WCTM MATHEMATICS CONTEST, 1994

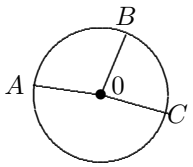
Test 1 **NAME**: _____

CLASS AB **SCHOOL**: _____

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

1. Given a circle with center O and $\angle ABO = 15°$ and $\angle ACO = 5°$, then $\angle BOC$ =?

   (A) $20°$ (B) $60°$ (C) $40°$ (D) $30°$ (E) $45°$



[1] _____

2. The product of the roots of $(\log_3 x)^3 = 2\log_3(x^2)$ is:

   (A) 27 (B) 9 (C) 81 (D) 82 (E) none of these [2] _____

3. If $F(x) = 2x^3 - 5x^2 + 2x - 3$, then the set of all x such that $F'(x) = -2$ is:

   (A) $\{-2/3, 1\}$ (B) $\{-2/3, -1\}$ (C) $\{2/3, -1\}$ (D) $\{2/3, 1\}$ (E) $F'(x)$ is never -2 [3] _____

4. The solution set for $\left|\dfrac{x^2 - x}{x - 1}\right| \leq 1$ is:

   (A) the empty set (B) $-1 \leq x < 1$ (C) all real numbers (D) $x \leq 1$ (E) $x > -1$ [4] _____

5. The number $n = 739_{10}$ is in base ten. In base 7 the number n is:

   (A) 10312_7 (B) 1032_7 (C) 214_7 (D) 1042_7 (E) 2104_7 [5] _____

6. An equation of the line through $(1, -1)$ and parallel to $3x - y = 4$ is:

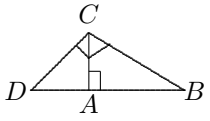
   (A) $y = 3x - 4$ (B) $y = 3x - 2$ (C) $y = x/3 - 4/3$ (D) $y = -3x - 4$ (E) $y = -3x + 2$ [6] _____

7. If 2" bolts cost x cents each and 3" bolts cost y cents each, then the total cost (in cents) of 50 bolts, 20% of which are 2" and 80% are 3" is:

   (A) $40x + 10y$ (B) $10(x + y)$ (C) $10(x + 4y)$ (D) $x/5 + 4y/5$ (E) $10(4x + y)$ [7] _____

8. $\overline{DC} \perp \overline{CB}$, $\overline{CA} \perp \overline{DB}$, $\overline{AD} = 3$", $\overline{AC} = 9$". Then $\overline{AB}$=?

(A) 30" (B) 24" (C) 72" (D) 27" (E) 12"



[8] _____

9. Pacific Power and Light reported that the toal use of electricity had decreased by 2% over the past year. However, residential use had decreased by 4% and all other uses had increased by 25%. If R and I are: "the amounts used by residences" and "other uses", respectively, (one year ago) then R/I is:

(A) 10/1 (B) 13/2 (C) 2/13 (D) 27/2 (E) Impossible to determine from the data given [9] _____

10. Which is equivalent to $\sin(A + B) - \sin(A - B)$?

(A) $2 \sin A$ (B) $\sin 2A$ (C) $2 \sin A \cos B$ (D) $\sin^2 A$ (E) $2 \cos A \sin B$ [10] _____

WCTM MATHEMATICS CONTEST, 1994

Test 2 **NAME**: _____

CLASS AB **SCHOOL**: _____

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

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

   (A) $-1/5 < x < 2$ (B) $x < -1/5$ or $x > 1/2$ (C) $1/2 < x < -1/5$

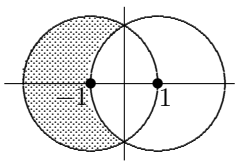
   (D) $-1 < x < 1/2$ (E) $x < -1/5$

   [1] _____

2. A small 9" diameter pizza sells for \$15. A large pizza sells for \$20. If the price per square inch is the same then the radius of the large pizza is:

   (A) 11" (B) 6" (C) $\left(\frac{3}{\sqrt{2}}\right)$" (D) $\left(\frac{\sqrt{2}}{3}\right)$" (E) $3\sqrt{3}$" [2] _____

3. The shaded region is described by:



   (A) $(x+1)^2+y^2 \le 4$ or $(x-1)^2+y^2 \ge 4$

   (B) $(x+1)^2+y^2 \ge 4$ and $(x-1)^2+y^2 \ge 4$

   (C) $(x+1)^2+y^2 \le 4$ and $(x-1)^2+y^2 \ge 4$

   (D) $(x+1)^2+y^2 \le 2$ and $(x-1)^2+y^2 \le 2$

   (E) $(x+1)^2+y^2 \le 2$ and $(x-1)^2+y^2 \ge 2$ [3] _____

4. A polynomial with integer coefficients with leading coefficient 2 and constant term 4. Which of the following cannot be a zero (root) of the polynomial?

   (A) 1 (B) -1 (C) 2 (D) 3 (E) 4 [4] _____

5. If 232 is divided by a number n, the remainder is 4. n cannot be

   (A) 12 (B) 19 (C) 38 (D) 21 (E) 57 [5] _____

6. If $\begin{pmatrix} 3y & (w+1) & x \\ 4y & 2w & 5z \end{pmatrix} = \begin{pmatrix} 6 & 3 & (4x-3) \\ 8 & 4 & (4z-6) \end{pmatrix}$, then $w+x+y+z=$?

(A) -1 (B) 3 (C) 5 (D) 6 [6] _____

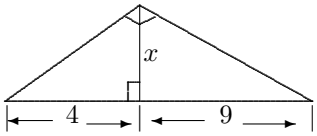
7. If $i^2 = -1$, then $i^{29503} - i^{108} = ?$

(A) -1 (B) i (C) 1 (D) $i+1$ (E) $-i-1$ [7] _____

8. The number $234_{\text{base } 5} \times 12_{\text{base } 5} = ?$

(A) $3413_{\text{base } 5}$ (B) $3363_{\text{base } 5}$ (C) $2303_{\text{base } 5}$ (D) $42213_{\text{base } 5}$ (E) $2203_{\text{base } 5}$ [8] _____

9. Find x



(A) $x = 3$ (B) $x = \sqrt{13}$ (C) $x = 6$ (D) $x = 5$ (E) $x = \frac{3}{2}$ [9] _____

10. If $\frac{3}{x} + \frac{4}{y} = 6$ and $\frac{6}{x} + \frac{6}{y} = 5$ then $x + y = ?$

(A) $-\frac{1}{3}$ (B) $\frac{2}{7}$ (C) $-\frac{3}{8}$ (D) $-\frac{5}{56}$ (E) $\frac{37}{56}$ [10] _____

WCTM MATHEMATICS CONTEST, 1994

Test 3 **NAME**: _____

CLASS AB **SCHOOL**: _____

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

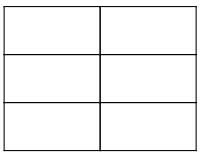
1. In an election Hillary won by a 5 to 4 margin. If she received 635 votes then how many votes were cast?

   (A) 2540 (B) 1200 (C) 5715 (D) 952 (E) 1143 [1] _____

2. Walmart advertises a "40% off " sale on all items. They also offer an extra 10% off the sale price for items bought in quantities larger than 10. How much will it cost to buy 12 light bulbs with a list price of $1.50 each?

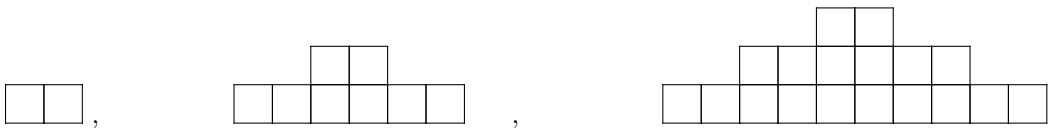
   (A) $10.26 (B) $9.72 (C) $15.00 (D) $11.70 (E) $9.90 [2] _____

3. 1200 feet of fence are to be used to make 6 pens. The maximum of the total area to be fenced is:



   (A) 16,667 sq ft. (B) 17,500 sq ft. (C) 60,000 sq ft. (D) 30,000 sq ft. (E) 29,395 sq ft. [3] _____

4.



   The tenth figure in the sequence will have how many unit squares?

   (A) 40 (B) 200 (C) 162 (D) 100 (E) 196 [4] _____

5. When $5^{128,573}$ is divided by 8, the remainder is:

   (A) 1 (B) 2 (C) 4 (D) 5 (E) 7 [5] _____

6. If $\sin A = -\frac{1}{2}$, and $\cos A = \frac{\sqrt{3}}{2}$ then $\sin 2A$ is:

   (A) $-\frac{\sqrt{3}}{2}$ (B) $\frac{1}{2}$ (C) $-\frac{1}{2}$ (D) $\frac{\sqrt{3}}{2}$ (E) none of these [26] _____

7. The graph of $y = 3x^2 - 5x + 1$ does not pass through the following point:

(A) (0,1) (B) (2,11) (C) $(-1, 9)$ (D) $(-2, 23)$ (E) (3,13) [7] _____

8. If $\dfrac{x}{(x-3)(x+1)} = \dfrac{A}{x-3} + \dfrac{B}{x+1}$ then A/B is:

(A) -3 (B) $\dfrac{1}{3}$ (C) 3 (D) $-\dfrac{1}{3}$ (E) $\dfrac{3}{4}$ [8] _____

9. A circle is inside a square with sides 3 inches. The largest area possible for the circle is:

(A) 9π in^2 (B) $\dfrac{9\pi}{4}$ in^2 (C) 6π in^2 (D) 3π in^2 (E) $(9 - 9\pi)$ in^2 [9] _____

10. The minimum x value for the graph of $y^2 + 4y = 3x - 5$ is:

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) -1 (D) -3 (E) -2 [10] _____

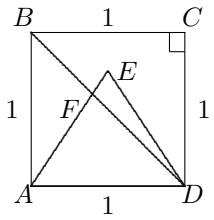
WCTM MATHEMATICS CONTEST, 1994

Test 4 **NAME**: _____

CLASS AB **SCHOOL**: _____

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

1. If $\triangle AED$ is equilateral, $ABCD$ is a unit square, and $\overline{BD}$ intersects $\overline{AE}$ in F, then the area of $\triangle ABF$ is:



(A) $\sqrt{3}+1$ (B) $\dfrac{1}{\sqrt{3}+1}$ (C) $\dfrac{1}{2\sqrt{3}-1}$ (D) $\dfrac{1}{2\left(\sqrt{3}+1\right)}$ (E) $\dfrac{1}{2}\sqrt{3}+1$ [1] _____

2. K digits are to be selected from $\{0,1,2,3,4,5,6,7,8,9\}$ (Repetitions are allowed). The probability that exactly one 9 is selected is:

(A) $\left(\dfrac{9}{10}\right)^k\left(\dfrac{1}{10}\right)$ (B) $\left(\dfrac{9}{10}\right)^{k-1}+k\left(\dfrac{1}{10}\right)$ (C) $\dfrac{k}{10}\left(\dfrac{9}{10}\right)^{k-1}$

(D) $\left(\dfrac{9}{10}\right)^k+\dfrac{1}{10}$ (E) $k\left[\left(\dfrac{9}{10}\right)^{k-1}+\dfrac{1}{10}\right]$

[2] _____

3. $\lim\limits_{x\to\infty}\dfrac{2x^2+x-6}{x^2-x-2}$ is :

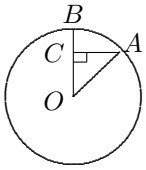
(A) 1 (B) 0 (C) does not exist (D) 2 (E) 3 [3] _____

4. The zeros(roots) of $3x^2+5x-7=0$ are:

(A) complex and unequal (not real) (B) rational (C) irrational and unequal
(D) irrational and equal (E) complex and equal (not real)

[4] _____

5. If $\overline{AC}=36$ and $\overline{CB}=12$, then $\overline{OC}=$



(A) 24 (B) 40 (C) 48 (D) 120 (E) $12\sqrt{10}$ [5] _____

6. $\left(\sqrt{3}+\frac{1}{\sqrt{3}}\right)^2 =$

(A) $\frac{16}{3}$ (B) $\frac{3}{2}$ (C) $\sqrt{3}-\sqrt{2}$ (D) $\frac{19}{6}$ (E) none of these [6] _____

7. The number of solutions $\begin{pmatrix} x \\ y \end{pmatrix}$ to $\begin{pmatrix} 4 & 8 \\ 3 & 6 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix}=\begin{pmatrix} 4 \\ 2 \end{pmatrix}$ is:

(A) 0 (B) exactly one (C) exactly 2 (D) exactly 3 (E) infinite [7] _____

8. If $P = \{x | x$ is a positive integer and $x < 2\pi\}$ and $Q = \{$all real numbers greater than $1\}$, then $P \cap Q =$

(A) $\{5\}$ (B) $\{1, 2, 3, 4, 5, 6\}$ (C) $\{2, 3, 4, 5, 6\}$ (D) 5 (E) $\{2, \pi, 3, 4, 5, 6\}$ [8] _____

9. The 2nd term of an arithmetic progression $a, a + d, a + 2d, \ldots$ is 3 and the 4th term is 17. The first term is:

(A) 0 (B) 1 (C) 4 (D) 2 (E) -4 [9] _____

10. Water flows into a 100 gallon tank at 4 gal/min. The drain is left open in the bottom and drains at 3 gal/min. The tank is empty when the water is turned on. In how many minutes will the tank be **half** full?

(A) 100 minutes (B) 42 minutes (C) 7 1/7 minutes (D) 50 minutes (E) 30 minutes [10] _____

WCTM MATHEMATICS CONTEST, 1994

Test 5 **NAME**: _____

CLASS AB **SCHOOL**: _____

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

1. The number of subsets of $\{a, b, c, d, e, f, g, h\}$ is:

   (A) 8 (B) 256 (C) 64 (D) 512 (E) none of these [1] _____

2. If $A * B = 3A - 2B$, then $3 * (2 * 3) =$?

   (A) -3 (B) 9 (C) -6 (D) 0 (E) -2 [2] _____

3. $\tan \text{Cos}^{-1}\left(-\frac{1}{2}\right) =$?

   (A) $\sqrt{3}$ (B) $\frac{1}{3}$ (C) -3 (D) $-\sqrt{3}$ (E) 6 (F) $-\frac{\sqrt{3}}{2}$ [3] _____

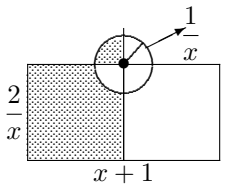
4. The polynomial of lowest degree and with real coefficients which has zeros, $\{2, 3, 3, 2 - i\}$ has degree:

   (A) 4 (B) 3 (C) 5 (D) 6 (E) cannot be determined [4] _____

5. Simplify: $\frac{y^2 + 2y}{2y^2 - 10y} \div \frac{y^2 - y - 6}{y^2 - 25} =$

   (A) $\frac{y+5}{2y-3}$ (B) $\frac{y+5}{2y-6}$ (C) $\frac{y-5}{2y-3}$ (D) $\frac{-5y}{y+6}$ (E) none of these [5] _____

6. The area of the shaded region is:



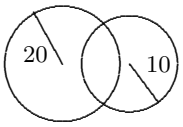
   (A) $\frac{x+1}{x}$ (B) $\frac{x+1}{2x} - \frac{\pi}{x^2}$ (C) $\frac{x+1}{x} - \frac{\pi}{2x^2}$ (D) $\frac{x+1}{2x} - \frac{\pi}{2x^2}$ (E) None of these [6] _____

7. The perimeter of a rhombus is 40 meters. The long diagonal is 16 meters. The area is:

   (A) 80 m^2 (B) 90 m^2 (C) 160 m^2 (D) 96 m^2 (E) 48 m^2 [7] _____

8. The area of an equilateral triangle and a circle are equal. If the sides of the triangle are length s and the radius of the circle is r then $\left(\frac{r}{s}\right)^2 = ?$

(A) $\frac{2\pi}{\sqrt{3}}$ (B) $\frac{\sqrt{3}}{2\pi}$ (C) $\frac{\sqrt{3}}{4\pi}$ (D) $\frac{\pi\sqrt{3}}{4}$ (E) $\frac{4\pi}{\sqrt{3}}$ [8] _____



9. The positive difference between the areas of the two circles shown? regions is:

(A) 20π (B) 30π (C) 300π (D) 200π (E) 150π [9] _____

10. Fred drives from Rawlins to Rock Springs in 2 hours and 5 minutes. Kwan drives from Rock Springs to Rawlins in 1 hour and 45 minutes (a tail wind of course). If they leave at noon when do they meet on the highway? (nearest minute)

(A) 12:41 pm (B) 1:22 pm (C) 2:45 pm (D) 12:57 pm (E) We need to know the distance from Rawlins to Rock Springs. [10] _____

Grades HS
1995 Math Contest Exam

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