



MONTANA COUNCIL OF TEACHERS OF MATHEMATICS
2012 MATH CONTEST

11 - 12 Team Test

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

- Find a regression equation for the data $(-3,-3)$, $(-1,-1)$, $(2,1)$, and $(5,4)$.
(A) $y = 0.85x - 0.39$ (B) $y = 1.17x + 0.46$ (C) $y = 0.85x + 0.39$ (D) $y = 0.89x + 0.06$
- Determine the name of a regular polygon which has interior angles of 144° .
(A) pentagon (B) octagon (C) decagon (D) dodecagon
- x varies directly with y squared and inversely with z . If $x = \frac{1}{4}$ when $y = \frac{1}{2}$ and $z = \frac{1}{3}$, then find x when $y = 3$ and $z = 1$.
(A) 13.5 (B) 4 (C) 3 (D) $\frac{1}{12}$
- Which trigonometric relationship is the same as $(\cos x - \sin x)^2$.
(A) 1 (B) $-\cos x \sin x$ (C) $\cos^2 x - \sin^2 x$ (D) $1 - \sin 2x$
- Which quadratic equation has solutions $x = 1 \pm \sqrt{2}i$?
(A) $2x^2 - x - 3$ (B) $x^2 - 2x + 3$ (C) $3x^2 - 2x + 1$ (D) $4x^2 + x - 3$
- A multiple choice test has 20 questions each with 4 possible answers. Assuming that a student answers all questions randomly determine the probability of getting no more than 5 right answers.
(A) 0.617 (B) 0.202 (C) 0.929 (D) 0.535
- If M is a 3×3 matrix then the $\det(cM)$ is
(A) $3c \det(M)$ (B) $c \det(M)$ (C) $c^3 \det(M)$ (D) not enough information
- Solve the following system of equations.
$$\begin{cases} x + 2y - 2z = 1 \\ 3x - y + 5z = 6 \\ 4x + y + 3z = 7 \end{cases}$$

(A) $(3, -2, -1)$ (B) $(-3, -2, 1)$ (C) no solutions (D) infinitely many solutions
- Find the hypotenuse of a 30° - 60° - 90° triangle whose side opposite the 60° angle is $\sqrt{6a}$.
(A) $\sqrt{12a}$ (B) $\sqrt{8a}$ (C) $\sqrt{6a}$ (D) $\sqrt{2a}$
- Determine the number of vertical asymptotes for $f(x)$.
$$f(x) = \frac{x^2 - 1}{x^4 + 27x^3 + 49x^2 - 27x - 50}$$

(A) 4 (B) 3 (C) 2 (D) 0
- Find the sum of the first 50 perfect squares.
(A) 1275 (B) 36474 (C) 42925 (D) 45526

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12. Find the value of the constant k such that the following limit exists.

$$\lim_{x \rightarrow 1} \frac{x^2 - kx + 4}{x - 1}$$

- (A) 5 (B) 1 (C) -1 (D) -5

13. Find the sum of all solutions to the equation $|2x^2 - 8x + 9| = 9$.

- (A) 4 (B) 6 (C) 8 (D) non-solvable equation

14. The US Post Office charges 44 cents for first class letters weighing up to one ounce and 20 cents for each additional ounce or fraction of an ounce. Which formula gives the cost $c(z)$ of mailing a letter of z ounces?

- (A) $c(z) = 20 + 44 \lfloor z \rfloor$ (B) $c(z) = 44 + 20 \lfloor z - 1 \rfloor$
(C) $c(z) = 44 + 20 \lfloor z \rfloor$ (D) $c(z) = 20 + 44 \lfloor z - 1 \rfloor$

15. If vector $\vec{v} = \langle a, b \rangle$ which vector has twice the magnitude of \vec{v} and is perpendicular to \vec{v} ?

- (A) $\langle 2a, 2b \rangle$ (B) $\langle -2a, b \rangle$ (C) $\langle -2b, 2a \rangle$ (D) $\langle 4b, 4a \rangle$

16. If $a = \frac{bc^2}{d}$, where b is measured in kg, c is measured in $\frac{m}{sec}$, and d is measured in $\frac{kg \cdot m}{sec^2}$, what are the units for a ?

- (A) m (B) $\frac{m}{sec^2}$ (C) $\frac{m^2}{sec}$ (D) $\frac{1}{sec}$

17. The population of Xortha grows continuously at a rate of 2.4% each year. How many Xorthians will there be in 5.5 years if the current population is 10.7 million?

- (A) 12 million (B) 12.19 million (C) 12.21 million (D) 12.24 million

18. If a mother has two children and one is a boy what is the probability the other is a boy?

- (A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{4}$ (D) 0

19. In a study 4 groups of people were given a 20 question trivia test. For each group researchers recorded the following statistics: size of group (n), mean value correct (\bar{x}), and standard deviation (s).

Group 1: $n = 20, \bar{x} = 15.3, s = 2.5$

Group 2: $n = 25, \bar{x} = 12.1, s = 5.4$

Group 3: $n = 18, \bar{x} = 11.3, s = 7.9$

Group 4: $n = 30, \bar{x} = 10.4, s = 3.2$

A group is called “homogenous” if the group is alike with respect to a specific measurement. Which group is the most homogeneous group with respect to trivia?

- (A) Group 4 (B) Group 3 (C) Group 2 (D) Group 1

20. What is the vertex of a parabola with the equation $x = 8y^2 + 16y + 3$?

- (A) (1,5) (B) (-5,-1) (C) (3,-1) (D) (-1,3)

11 – 12 Team Test 2012: Answer Key

1. A
2. C
3. C
4. D
5. B
6. A
7. C
8. D
9. B
10. C
11. D ****42925
12. A
13. C ****A
14. B
15. C
16. A
17. C
18. B
19. D
20. B