

MONTANA COUNCIL OF TEACHERS OF MATHEMATICS  
2013 MATH CONTEST  
SCHOLARSHIP TEST

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

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1. There is a 10% chance that a person chosen at random is left-handed. What is the probability that exactly two out of three people chosen at random will be right-handed?

A) 0.972      B) 0.729      C) 0.271      D) 0.243

2. There are 9 basketball teams in the Southern League. The conference requires each team to play every other team in the league twice. How many total league games are played?

A) 72      B) 36      C) 45      D) 90

3. Write the series  $4 + 10 + 18 + 28 + \dots$  in sigma-notation.

A)  $\sum_{n=1}^{\infty} (n+1)^2$       B)  $\sum_{n=2}^{\infty} (n+2)(n-1)$       C)  $\sum_{n=2}^{\infty} (n-1)^2 - 5$       D)  $\sum_{n=2}^{\infty} (n+3)(n-2)$

4. The velocity of a bicycle, in feet per second, is given by the function  $f(t) = 4t$ . How far does the bicycle travel in 5 seconds?

A) 50 feet      B) 75 feet      C) 100 feet      D) 175 feet

5. Jessica has a starting salary of \$35,000 per year. Her company CEO offers her a raise of 4% each year. What will be Jessica's salary during her 10<sup>th</sup> year of work to the nearest dollar?

A) \$49,816      B) \$51,809      C) \$36,400      D) \$52,214

6. Identify the conic section represented by the equation  $3x^2 - 5xy - 2y^2 + 4x - 3y = 12$ .

A) ellipse      B) parabola      C) hyperbola      D) circle

7. Evaluate the following limit.

$$\lim_{x \rightarrow -2} \frac{x^3 - 7x - 6}{x^2 - x - 6}$$

A) 1      B) 0      C) -1      D) undefined

8. Find the integral  $\int (1 - \cos x) dx$

A)  $1 + \sin x$       B)  $\sin x$       C)  $x + \sin x$       D)  $x - \sin x$

9. Find the vertex of the graph represented by the equation  $-2y^2 + 12y + x = 14$ .

A) (-4,3)      B) (4,3)      C) (3,8)      D) (-3,8)

10. Find  $\lim_{h \rightarrow 0} \frac{(x-5+h)^{\frac{3}{2}} - (x-5)^{\frac{3}{2}}}{h}$

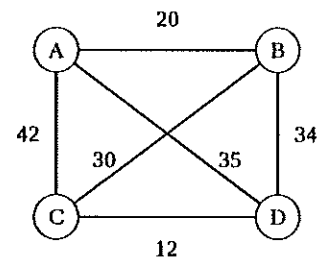
A) undefined      B)  $\frac{3}{2}\sqrt{x-5}$       C)  $\frac{3}{2\sqrt{x-5}}$       D) 0

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11. Determine  $\lim_{x \rightarrow -2} f(x)$ , where  $f(x) = \begin{cases} 2(x+1)^2 - 8, & x > -2 \\ -0.5x - 4, & x \leq -2 \end{cases}$   
 A) -6                      B) -3                      C) 2                      D) limit does not exist
12. If  $f(3) = 2$ ,  $f'(3) = 4$ ,  $g(3) = 1$ ,  $g'(3) = 3$  and  $h(x) = f(x)g(x)$ , then what is  $h'(3)$ .  
 A) 2                      B) 10                      C) 11                      D) 12
13. Evaluate  $\int_2^7 2 dt$   
 A) -8                      B) 4                      C) 8                      D) -4
14. How many different ways can *all* seven letters in EKALAKA be arranged?  
 A) 24                      B) 420                      C) 840                      D) 5040
15. Determine the  $\lim_{x \rightarrow 0} \frac{\cos x - 1}{x}$ .  
 A) 0                      B) -1                      C) 1                      D) limit does not exist
16. A cylindrical can is made to hold 100 cubic inches of soup. What is the radius that minimizes the cost of the metal used to manufacture the can?  
 A) 2.52 inches                      B) 3.15 inches                      C) 1.73 inches                      D) 4.10 inches
17. Find the maximum value of the function,  $f(x, y) = y - x$  given the mathematical conditions  $y \leq 4 - 2x$ ,  $x + 2 \geq 2$ , and  $y \geq 0$ .  
 A) -2                      B) 0                      C) 6                      D) 4
18. Determine the y-intercept of the function graphed by the parametric equations:  

$$\begin{cases} x = 4 - 2t \\ y = t^2 + 3t \end{cases}$$
  
 A) (0,9.5)                      B) (0,10)                      C) (0,10.5)                      D) (0,11)

19. A travelling salesperson visits 4 cities selling softball bats where the distances between cities is given in the graph to the right. Find the shortest possible route if the salesperson starts at A and finishes at A.  
 A) ABDCA                      B) ACBDA                      C) ADCBA                      D) ABCBA



20. A continuous function intersects the  $x$ -axis at only points  $a$  and  $b$ , where  $a < b$ . The slope at  $a$  is positive while the slope at  $b$  is negative. Which of the following is true for any such function?  
 There exists some point on the interval  $(a, b)$  where  
 A) The slope is 0; the function has a local maximum  
 B) The slope is 0; the function does not have local maximum  
 C) There is a local maximum but there does not have to be a point at which the slope is 0  
 D) None of the above choices have to be true

## SCHOLARSHIP TEST 2013 ANSWER KEY

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