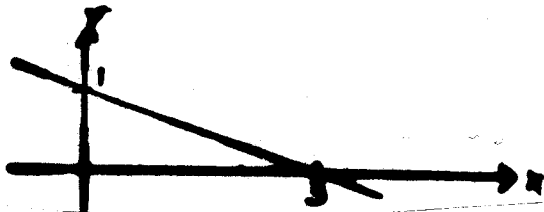


1. Simplify:  $\frac{15}{1 - \frac{1}{2}}$ .  
 A.  $2/3$  B.  $2$  C.  $3/2$  D.  $6$  E. None of the above.
2. Factor:  $16x^2 - 4y^8$   
 A.  $(4x - y^2)(4x + y^2)$  B.  $(4x - 2y^4)^2$  C.  $4(2x - y^4)(2x + y^4)$  D.  $4(2x - y^2)$  E. None of the above.
3. Simplify:  $\left(\frac{4a^4b^8}{c^{-2}}\right)^{-1/2}$ . (All letters denote positive real numbers.)  
 A.  $\frac{1}{2a^2b^4c}$  B.  $\frac{2a^2b^4}{c}$  C.  $\frac{a^4b^3}{16c^2}$  D.  $\frac{c}{2a^2b^4}$  E. None of the above.
4. Subtract and simplify:  $\frac{3x}{3x+1} - \frac{x}{x-2}$ .  
 A.  $\frac{2x^2 - 1}{(3x+1)(x-2)}$  B.  $\frac{-3x^2}{(3x+1)(x-2)}$  C.  $\frac{-7x}{(3x+1)(x-2)}$  D.  $\frac{2x}{(3x+1)(x-2)}$   
 E. None of the above.
5. Divide and simplify:  $\frac{x-2}{x^2-2x-3} \div \frac{x^2-x-2}{x^2-9}$ .  
 A.  $\frac{(x-2)^2}{(x-3)^2(x+3)}$  B.  $\frac{x+3}{(x+1)^2}$  C.  $\frac{x+3}{x+1}$  D.  $\frac{1}{x+3}$  E. None of the above.
6. A job takes 4 hours for two people working together. If one person works alone he can do the job in 6 hours. How long will it take the other person working alone to complete the job?  
 A. 4 hrs. B. 6 hrs. C. 8 hrs. D. 10 hrs. E. None of the above.
7. Write without negative exponents:  $\frac{xy^{-1}}{(x+y)^{-1}}$ .  
 A.  $\frac{x(x+y)}{y}$  B.  $\frac{x^2}{x+y}$  C.  $\frac{x+y}{xy}$  D.  $\frac{xy}{x+y}$  E. None of the above.
8. Simplify by rationalizing the denominator:  $\frac{\sqrt{3}}{2+\sqrt{3}}$ .  
 A.  $\frac{1}{2}$  B.  $2$  C.  $2\sqrt{3}-3$  D.  $\sqrt{3}+2$  E.  $\frac{2\sqrt{3}-3}{7}$
9. Let  $x$  and  $y$  be two consecutive positive integers such that  $x$  is less than  $y$  and the difference of their squares is 145. Find  $x$ .  
 A. 73 B. 72 C. 12 D. 8 E. None of the above.
10. If  $A = P(1 + rt)$ , then  $t =$   
 A.  $\frac{A-P}{r}$  B.  $A-P$  C.  $\frac{A-P}{P}$  D.  $\frac{A}{P}$  E. None of the above.
11. A truck enters a freeway traveling 40 mph. One hour later a car enters the same freeway traveling 55 mph. After how many miles will the car overtake the truck?  
 A.  $146\frac{2}{3}$  miles B.  $201\frac{2}{3}$  miles C. 120 miles D.  $106\frac{2}{3}$  E. None of the above.

12. A square of side  $x$  is inscribed in a circle. Express the area,  $A$ , of the circle as a function of  $x$ .  
 A.  $A = \frac{\pi}{2}x^2$  B.  $A = x^2$  C.  $A = \pi x^2$  D.  $A = \frac{\pi}{4}x^2$  E. None of the above.
13. Solve for  $p$ :  $\frac{4}{2p-3} + \frac{10}{4p^2-9} = \frac{1}{2p+3}$   
 A.  $p = -\frac{3}{2}$  B.  $p = \frac{5}{6}$  C. There is no solution D.  $p = -\frac{25}{6}$  E. None of the above.
14. How many ml of a 50% acid solution should be added to 40 ml of a 20% acid solution to obtain a solution that is 25% acid?  
 A. 10 ml B. 8 ml C. 6 ml D. 4 ml E. None of the above.
15. Solve for  $x$ :  $x = \sqrt{14+5x}$ .  
 A.  $x = 3, x = 14$  B.  $x = -2, x = 7$  C.  $x = -2$  D.  $x = \frac{14}{3}$  E. None of the above.
16. Find all solutions:  $m^4 - m^2 - 6 = 0$ .  
 A.  $m = 2, 3$  B.  $m = -2, \pm\sqrt{3}$  C.  $m = \pm\sqrt{3}, \pm 2i$  D.  $m = \pm\sqrt{3}, \pm\sqrt{2}i$  E. None of the above.
17. Solve the inequality and express the solution in terms of intervals:  $3x - 2 > 6x + 1$   
 A.  $(-\infty, -1)$  B.  $(-1, 1)$  C.  $(-\infty, -1]$  D.  $(-1, \infty)$  E. None of the above.
18. Solve the inequality:  $|6 - 2x| \leq 3$ .  
 A.  $x \geq \frac{3}{2}$  B.  $x \leq \frac{3}{2}$  C.  $\frac{3}{2} \leq x \leq \frac{9}{2}$  D.  $-\frac{9}{2} \leq x \leq -\frac{3}{2}$  E. None of the above.
19. Find all values of  $k$  so that the solutions of the following equation are real numbers:  
 $2x^2 - 4x + k = 0$ .  
 A.  $k = 2$  B.  $k > 2$  C.  $k \geq 2$  D.  $k \leq 2$  E. None of the above.
20. The base of a triangle is three inches more than its height. If each is increased by 3 inches the area is 14 square inches. Find the original base ( $b$ ) and original height ( $h$ ) in inches.  
 A.  $b = 4, h = 1$  B.  $b = 9, h = 6$  C.  $b = 8, h = 5$  D.  $b = 7/2, h = 1/2$  E. None of the above.
21. Solve for  $x$ :

$$\begin{aligned} 2x^2 + y^2 &= 1 \\ x - y &= 1 \end{aligned}$$

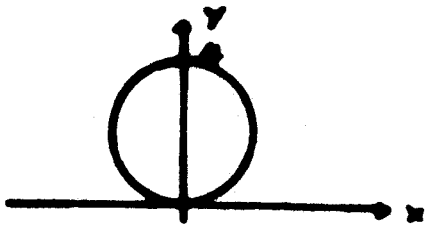
- A.  $x = 2/3$  B.  $x = 0, 2/3$  C.  $x = -2/3$  D.  $x = 0, 3/2$  E. None of the above.
22. If the point  $(2, 3)$  is midway between  $A$  and  $B$  and the point  $A$  has coordinates  $(1, -2)$ , find the coordinates of the point  $B$ .  
 A.  $(1, 5)$  B.  $(3, 1)$  C.  $(3, 8)$  D.  $(3/2, 1/2)$  E. None of the above.
23. The slope of a line perpendicular to the line drawn is:



- A.  $1/3$  B.  $-1/3$  C.  $-3$  D.  $3$  E. None of these.
24. If  $m$  varies directly as the product of  $x$  and  $y$  and inversely as  $z$ , find the constant of proportionality  $k$  if  $m = 3$  when  $x = 4, y = 2$  and  $z = 6$ .  
 A.  $k = 1/6$  B.  $k = 9/4$  C.  $k = 3$  D.  $k = 1/4$  E. None of the above.

25. Give the equation of the line in slope-intercept form which is parallel to the line  $2x - 3y = 7$  and contains the point  $(4, -1)$ .  
 A.  $y = \frac{3}{2}x - 7$  B.  $y = -\frac{2}{3}x + \frac{5}{2}$  C.  $y = \frac{2}{3}x - \frac{11}{3}$  D.  $y = \frac{2}{3}x + \frac{14}{3}$  E. None of the above.

26. The equation for the circle shown is:



- A.  $x^2 + y^2 = 4$  B.  $x^2 + y^2 - 4y = 0$  C.  $x^2(y - 2) = 4$  D.  $x^2 + y^2 + 4y = 0$   
 E.  $x^2 + y^2 + 4x + 4y - 8 = 0$

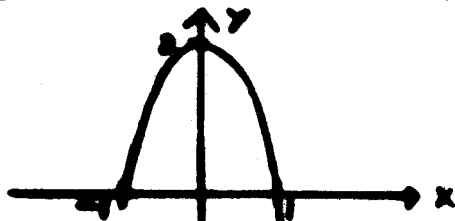
27. Determine  $(g \circ f)(x)$  for the following functions:  $f(x) = 1 - \sqrt{x}$  and  $g(x) = 1/x$ .

- A.  $-\sqrt{x}$  B.  $1 - \sqrt{1/x}$  C.  $1 - \sqrt{x}$  D.  $\frac{1}{1 - \sqrt{x}}$  E.  $1/\sqrt{x}$

28. If  $f(x) = \frac{x}{x^2 + 1}$ , find  $\frac{1}{f(3)}$ .

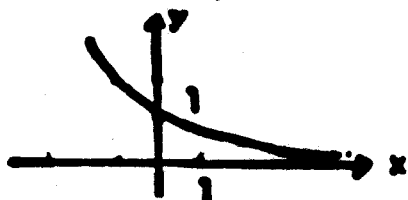
- A.  $3/10$  B.  $3/16$  C.  $16/3$  D.  $10/3$  E. None of these.

29. The graph below could best be described by which equation?



- A.  $y = 2x^2 + 2$  B.  $y = -2x^2 + 2$  C.  $y = -2x^2 - 2$  D.  $y = 2x^2 - 2$  E.  $y = -(x - 2)^2$

30. The figure below most closely resembles the graph of which function?



- A.  $y = (1/2)^x$  B.  $y = 2^x$  C.  $y = -2^x$  D.  $y = -(1/2)^x$  E.  $y = 1 - 2^x$

31. Express as one logarithm:  $\log_b y^3 + \log_b y^2 - \log_b y^4$

- A.  $\log_b y^2$  B.  $\log_b y$  C.  $\log_b(y^3 + y^2 - y^4)$  D.  $\log_b \frac{y^3 + y^2}{y^4}$  E. None of the above.

32. Which are true of the function  $f(x) = \log_a x$  if  $a > 1$ ?

- I.  $f$  is an increasing function. II.  $f$  has  $a$  as an  $x$  intercept. III.  $f$  has 1 as a  $y$  intercept.  
 IV. The domain of  $f$  is  $(0, \infty)$ . List all correct answers.

- A. I, II and III B. I and II C. II and IV D. I and IV E. I and III

33. Which of the following is equivalent to  $\log\left(\frac{432}{\sqrt{.095}\sqrt[3]{72.1}}\right)$ ?
- A.  $\log 432 - \frac{1}{2}\log .095 - 3\log 72.1$  B.  $\log 432 - \frac{1}{2}\log .095 - \frac{1}{3}\log 72.1$   
 C.  $\log 432 - 2\log .095 + 3\log 72.1$  D.  $\log 432 - \frac{1}{2}\log .095 + \frac{1}{3}\log 72.1$   
 E.  $\log 432 - 2\log .095 - 3\log 72.1$

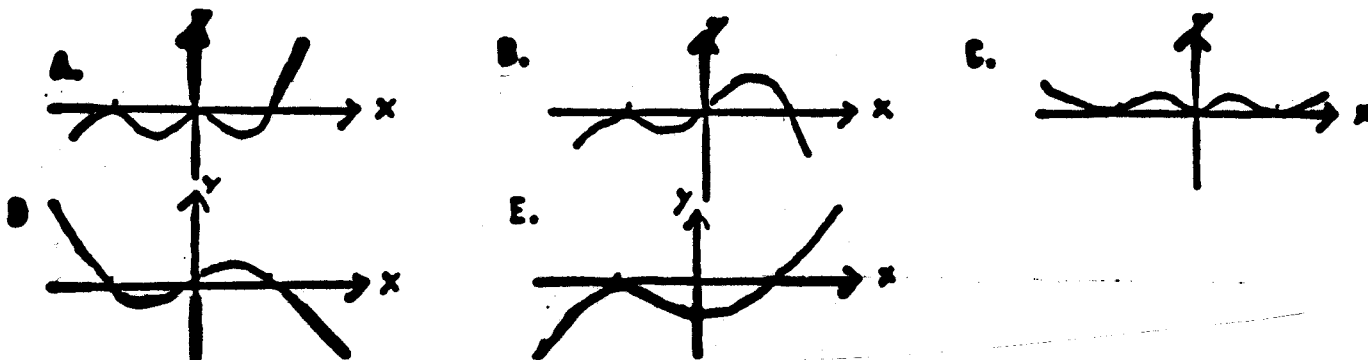
34. Solve for  $x$ :  $3^{x-5} = 4$ .
- A.  $x = \log 4 + 5\log 3$  B.  $x = 5 + \log(4/3)$  C.  $x = 5 + \frac{\log 4}{\log 3}$   
 D.  $x = 5 + \log 4$  E.  $x = \frac{5 + \log 4}{\log 3}$

35. Solve for  $x$ :  $\log_3 \sqrt{2x+3} = 2$ .
- A.  $x = 5/2$  B.  $x = 3/2$  C.  $x = 39$  D.  $x = 17$  E.  $x = 3$

36. Given that  $\log_3 m = 8$ ,  $\log_3 n = 10$  and  $\log_3 p = 6$ . Calculate  $\log_3\left(\frac{\sqrt{mn}}{p^3}\right)$ .
- A. -9 B.  $\frac{2\sqrt{5}}{27}$  C. 22 D. -56 E. -4

37. The graph of  $y = 2 + 2^x$  crosses the y-axis at
- A. 0 B. 1 C. 2 D. 3 E. 4

38. Which of the following looks most like the graph of  $y = x^2(x-1)(x+1)^2$ ?



39. Which set of equations below has no solution?

A.  $2x + 3y = 8$  B.  $3x + 4y = 5$  C.  $2x - 3y = 4$  D.  $x - 4y = 6$  E.  $3x - 2y = 4$   
 $3x - 2y = 4$  B.  $6x + 8y = 10$  C.  $-4x + 6y = 3$  D.  $2x - 4y = 6$  E.  $6x + 4y = 8$

40. Determine where the two lines  $x + 4y = 3$  and  $2x - 6y = 8$  intersect.
- A.  $x = \frac{-12}{5}, y = \frac{6}{5}$  B.  $x = \frac{1}{3}, y = \frac{4}{9}$  C.  $x = \frac{2}{7}, y = \frac{5}{7}$  D.  $x = \frac{1}{8}, y = \frac{2}{5}$  E. None of the above.

41. The value of a rare book is increasing linearly. It was worth \$54 in 1981 and \$62 in 1983. What is the formula for the value ( $v$ ) of the book  $t$  years after 1980?
- A.  $v = 50 + 4t$  B.  $v = 48 + 3t$  C.  $v = 50 + 3t$  D.  $v = 51 + 4t$  E. None of the above.

42. If  $f(x) = x^2 - 2x + 4$  then  $\frac{f(x+h) - f(x)}{h} =$
- A.  $2x + h - 2$  B.  $x + 2h - 2$  C.  $x + 2h + 2$  D.  $2x - h - 2$  E.  $2x - h + 2$ .

43. An aquarium in the shape of a rectangular box is to have a height of 1.5 feet and a volume of 6 cubic feet. Let  $x$  denote the length of the base and  $y$  the width of the base. Express  $y$  as a function of  $x$ .
- A.  $y = 1.5x$  B.  $y = \frac{4}{x}$  C.  $y = x^2$  D.  $y = \frac{6}{x}$  E.  $y = 9x$

44. If  $\log_x 2 = 5$ , solve for  $x$ . Give your answer correct to four decimal places. (Hint: Change to exponential notation.)  
A. 2.2361 B. 1.4142 C. 0.6990 D. 1.1487 E. 0.3010

SOLUTION

1. D; 2. C; 3. A; 4. C; 5. B; 6. E [12 hrs.]; 7. A; 8. C; 9. B; 10. E  $[(A - P)/Pr]$ ; 11. A; 12. A; 13. D; 14. B; 15. E  $[x = 7]$ ; 16. D; 17. A; 18. C; 19. D; 20. A; 21. B; 22. C; 23. D; 24. B; 25. C; 26. B; 27. D; 28. D; 29. B; 30. A; 31. B; 32. D; 33. B; 34. C; 35. C; 36. A; 37. D; 38. A; 39. C; 40. E  $[x = \frac{25}{7}, y = \frac{-1}{7}]$ ; 41. A; 42. A; 43. B; 44. D