

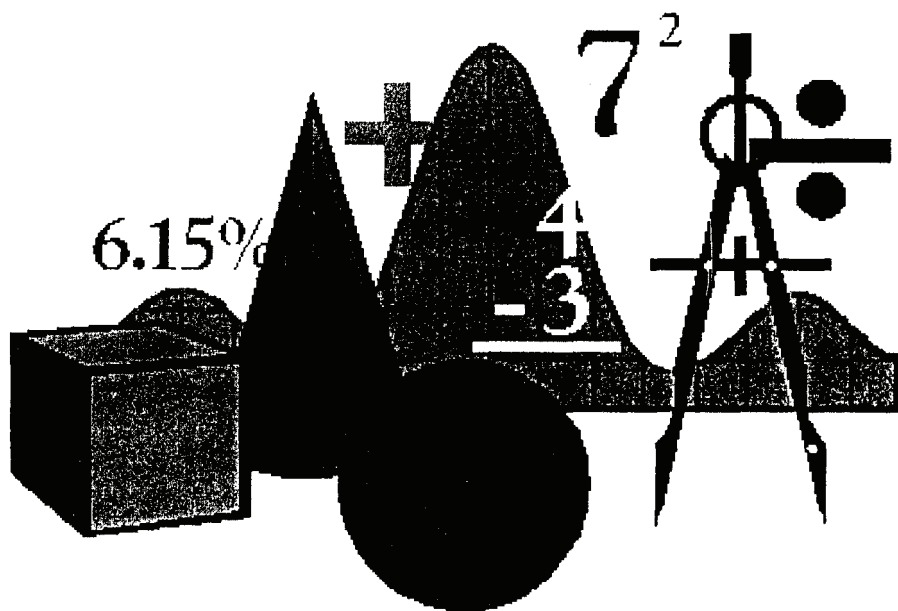


UNIVERSITY INTERSCHOLASTIC LEAGUE

Making a World of Difference

Mathematics

SAC • 2008



**WRITE ALL ANSWERS WITH
CAPITAL LETTERS**

DO NOT TURN THIS PAGE UNTIL
YOU ARE INSTRUCTED TO DO SO!

1. Evaluate: $\frac{3}{8} \div .75 \times \frac{1}{2} - .25 + \frac{1}{16}$

- (A) $-\frac{1}{8}$ (B) $-.1875$ (C) $.0625$ (D) $\frac{3}{4}$ (E) $.5$

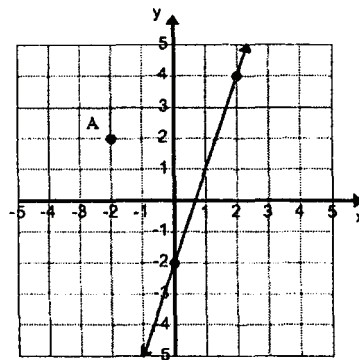
2. A legend on a map shows 2.5 cm representing 200 miles. The distance on the map from El Paso to Texarkana is 9.8 cm. According to the map, how far is it from El Paso to Texarkana?

- (A) 735 (B) 750 (C) 763 miles (D) 784 miles (E) 800 miles

3. Phil Errup's car has a gas tank with a capacity of 18 gallons. The gauge shows that it is $\frac{1}{4}$ full. How many gallons will need to be added to the tank so that it is 75% full?

- (A) 4.5 (B) 6 (C) 7.5 (D) 9 (E) 13.5

4. Find an equation of the line shown.



- (A) $x - 3y = 6$ (B) $3x - y = 2$ (C) $x - 3y = -2$ (D) $-3x + y = 2$ (E) $3x + y = -2$

5. Let p and q be the roots of $8x^2 + 2x - 15 = 0$. Find $p^3 + 3p^2q + 3pq^2 + q^3$.

- (A) $3\frac{1}{2}$ (B) $1\frac{5}{8}$ (C) $-\frac{1}{4}$ (D) $-\frac{15}{32}$ (E) $-\frac{1}{64}$

6. One of the factors of $x^3 - 4x^2 - 3x + 18$ is:

- (A) $x + 2$ (B) $x + 3$ (C) $x + 6$ (D) $x - 2$ (E) $x - 9$

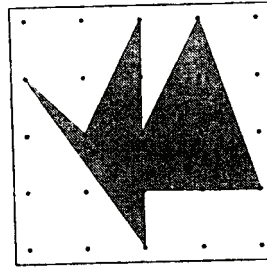
7. Point $P(3, 3)$ is rotated 270° counterclockwise about the origin to point Q . Point Q is reflected across the y -axis to point R . Find the coordinates of point R .

- (A) $(-3, 3)$ (B) $(-3, -3)$ (C) $(3, -3\sqrt{2})$ (D) $(3\sqrt{2}, 3)$ (E) $(3, 3)$

8. Two chords, AC and BD intersect in the interior of a circle at point X such that $m\widehat{BC} = 20^\circ$ and $m\widehat{AD} = 120^\circ$. If points B and C are not on \widehat{AD} then $m\angle AXD$ is:

- (A) 50° (B) 70° (C) 100° (D) 110° (E) 140°

9. The adjacent dots on the grid are 1 cm apart when measured vertically and horizontally. Find the area of the shaded figure shown.



- (A) 4.5 cm^2 (B) 5 cm^2 (C) 5.5 cm^2 (D) 6 cm^2 (E) 6.5 cm^2
10. The roots of the equation $x^3 - 5x^2 + cx + 24 = 0$ are 3, 4, and R. Find c.
- (A) -26 (B) -24 (C) -9 (D) -5 (E) -2
11. Let $f(x) = 2x + 5$ and $g(x) = 3x - 4$ and $h(x) = 6x$. Find $f(g(h(-1)))$.
- (A) -49 (B) -39 (C) -23 (D) -21 (E) -11
12. The graph of $x^2 + y^2 + 10x - 12y - 20 = 0$ is a circle with a radius of:
- (A) $2\sqrt{5}$ (B) $\sqrt{41}$ (C) 9 (D) $4\sqrt{39}$ (E) 11
13. One of the base angles of an acute isosceles triangle has a measure of 50° and the length of its base is 6 cm. Find the perimeter of the acute isosceles triangle. (nearest tenth)
- (A) 13.0 cm (B) 13.8 cm (C) 15.3 cm (D) 16.0 cm (E) 17.7 cm
14. A cliff near a lake is 125 feet high. The angle of depression of a canoe from the top of the cliff is 30° . How far is the canoe from the base of the cliff? (nearest foot).
- (A) 63 ft (B) 72 ft (C) 108 ft (D) 188 ft (E) 217 ft
15. Simplify: $\sin \theta \tan \theta + \cos \theta$
- (A) $2\sin(\frac{\pi}{2} - \theta)$ (B) $2\csc \theta$ (C) $2\tan(\frac{\pi}{2} + \theta)$ (D) $\sec \theta$ (E) $-\cos \theta$
16. Let $A = \begin{bmatrix} 1 & -2 \\ 1 & -3 \end{bmatrix}$ and $B = \begin{bmatrix} -3 & 2 \\ -1 & 1 \end{bmatrix}$ and $AB = \begin{bmatrix} W & X \\ Y & Z \end{bmatrix}$. What is the determinant of AB?
- (A) 5 (B) 3 (C) 2 (D) 1 (E) 0
17. The coefficient of the 2nd term of the expansion of $(3x - 4)^5$ is:
- (A) -1620 (B) -1296 (C) -324 (D) -60 (E) -1

18. Which of the following is true about the relation $h(x) = 5 - x^2$?

- (A) odd function (B) even function (C) neither even nor oddfunction
(D) not a function (E) none of these are true

19. If $f'(x) = 6x^2 - 4x + 1$ and $f(1) = 0$, find $f(-1)$.

- (A) -8 (B) -6 (C) 0 (D) 4 (E) 11

20. $f(x) = 2x^3 - 6x + 1$ has an inflection point at :

- (A) $(0, 1)$ (B) $(-1, 1)$ (C) $(-1, 0)$ (D) $(1, 0)$ (E) $(-1, -1)$

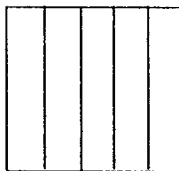
21. Find the area (in square units) of the region bounded by $x = \frac{y^2+2}{2}$ and $x = y + 5$.

- (A) 6 (B) $7\frac{1}{3}$ (C) 9 (D) $12\frac{2}{3}$ (E) 18

22. If two dice are rolled at one time, what is the probability that both dice show a prime number?

- (A) $8\frac{1}{3}\%$ (B) 9% (C) $16\frac{2}{3}\%$ (D) 25% (E) $66\frac{2}{3}\%$

23. The square below is divided into 5 congruent rectangles. The perimeter of each of the congruent rectangles is 30 units. What is the perimeter of the square?



- (A) 60 units (B) 50 units (C) 45 units (D) 35 units (E) 25 units

24. Simplify: $\frac{n! + (n-1)!}{(n-2)!}$

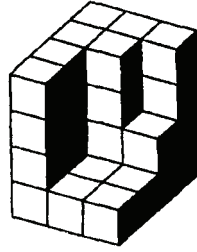
- (A) $n^2 - 1$ (B) $\frac{n^2 - n}{n - 1}$ (C) $\frac{n^2 - 1}{n - 2}$ (D) $\frac{n!}{(n-2)!}$ (E) $n^2 - 2n - 1$

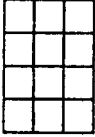
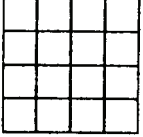
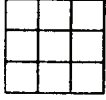
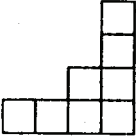
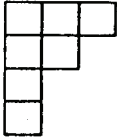
Note: # 25, 26, and 27 are new approaches for 2009

25. Use the angle of rotation, θ (nearest degree), where $0^\circ < \theta < 90^\circ$, to transform the conic $xy = 1$ into an equation that is in standard position and does not contain an xy term. The transformed equation is:

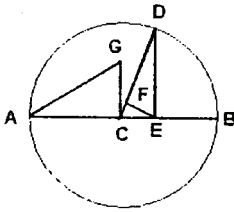
- (A) $x^2 + y^2 = 1$ (B) $x^2 = y^2$ (C) $\frac{x^2 + y^2}{2} = 0$ (D) $x^2 - y^2 = 2$ (E) $\frac{x^2 - y^2}{2} = 0$

26. Which of the following would best represent a two dimensional perspective of the top view of this figure shown?



- (A)  (B)  (C)  (D)  (E) 

27. Let AB be the diameter of the circle with center C with $CG \perp AB$, $DE \perp AB$, and $EF \perp DC$. If $AE = 9$ and $BE = 4$ then $DE = ?$



- (A) 5 (B) $5\frac{7}{13}$ (C) 6 (D) $6\frac{1}{2}$ (E) $6\frac{27}{28}$

**University Interscholastic League
MATHEMATICS CONTEST
HS • SAC • 2008
Answer Key**

- | | |
|-------|-------|
| 1. C | 21. E |
| 2. D | 22. D |
| 3. D | 23. B |
| 4. B | 24. A |
| 5. E | 25. D |
| 6. A | 26. A |
| 7. B | 27. C |
| 8. B | |
| 9. D | |
| 10. E | |
| 11. B | |
| 12. C | |
| 13. C | |
| 14. E | |
| 15. D | |
| 16. D | |
| 17. A | |
| 18. B | |
| 19. B | |
| 20. A | |