



8. In a state wrestling tournament, every wrestler is eliminated after one loss. There are 33 wrestlers at 155 lb. How many matches must be scheduled in the 155 lb class?

- (A) 37    (B) 33    (C) 64    (D) 32    (E) none of these

[8] \_\_\_\_\_

9. If  $x^4 + 2x^2 - 15 = 0$  then,

- (A) there are no positive roots  
(B) there are exactly 4 real roots and their sum is 0  
(C) there are exactly 2 real roots and their sum is 0  
(D) there are no real roots  
(E) none of these

[9] \_\_\_\_\_

10. Identify the true statement.

- (A) Every real number has a real multiplicative inverse.  
(B)  $\sqrt{a^2} = a$   
(C)  $(a + b)^n = a^n + b^n$   
(D) If  $|x - a| < b$  then  $a - b < x < b + a$   
(E) All of the above statements are true.

[10] \_\_\_\_\_

WCTM MATHEMATICS CONTEST, 1997

Test 2

NAME: \_\_\_\_\_

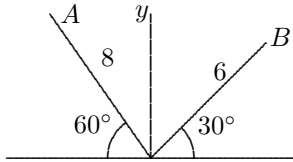
CLASS AB

SCHOOL: \_\_\_\_\_

SCORING: 20 points for each correct answer, -5 for each wrong answer.

1. In an "Ironman" competition Mike runs from Point A to Point B and rides a bicycle back to Point A in  $1\frac{1}{2}$  hours. If he were to ride the bicycle both ways it would take 30 minutes. How long would it take to run the round trip?

(A) 1.15 hours      (B) 1.25 hours      (C) 2.3 hours      (D) 2.5 hours      (E) 3 hours      [1] \_\_\_\_\_



2. The distance from A to B is:

(A)  $\sqrt{100 + 48\sqrt{3}}$       (B)  $\sqrt{100 - 48\sqrt{3}}$       (C)  $\sqrt{110}$       (D) 100      (E) 10      [2] \_\_\_\_\_

3. The set  $\{A, B, C, D, E, F\}$  has how many subsets?

(A) 6!      (B) 63      (C) 32      (D) 64      (E) none of these      [3] \_\_\_\_\_

4. If  $(a + b)^2$  is odd and  $b^2$  is odd then

(A)  $a$  is odd      (B)  $a$  is even      (C)  $ab$  is odd      (D)  $a + b$  is even      (E) more information is needed      [4] \_\_\_\_\_

5. The center of the ellipse  $9x^2 - 36x + 4y^2 = 0$  is the point

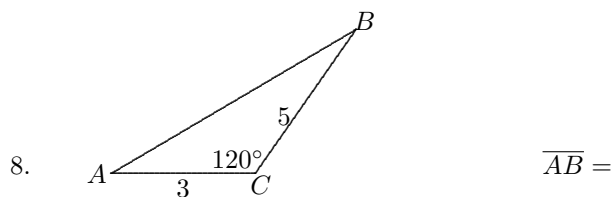
(A) (0,0)      (B) (-2,0)      (C) (2,2)      (D) (-2,2)      (E) (2,0)      [5] \_\_\_\_\_

6. A car is traveling on I-25 at 60 mph. A truck behind the car and in the same lane is traveling at 75 mph. How far apart are they one minute before the crash?

(A) 132 ft.      (B) 1320 ft.      (C) 660 ft.      (D) 2640 ft.      (E) none of these      [6] \_\_\_\_\_

7. The numerator of a fraction is 8 less than the denominator. If both the numerator and the denominator are increased by 5, the value of the fraction is  $1/5$ . The original numerator is

(A) 3      (B) -3      (C) 2      (D) 4      (E) 5      [7] \_\_\_\_\_



- (A)  $\sqrt{34}$     (B)  $\sqrt{34 + 8\sqrt{3}}$     (C)  $34 + 8\sqrt{3}$     (D) 7    (E) none of these    [8] \_\_\_\_\_

9. Let  $f(x) = 3x^2 - kx + 3$ . If  $f(k) = 0$ , identify the true statement below:

- (A)  $k = 0$   
 (B) there are 2 values for  $k$ ; their sum is 0  
 (C) there are two values for  $k$ ; their sum is  $2\sqrt{\frac{3}{2}}$     [9] \_\_\_\_\_  
 (D)  $k$  is any nonzero real number  
 (E) none of the above

10.  $\frac{\sqrt{5} - 10}{\sqrt{5} + 5} =$

- (A) -1    (B) -2    (C)  $\frac{3\sqrt{5} - 11}{4}$     (D)  $\frac{11 - 3\sqrt{5}}{4}$     (E)  $\frac{3\sqrt{5} + 11}{4}$     [10] \_\_\_\_\_

WCTM MATHEMATICS CONTEST, 1997

Test 3

NAME: \_\_\_\_\_

CLASS AB

SCHOOL: \_\_\_\_\_

SCORING: 20 points for each correct answer, -5 for each wrong answer.

1.  $\sin\left(2\left(\text{Arc sin } -\frac{1}{5}\right)\right) =$  Note:  $\text{Arc sin } x = \sin^{-1} x$

(A)  $-\frac{2}{5}$       (B)  $\frac{-2\sqrt{24}}{25}$       (C)  $-\frac{1}{5}$       (D)  $\frac{2}{5}$       (E)  $\frac{1}{5}$  [1] \_\_\_\_\_

2. The product of the roots of  $2^{x^2-3x} = 16$  is:

(A) 4      (B) -3      (C) 3      (D) 0      (E) -4 [2] \_\_\_\_\_

3. If  $f$  is a continuous function and  $f(-x) = f(x)$  then  $\int_{-1}^1 f(x)dx =$

(A) 0      (B)  $2 \int_0^1 f(x)dx$       (C)  $-2 \int_{-1}^0 f(x)dx$       (D)  $\int_0^1 f(x)dx$       (E) none of these [3] \_\_\_\_\_

4. If  $(x - 3)(x - 5) = 48$ , then which of the following is true?

(A) the product of the roots is 8  
 (B) the product of the roots is 33  
 (C) the product of the roots is -33 [4] \_\_\_\_\_  
 (D) the sum of the roots is 33  
 (E) none of these

5.  $2 \cdot 10^{-1} + 5 \cdot 2^{-1} =$

(A) -30      (B) 1.5      (C) .5      (D) 7.5      (E) 2.7 [5] \_\_\_\_\_

6.  $\log \frac{x(x^2 - 1)^2}{x^2 + 1} =$

(A)  $\frac{\log x \log(x^2 - 1)^2}{\log x^2 + 1}$       (B)  $10 \frac{x(x^2 - 1)^2}{x^2 + 1}$       (C)  $\frac{\log x + 2 \log(x^2 - 1)}{-\log(x^2 - 1)}$   
 (D)  $\log x + 2 \log(x^2 - 1) - \log(x^2 + 1)$       (E) none of these [6] \_\_\_\_\_

7. If  $\begin{vmatrix} 3 & x \\ x+2 & 5 \end{vmatrix} = 0$ , then the solution set is:

- (A)  $\{3, 5\}$       (B)  $\{3, -5\}$       (C)  $\{-3, 5\}$       (D)  $\{0\}$       (E) none of these      [7] \_\_\_\_\_

8. A jury of 12 is deadlocked in a 9-3 vote for conviction. In how many different ways can such a vote be made?

- (A) 84      (B) 27      (C) 6      (D)  $12!$       (E) 220      [8] \_\_\_\_\_

9. The graph of the equation  $x^2 - 2x + 3y^2 - y - 7 = 0$  is

- (A) a circle      (B) an ellipse      (C) an hyperbola      (D) 2 straight lines      (E) none of these      [9] \_\_\_\_\_

10.  $\begin{pmatrix} 3a & 4a \\ 2k & k \end{pmatrix} = \begin{pmatrix} 6b & 5c \\ 4b & d \end{pmatrix}$  then

- (A)  $bc$  is any real number      (B)  $bc = 0$       (C)  $bc = \frac{a}{2}$

- (D)  $bc = \frac{2a^2}{5}$       (E) not enough information is given to express  $bc$  in terms of  $a, k$ , and  $d$       [10] \_\_\_\_\_

WCTM MATHEMATICS CONTEST, 1997

Test 4

NAME: \_\_\_\_\_

CLASS AB

SCHOOL: \_\_\_\_\_

SCORING: 20 points for each correct answer, -5 for each wrong answer.

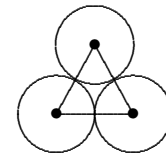
1. If  $|1 - 2x| > 1 + 3x$ , then

- (A)  $x < 0$       (B)  $0 < x < 2$       (C)  $-2 < x < 0$       (D)  $x < -2$  or  $x > 0$       (E)  $-2 < x < 0$       [1] \_\_\_\_\_

2. Sarah has some half-dollars, \$5 bills and \$10 bills. She has 100 pieces of money, worth \$100. How many \$10 bills are there?

- (A) 5                      (B) 4                      (C) 3                      (D) 2                      (E) 1                      [2] \_\_\_\_\_

3. In the figure, the radii of the circles is 1. The area of the region interior to the triangle and exterior to all three circles, is:



- (A)  $\pi - \sqrt{3}$       (B)  $\frac{\pi}{2} - \frac{\sqrt{3}}{2}$       (C)  $\sqrt{3} - \frac{\pi}{2}$       (D)  $\frac{\pi - \sqrt{3}}{2}$       (E) none of these      [3] \_\_\_\_\_

4. If  $a$  and  $b$  satisfy  $\frac{2}{a} + \frac{5}{b} = 6$  and  $\frac{3}{a} - \frac{2}{b} = -2$  then  $a + b =$

- (A) 0                      (B)  $\frac{1}{4}$                       (C) 4                      (D) -4                      (E) none of these      [4] \_\_\_\_\_

5.  $\frac{y^3 - 64}{y^2 - 4y - 5} \div \frac{y^2 - 4y}{2y^2 - 10y} =$

- (A)  $\frac{2y^2 - 8y + 32}{y + 1}$       (B)  $\frac{2y^2 + 8y + 32}{y + 1}$       (C)  $\frac{2y^2 + 4y + 16}{y + 1}$       [5] \_\_\_\_\_  
 (D)  $\frac{y^2 + 4y + 16}{y - 5}$       (E) none of these

6. A parabola has directrix  $y = -x$  and focus  $(4, 0)$ . The vertex is:

- (A)  $(2, 0)$       (B)  $(4 - \sqrt{2}, -\sqrt{2})$       (C)  $(4 - \sqrt{2}, -2\sqrt{2})$       (D)  $(3, -1)$       (E) none of these      [6] \_\_\_\_\_

7. The system of equations  $\begin{cases} 2x - 2y = 1 \\ 2x + 4y = 1 \\ 6x + 5y = 2 \end{cases}$  has:

(A) no solution                      (B) 2 distinct solutions                      (C) infinitely many solutions

(D) one solution  $\left(2, \frac{3}{2}\right)$                       (E) one solution  $(2, -2)$

[7] \_\_\_\_\_

8. Which point is not on the graph of  $y = x^3 + 3x^2 + 2x - 2$ ?

(A)  $(1, 4)$                       (B)  $(-1, -2)$                       (C)  $(0, -2)$                       (D)  $(2, 22)$                       (E)  $(-2, 18)$

[8] \_\_\_\_\_

9. If  $a$  and  $b$  are integers and the least common multiple of  $a$  and  $b$  is  $\frac{ab}{2}$ , then which statement is always true.

(A) 2 divides both  $a$  and  $b$                       (B) 2 divides one of  $a$  or  $b$                       (C)  $a = 2$  or  $b = 2$   
and 2 does not divide the  
other

[9] \_\_\_\_\_

(D)  $a$  and  $b$  are relatively prime                      (E) one of  $a$  or  $b$  is prime

10. The number of times that the graph of  $y = x^7 + 3x^6 - 2x^5 + x + 1$  intersects the graph of  $y = x^7 + 3x^6 - 2x^5 + x^4 - x^3 + 1$  is

(A) 5                      (B) 7                      (C) 4                      (D) 3                      (E) 2

[10] \_\_\_\_\_

WCTM MATHEMATICS CONTEST, 1997

Test 5

NAME: \_\_\_\_\_

CLASS AB

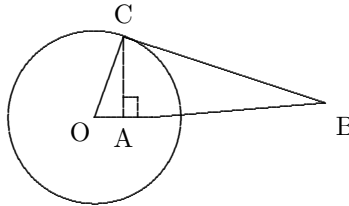
SCHOOL: \_\_\_\_\_

SCORING: 20 points for each correct answer, -5 for each wrong answer.

1. When  $5^{12,345}$  is divided by 7 the remainder is

- (A) 1                      (B) 2                      (C) 3                      (D) 5                      (E) 6                      [1] \_\_\_\_\_

2. If  $OC = 2$ , then  $\overline{OA} \cdot \overline{OB} =$



- (A) 2                      (B) 4                      (C)  $2\pi$                       (D) 3                      (E) none of these                      [2] \_\_\_\_\_

3. Water flows into a 90-gallon tank at 3 gallons per minute. There is a leak which flows at the rate of  $\frac{1}{2}$  gallon per minute. Starting with an empty tank, how many minutes will it take to fill the tank?

- (A) 30                      (B) 36                      (C) 40                      (D) 25                      (E) 60                      [3] \_\_\_\_\_

4. A recreation center is to be built costing \$360,000. If  $\frac{1}{3}$  of the amount already collected is equal to  $\frac{3}{5}$  of the amount still needed, how much money has been collected? (Round to the nearest dollar.)

- (A) \$110,769                      (B) \$231,429                      (C) \$300,000                      (D) \$249,231                      (E) \$275,314                      [4] \_\_\_\_\_

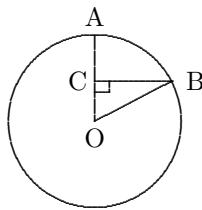
5. The polynomial of smallest degree which has real coefficients and has zeros 2, 2, 5,  $3 - i$  is

- (A)  $(x^2 - 2)(x - 5)(x - 3 + i)$                       (B)  $(x - 2)^2(x - 5)(x - 3 + i)$   
 (C)  $(x^2 - 2)(x - 5)(x^2 - 6x + 10)$                       (D)  $(x - 2)^2(x - 5)(x^2 - 6x + 10)$                       [45] \_\_\_\_\_  
 (E)  $(x + 2)^2(x + 5)(x^2 - 6x + 10)$

6.  $(123_{\text{base } 6})(5_{\text{base } 6}) =$

- (A)  $1053_{\text{base } 6}$                       (B)  $1103_{\text{base } 6}$                       (C)  $1003_{\text{base } 6}$                       (D)  $1163_{\text{base } 6}$                       (E)  $1055_{\text{base } 6}$                       [6] \_\_\_\_\_

7. Find  $\overline{OC}$ , given that  $\overline{AC} = 15$  and  $\overline{BC} = 36$ .



- (A) 45.3      (B) 30.7      (C) 40.7      (D) 35.7      (E) none of these      [7] \_\_\_\_\_

8. The drama club dues are five cents the first week, 10 cents the second week, and so on increasing by five cents per week. What are the dues for a 36-week school year.

- (A) \$33.30      (B) \$30.30      (C) \$30.00      (D) \$25.50      (E) \$18.50      [8] \_\_\_\_\_

9. The coefficient of  $x^{38}$  when  $(x^2 - 9)^{20}$  is expanded is

- (A) -810      (B) -180      (C) 1      (D) -1      (E) none of these      [9] \_\_\_\_\_

10. If  $\frac{x-2}{x^2+4x+3} = \frac{a}{x+3} + \frac{b}{x+1}$

- (A)  $a + b = 1$       (B)  $a + b = -1$       (C)  $a + b = -2$       (D)  $a + b = 2$       (E)  $a + b$  is none of these      [10] \_\_\_\_\_

Grades HS  
1997 Math Contest Exam

Exam	T1	T2	T3	T4	T5
P1	D	D	B	A	E
P2	B	E	E	E	B
P3	B	D	B	C	B
P4	E	B	C	E	B
P5	B	E	E	B	D
P6	E	B	D	D	B
P7	C	B	B	A	D
P8	D	D	E	E	A
P9	C	B	B	A	B
P10	D	C	D	E	A