



MONTANA COUNCIL OF TEACHERS OF MATHEMATICS  
2011 MATH CONTEST

**PROBLEM SOLVING TEST**

DIRECTIONS: DO NOT WRITE ON THIS TEST. Place the best answer for each question on the separate answer sheet.

\*\*\*\*\*

1. The number of students participating in fall sports at a certain high school can be shown by the following matrix.

<i>tennis</i>	<i>soccer</i>	<i>cross-country</i>	<i>football</i>
[ 40	60	80	80 ]

The athletic director estimates the ratio of the number of sports awards that will be earned to the number of students participating with the following matrix.

<i>tennis</i>	[ 0.3
<i>soccer</i>	0.4
<i>cross - country</i>	0.2
<i>football</i>	0.5 ]

Given these matrices, what is the athletic director's estimate for the number of sports awards that will be earned for these fall sports?

- a.) 80                      b.) 88                      c.) 91                      d.) 92
2. Which of the following statements describes the total number of dots in the first  $n$  rows of the triangular arrangement illustrated below?
- |       |                     |
|-------|---------------------|
| .     | 1 <sup>st</sup> row |
| ...   | 2 <sup>nd</sup> row |
| ..... | 3 <sup>rd</sup> row |
| ..... | 4 <sup>th</sup> row |
| ..... | 5 <sup>th</sup> row |
- a.) This total is always equal to 25 regardless of the number of rows.  
b.) This total is equal to twice the number of rows.  
c.) This total is equal to 5 times the number of rows.  
d.) This total is equal to the square of the number of rows.
3. You bought a car for \$12000 in 1996. It has decreased in value by 14.5% each year since then. Which model best fits the situation, where  $t$  is the number of years since 1996?
- a.)  $y = 0.145t + 12000$                       b.)  $y = 12000 - 0.145t$   
c.)  $y = 12000(1.45)^t$                       d.)  $y = 12000(0.855)^t$
4. Let  $f(x) = x^2 + 5x$ . What is  $f(x - 2)$ ?
- a.)  $x^2 + x - 6$       b.)  $x^2 + x + 4$       c.)  $x^2 + 5x - 2$       d.)  $x^2 + 5x - 10$
5. Evaluate the product  $(7.2 \times 10^5)(6.1 \times 10^{-8})$ .
- a.)  $4.392 \times 10^{-2}$       b.)  $4.392 \times 10^{-3}$       c.)  $4.392 \times 10^3$       d.)  $4.392 \times 10^2$
6. The line that passes through the points (3,0) and (-5, 8)
- a.) is vertical      b.) falls      c.) rises      d.) is horizontal

**PROBLEM SOLVING 2011 page 2**

7. The values in the following table are linearly related.

x	y
410	512
1410	p
2410	312
3410	q

Which statement is true?

- a.)  $p > q$                       b.)  $q > p$                       c.)  $p = q$                       d.)  $p + q = 200$
8. You are in your state's high school tennis championship tournament. At the start of the event there are 128 participants, and each round eliminates half of the players. How many players remain after round 3?  
 a.) 64                      b.) 32                      c.) 16                      d.) 8
9. The depth of a pond is 180 cm and is being reduced by 1 cm per week. The depth of a second pond is 160 cm and is being reduced by  $\frac{1}{2}$  cm per week. If the depths of both ponds continue to be reduced at these constant rates, in about how many weeks will the ponds have the same depth?  
 a.) 10                      b.) 20                      c.) 40                      d.) 80
10. Find the value of x so that the line passing through (10, 5) and (x, 9) has a slope of -2.  
 a.) 2                      b.) -2                      c.) 8                      d.) -8
11. Light travels close to 186000 miles per second. Approximately how many feet per hour is this?  
 a.)  $2.6 \times 10^6$                       b.)  $4.7 \times 10^7$                       c.)  $8.6 \times 10^{10}$                       d.)  $3.5 \times 10^{12}$
12. What is the sum of the first 20 terms of the series  $3 + 14 + 25 + 36 + \dots$   
 a.) 1252                      b.) 1860                      c.) 2010                      d.) 2150
13. In January 1995, the 6230 residents of Floodplains begin leaving at a rate of 60% per year. If that rate stays constant, when will there be less than 100 residents?  
 a.) by 1996                      b.) by 2000                      c.) by 2004                      d.) by 2008
14. What is the matrix product  $\begin{bmatrix} a \\ 2a \\ 3a \end{bmatrix} \begin{bmatrix} 1 & 0 & -1 \end{bmatrix}$   
 a.)  $\begin{bmatrix} a & 0 & -a \\ 2a & 0 & -2a \\ 3a & 0 & -3a \end{bmatrix}$                       b.)  $\begin{bmatrix} a & 2a & 3a \\ 0 & 0 & 0 \\ -a & -2a & -3a \end{bmatrix}$                       c.)  $\begin{bmatrix} 2a & 0 & -2a \end{bmatrix}$                       d.)  $\begin{bmatrix} 6a & 0 & -6a \end{bmatrix}$
15. A ball is dropped from a height of 7 feet. Each time it hits the ground it bounces half of its previous height. What is the total distance travelled by the ball?  
 a.) 7 feet                      b.) 14 feet                      c.) 21 feet                      d.) 28 feet
16. Y varies inversely as the square of x and directly as z. What is the change in y if x is doubled and z is halved?  
 a.) no change                      b.) halved                      c.) doubled                      d.)  $\frac{1}{8}$ th as large
17. What is the next term in the sequence: 1, 3, 6, 10, 15  
 a.) 18                      b.) 21                      c.) 25                      d.) 16
18. If the equation for the relationship between pizza diameter and price were  $y = 0.5x + 2.99$ . How much would an 18 inch pizza cost?  
 a.) \$16.99                      b.) \$11.99                      c.) \$18.99                      d.) \$12.01

## PROBLEM SOLVING 2011 Answer Key

- 1.) D
- 2.) D
- 3.) D
- 4.) A
- 5.) A
- 6.) B
- 7.) A
- 8.) C
- 9.) C
- 10.) C
- 11.) D
- 12.) D
- 13.) B
- 14.) A
- 15.) C
- 16.) D
- 17.) B
- 18.) B