



MONTANA COUNCIL OF TEACHERS OF MATHEMATICS
2014 MATH CONTEST
PROBLEM SOLVING TEST

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

.....

Use the following information to answer questions 1 – 2.

Suppose $a \cdot 10^k$ must be in scientific notation.

- What are all the possible values of a ?
A) $a > 1$ B) $a < 10$ C) $a > 10$ D) $1 \leq a < 10$ E) none of these
- What are the possible values of k ?
A) All real numbers B) All integers C) All whole numbers
D) All rational numbers E) none of these
- If an animal is a pronghorn, then it belongs to the goat family. If a Montana game animal belongs to the goat family, then it is an antelope. You just shot a pronghorn. What is your conclusion?
A) You shot a goat. B) A pronghorn is a Montana game animal. C) You shot an antelope.
D) You get arrested because it is not hunting season. E) none of these
- Harold's equine taxi service, The Two Dot Trotters, charges \$6.50 for the first mile and \$2.25 for each additional half-mile. How much does a 7-mile ride cost, not including the \$5 tip?
A) \$35.75 B) \$13.25 C) \$22.25 D) \$33.50 E) none of these
- Which of the following is equal to $3(a + b) - 3ab - 3b$?
A) $3a(1 - b)$ B) $-3b$ C) b D) $3ab$ E) none of these
- The following are your math test scores for the current quarter: 65, 73, 84, 92, 87, 83, 80, 77, 67, 74, 75, 81, 90, 88, 78, 85. Give the interquartile range of your test scores.
A) 11.5 B) 13.5 C) 12 D) cannot be determined without the graph E) none of these
- Crusty's Circus Emporium rolled through Columbus last week. Unbeknownst to the locals, a rabid clown escaped his enclosure and is hiding in the faculty restroom at Columbus High School. When the math teacher opened the stall door and saw the clown, she screamed and started running down the hallway at a constant rate of 8.8 feet per second. After 2 minutes, the clown comes out of his stupor and starts chasing the math teacher at a constant rate of 11.7 feet per second. Approximately how many minutes pass before the teacher gets tackled by the clown?
A) 4 min. B) 6min. C) 8 min. D) The clown never catches the teacher. E) none of these
- How many minutes would pass before the clown tackles the math teacher if she ran from the restroom at a constant rate of 11.7 feet per second?
A) 4 min. B) 6min. C) 8 min. D) The clown never catches the teacher. E) none of these
- The weight of a substance varies directly as the volume of the substance. ($w = kv$) If 20kg of a substance has a volume of 3L, what is the volume of 50kg of this substance?
A) 7.50L B) 7.75L C) 7.25L D) 7.70L E) none of these

PROBLEM SOLVING 2014 page 2

10. Ada's iPod has 1253 songs on it. She wants to make a playlist consisting of 45 songs, where order does not matter. How many different playlists are possible?
- A) 1.15×10^{139} B) 9.61×10^{82} C) 9.61×10^{139} D) 1.15×10^{82} E) none of these
11. A cookie jar contains 5 chocolate chip cookies, 7 sugar cookies, 3 peanut butter walnut cookies, and 10 macadamia nut cookies. If you reach in the jar for a cookie without looking, what is the probability that the cookie you select will contain nuts?
- A) $\frac{3}{25}$ B) $\frac{10}{13}$ C) $\frac{12}{13}$ D) $\frac{13}{25}$ E) none of these
12. During a recent Mythbusters experiment, one of Adam and Jamie's explosions cracked a cylinder of pressurized Nitrous Oxide. The initial pressure is 32 pounds per square inch (psi), and the nitrous oxide is escaping exponentially at a rate of 67 percent per second. The tank will stop leaking at 1psi. How long will it take to stop leaking, so that Adam and Jamie can quit rolling on the floor?
- A) about 10 seconds B) between 5 and 6 seconds C) between 3.1 and 3.2 seconds
D) approximately 2.075 seconds E) none of these
13. During Adam and Jamie's recent Nitrous Oxide incident, Jamie rolled in a substance that made his skin break out in a rash. When the rash was first spotted, it covered a 3 in^2 area on his upper calf. The size of the rash area is doubling every 2 min. If Jamie's total body surface area is 384 in^2 , and the hospital is 20 min away, how many minutes from the hospital will the ambulance be by the time Jamie is completely covered by the rash?
- A) The ambulance will reach the hospital before he's covered. B) 8 min from the hospital
C) 6 min D) 2 min E) none of these
14. Jim wants to know the approximate height of his elm tree. At 10:00am the tree's shadow is 50 feet long. At the same time, a yard stick casts a shadow of 6.5 feet at the same time. How tall is Jim's tree, to the nearest foot?
- A) 8 feet B) 23 feet C) 108 feet D) 13 feet E) none of these
15. Which of the following is equivalent to $(4x - 7)^2$?
- A) $16x^2 - 49$ B) $16x^2 + 49$ C) $16x^2 + 28x - 49$ D) $16x^2 - 56x - 49$ E) None of these.
16. The following is the first four terms of an arithmetic sequence: 3, 18, 33, 48, ... What is the 32nd term of this sequence?
- A) 453 B) 468 C) 483 D) 498 E) none of these
17. Which of the following linear equations have the same slope?
- I. $2x - 3y = 4$
II. $y = \frac{4}{3} + \frac{2}{3}x$
III. $y - 4 = -\frac{2}{3}(x + 6)$
- A) I & II B) II & III C) I, II, & III D) I & III E) none of these
18. When all possible diagonals are drawn from a given vertex of a polygon, the following sequence forms: 0, 1, 2, ..., where 0 corresponds to a triangle, 1 to a quadrilateral, 2 to a pentagon, etc. What is the number of diagonals drawn from one vertex of a dodecagon?
- A) 5 B) 7 C) 9 D) 12 E) none of these
19. x is a factor of 35. y is a factor of 16. Which number below could *not* be a value for xy ?
- A) 10 B) 24 C) 40 D) 56 E) none of these

PROBLEM SOLVING 2014 Answer Key

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