

February 14, 2000

Your name \_\_\_\_\_

The first 16 problems count 5 points each and the final two count 20 points each. Problems 2 through 10 are multiple choice and 11 through 16 are fill-in-the-blank. In the multiple choice section, circle the correct choice. You do not need to show your work on problems 2 through 15.

1. Fill in the three character code you received via email in the box
2. Simplify:  $3x - 3[x + 3 - (4x - 1)] + 2$   
(A)  $12x - 12$  (B)  (C)  $4x - 12$   
(D)  $-2x - 12$  (E)  $-5x - 10$
3. When the product  $(4x + 3) \cdot (x^2 + x - 3)$  is written in the form  $ax^3 + bx^2 + cx + d$ , what is the value of  $c$ ?  
(A)  (B) 2 (C) 3 (D) 4 (E) 7
4. Compute and simplify  $\frac{s^2 + 5s - 6}{s^2 + 9s + 18} \div \frac{s^2 - 1}{s^2 + 7s + 12}$ .  
(A)  $\frac{s - 1}{s + 1}$  (B)  (C)  $\frac{s - 1}{s + 6}$  (D)  $\frac{s + 3}{s - 1}$  (E)  $\frac{s + 6}{s + 1}$
5. What is the sum of the solutions of  $2x^3 + 5x^2 - 3x = 0$ ?  
(A)  $-3\frac{1}{2}$  (B)  (C) 0 (D)  $2\frac{1}{2}$  (E)  $3\frac{1}{2}$
6. What is the exact value of  $|3\sqrt{2} - 5| + |1 - 2\sqrt{2}|$ ?  
(A)  $6 + 5\sqrt{2}$  (B)  $\sqrt{2} - 4$  (C)  (D)  $5\sqrt{2} - 4$  (E)  $4 + 5\sqrt{2}$
7. Ashley is a salesperson in a retail store. She earns \$140 weekly plus a 10% commission on her weekly sales. Let  $s$  denote her weekly sales. Which of the following best describes her income?  
(A)  $140s$  (B)  $14s$  (C)  $140 + s$  (D)  (E)  $0.1(s + 140)$
8.  $(4^{-1} - 5^{-1})^{-1} =$   
(A)  $-20$  (B)  $-1$  (C)  $\frac{1}{20}$  (D) 4 (E)

9. How many positive integers satisfy the inequality  $(x+3)(2x-3)(2x-15) \leq 0$ ?

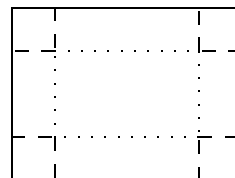
- (A) 3    (B) 4    (C) 5    (D) 6    (E) 7

10. The expression  $(2x-3) \cdot (4x+1) - (2x-3) \cdot 4x + 1$  is equivalent to

- (A) 0    (B)  $2x-4$     (C)  $2x-3$     (D)  $2x-2$     (E) None of the above

The next few questions are short answer questions. Write your answer in the blank provided.

11. A topless box is built from a 12 inch by 14 inch sheet of paper by cutting from each corner a 2 inch by 2 inch square. The four squares are discarded and the flaps are folded upwards to form the sides of the box. What is the volume of the box?



**Solution:**  $160\text{in}^3$

12. Niki has forgotten the relationship between Fahrenheit scale and the Celsius scale. She guesses to double the Celsius and then to add 30 degrees. The actual relationship is given by  $F^\circ = \frac{9}{5}C^\circ + 32^\circ$ , where  $F$  is the Fahrenheit temperature and  $C$  is the Celsius temperature. At what Celsius temperature does Niki's method produce the right Fahrenheit temperature?

**Solution:**  $10^\circ C$

13. Suppose  $a$  is a real number such that  $(a-3)(a^2+3) = 0$ . What is the value of  $|a - a^2|$ ?

**Solution:** 6

14. The sum of two real numbers is 12 and their product is 20. What is the sum of their reciprocals?

**Solution:**  $3/5$

15. The number  $6^9 \cdot 9^6 \cdot 6^6 \cdot 9^9$  can be written as  $A^B$ , where  $A$  and  $B$  are integers (whole numbers). Write  $A^B$  in the blank.

**Solution:**  $6^9 \cdot 9^6 \cdot 6^6 \cdot 9^9 = 6^{15} \cdot 9^{15} = 54^{15}$ .

16. Find all solutions to  $x^4 - 3x^2 + 2 = 0$

**Solution:** Factor to get  $(x^2 - 1)(x^2 - 2) = 0$  from which we get the four solutions  $x = \pm 1$ ;  $x = \pm\sqrt{2}$ . On all the following questions, **show your work.**

17. Find all  $x$  satisfying the inequality  $(x - 2)(x + 2)(3x + 4) \leq 0$ .

**Solution:** Test the intervals  $(-\infty, -2)$ ,  $(-2, -4/3)$ ,  $(-4/3, 2)$ ,  $(2, \infty)$  to find that the product in question is negative on the first and third of the intervals, ie,  $(-\infty, -2] \cup [-4/3, 2)$ .

18. Solve by completing the square the equation  $2x^2 - 3x - 4 = 0$ . Correct use of the quadratic formula is worth 4 points.

**Solution:** Subtract 4 from both sides, then divide by 2 and finally add 9/16 to both sides to get  $x^2 - 3x/2 + 9/16 = 2 + 9/16$ . The answers follow:  $x = \frac{3 \pm \sqrt{41}}{4}$ .