)  $\{x \mid x \neq 1, x \neq 0\}$     (d)  $\{x \mid x \neq 2, x \neq 1\}$   
 (b)  $\{x \mid x \neq 1, x \neq 0, x \neq 2\}$     (e)  $\{x \mid x \neq 2, x \neq 0\}$   
 (c)  $\{x \mid x \neq 2\}$
26. (5.1, Example 4) Find the domain of  $f \circ g$  if  $f(x) = \frac{1}{x+2}$  and  $g(x) = \frac{4}{x-1}$ .  
 (a)  $\{x \mid x \neq \pm 1\}$     (d)  $\{x \mid x \neq -2\}$   
 (b)  $\{x \mid x \neq 1\}$     (e) None of these  
 (c)  $\{x \mid x \neq -1\}$
27. (5.1 #59) If  $f(x) = 2x^2 + 5$  and  $g(x) = 3x + a$ , find  $a$  so that the  $y$ -intercept of  $f \circ g$  is 23.  
 (a)  $a = 8$     (b)  $a = -8$     (c)  $a = \pm 3$     (d)  $a = \pm 3\sqrt{2}$     (e) None of these
28. If  $f(x) = 3x^2 - 7$  and  $g(x) = 2x + a$ , find  $a$  so that the graph of  $f \circ g$  crosses the  $y$ -axis at 5.  
 (a)  $a = \pm 2$     (b)  $a = \pm 2\sqrt{3}$     (c)  $a = \pm 3$     (d)  $a = \pm 5$     (e) None of these
29. If  $f(x)$  has an inverse, and  $(2, -\frac{1}{2})$  is on the graph of  $f(x)$ , then what point is on the graph of  $f^{-1}(x)$ ?  
 (a)  $(\frac{1}{2}, -2)$     (b)  $(-2, -\frac{1}{2})$     (c)  $(-2, \frac{1}{2})$     (d)  $(-\frac{1}{2}, 2)$     (e)  $(2, -\frac{1}{2})$
30. (5.2 #41) The inverse of the function  $f(x) = 4x + 2$  is  
 (a)  $f(x) = \frac{x+2}{4}$     (d)  $f(x) = \frac{1}{2}x - \frac{1}{4}$   
 (b)  $f(x) = \frac{x+4}{2}$     (e) None of these  
 (c)  $f(x) = \frac{1}{4}x - \frac{1}{2}$
31. The function  $f(x) = \sqrt{x-2}$ , for  $x \geq 2$ , is a one-to-one function. Find the inverse function  $f^{-1}$ .  
 (a)  $f^{-1}(x) = x^2 + 2$ , for  $x \geq 0$     (d)  $f^{-1}(x) = -\sqrt{x-2}$ , for  $x \geq 2$   
 (b)  $f^{-1}(x) = x^2 + 2$ , for  $x \geq 2$     (e)  $f^{-1}(x) = \frac{1}{\sqrt{x-2}}$ , for  $x > 2$   
 (c)  $f^{-1}(x) = x^2 + 2$ , for all  $x$
32. (5.2 #52) The function  $f(x) = \frac{4}{2-x}$ , for  $x \neq 2$ , is a one-to-one function. Find the inverse  $f^{-1}$ .  
 (a)  $f^{-1}(x) = \frac{2x-4}{x}$     (d)  $f^{-1}(x) = \frac{4-2x}{x}$   
 (b)  $f^{-1}(x) = \frac{2-x}{4}$     (e) None of these  
 (c)  $f^{-1}(x) = \frac{-4}{2-x}$

33. (5.2 #55) The function  $f(x) = \frac{2x}{3x-1}$  is a one-to-one function. Find the inverse  $f^{-1}$ .

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

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

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

(e) None of these

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

34. (5.2 #55) Find the range of the function  $f(x) = \frac{2x}{3x-1}$ .

(a) all real numbers except  $\frac{1}{3}$

(d) all real numbers except  $-\frac{2}{3}$

(b) all real numbers except  $-\frac{1}{3}$

(e) all real numbers except 0

(c) all real numbers except  $\frac{2}{3}$

35. Which answer describes the graph of the exponential function  $f(x) = e^x$ ?

(a) The graph goes through  $(0, e)$  and decreases as  $x$  increases.

(b) The graph goes through  $(0, e)$  and increases as  $x$  increases.

(c) The graph goes through  $(0, 1)$  and decreases as  $x$  increases.

(d) The graph goes through  $(0, 1)$  and increases as  $x$  increases.

(e) The graph is a straight line through  $(1, e)$ .

36. (5.3 #48) The horizontal asymptote of the graph of  $y = e^x - 1$  is

(a)  $y = -1$

(d)  $y = e$

(b)  $y = 0$

(e) There is no horizontal asymptote

(c)  $y = 1$

37. (5.3 #48) The vertical asymptote of the graph of  $y = e^x - 1$  is

(a)  $x = -1$

(d)  $x = e$

(b)  $x = 0$

(e) There is no vertical asymptote

(c)  $x = 1$

38. (5.3 #39) Find the horizontal asymptote of  $f(x) = 3^{-x} - 2$ .

(a)  $y = 2$

(d)  $x = 0$

(b)  $y = 0$

(e)  $x = -2$

(c)  $y = -2$

39. (5.2 #53) Solve:  $2^{2x+1} = 4$

(a)  $x = 0$     (b)  $x = -\frac{1}{2}$     (c)  $x = 1$     (d)  $x = \frac{1}{2}$     (e) There is no solution

40. (5.3 #69) If  $3^{-x} = 2$ , what does  $3^{2x}$  equal?

(a) 4    (b) -4    (c)  $\frac{1}{4}$     (d)  $-\frac{1}{4}$     (e) None of these

41. (5.4 #37)  $\log_{\frac{1}{2}} 16 =$

(a) 8    (b) 4    (c)  $\frac{1}{4}$     (d)  $-\frac{1}{4}$     (e) -4

42. (5.4 #41)  $\log_{\sqrt{2}} 4 =$

(a) 0    (b) 1    (c) 2    (d) 3    (e) 4

43. (5.4 #43)  $\ln \sqrt{e} =$   
 (a)  $-1$       (b)  $.5$       (c)  $1.359$       (d)  $2.718$       (e) None of these
44. (5.4 #30) The equation  $\log_{\pi} x = \frac{1}{2}$  can be written in exponential form as  
 (a)  $x = \left(\frac{1}{2}\right)^{\pi}$       (b)  $x = \pi^{1/2}$       (c)  $x^{\pi} = \frac{1}{2}$       (d)  $\pi = x^{1/2}$       (e)  $\pi = \left(\frac{1}{2}\right)^x$
45. List the properties of the graph of  $y = \ln x$ .  
 A: The graph has a vertical asymptote at  $x = 1$ .  
 B: The graph has a vertical asymptote at  $x = 0$ .  
 C: The graph goes through  $(e, 0)$ .  
 D: The graph goes through  $(1, 0)$ .  
 E: The graph has a horizontal asymptote.  
 F: The graph increases as  $x$  increases.
- (a) A, C, and E  
 (b) A, D, and E  
 (c) A, C, and F  
 (d) B, D, and E  
 (e) B, D, and F
46. If  $f(x) = \log_3(x)$ , what is  $f^{-1}(x)$ ?  
 (a)  $f^{-1}(x) = e^x$       (d)  $f^{-1}(x) = \frac{1}{\log_3(x)}$   
 (b)  $f^{-1}(x) = 3^x$       (e)  $f^{-1}(x) = \log_{\frac{1}{3}}(x)$   
 (c)  $f^{-1}(x) = -\log_3(x)$
47. Which of the following pairs of functions are inverses of each other?  
 (a)  $\ln(x)$  and  $10^x$       (d)  $\log_{2.7}(x)$  and  $e^x$   
 (b)  $\log(x)$  and  $e^x$       (e)  $\log_2(x)$  and  $\left(\frac{1}{2}\right)^x$   
 (c)  $\ln(x)$  and  $e^x$
48. (see 5.4 #51) The domain of  $f(x) = \log_2\left(\frac{1}{x+1}\right)$  is  
 (a)  $\{x \mid x \geq -1\}$       (d)  $\{x \mid x > -1\}$   
 (b)  $\{x \mid x \neq -1\}$       (e) None of these  
 (c)  $\{x \mid x < -1\}$
49. (5.4 #93) Solve:  $\log_2(2x+1) = 3$   
 (a)  $x = 1$       (b)  $x = 0$       (c)  $x = 3$       (d)  $x = 4$       (e) None of these
50. (5.3 #64) Solve for  $x$ :  $9^{2x} = 27$   
 (a)  $x = \log_9 27$       (b)  $x = \log_3 27$       (c)  $x = \frac{4}{3}$       (d)  $x = \frac{3}{4}$       (e) None of these
51. Solve for  $x$ :  $2^{2x+1} = \left(\frac{1}{2}\right)^x$   
 (a)  $x = \frac{1}{3}$       (b)  $x = 0$       (c)  $x = -\frac{1}{3}$       (d)  $x = -1$       (e) None of these
52. Solve for  $x$ :  $\log_2(3x-1) = 3$   
 (a)  $x = \frac{7}{3}$       (b)  $x = \frac{10}{3}$       (c)  $x = \frac{8}{3}$       (d)  $x = \frac{4}{3}$       (e) None of these

53. (5.5 #46)  $\log\left(\frac{x^3\sqrt{x+1}}{(x-2)^2}\right) =$
- (a)  $3\log x + \frac{1}{2}\log(x+1) - 2\log(x-2)$  (d)  $3\log x + \log(x+1) + \log(x-2)$   
 (b)  $3\log x + \frac{1}{2}\log(x+1) + 2\log(x-2)$  (e) None of these  
 (c)  $3\log x + \log(x+1) - \log(x-2)$
54. (5.5 #49)  $\ln\left(\frac{5x\sqrt{1-3x}}{(x-4)^3}\right) =$
- (a)  $5\ln x + \ln(1-3x) + \ln(x-4)$  (d)  $\ln 5 + \ln x + \frac{1}{2}\ln(1-3x) + 3\ln(x-4)$   
 (b)  $5\ln x + \ln(1-3x) - \ln(x-4)$  (e) None of these  
 (c)  $\ln 5 + \ln x + \frac{1}{2}\ln(1-3x) - 3\ln(x-4)$
55. (5.5 #81) Express  $y$  as a function of  $x$ :  $\ln y = \ln x + \ln(x+1) + \ln C$
- (a)  $y = 2x + 1 + C$  (b)  $y = Cx(x+1)$  (c)  $y = Ce^{x(x+1)}$  (d)  $y = e^{Cx(x+1)}$  (e) None of these
56. (5.5 #83) Express  $y$  as a function of  $x$  (the constant  $C$  is positive).  $\ln y = 3x + \ln C$
- (a)  $y = 3x + C$  (b)  $y = \ln 3x + C$  (c)  $y = Ce^{3x}$  (d)  $y = C^{3x}$  (e)  $y = e^{3x} + C$
57. (see 5.5 #17)  $(\log_2 6)(\log_6 8) =$
- (a) 3 (b) 2 (c)  $\log_6 4$  (d)  $\log_2 \frac{4}{3}$  (e) None of these