

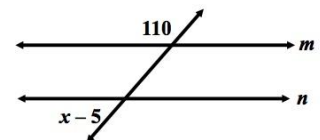
MONTANA COUNCIL OF TEACHERS OF MATHEMATICS
2019 MATH CONTEST
ADVANCED

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

- To the nearest square inch, find the surface area of a right cylinder with base radius of 5 inches and height 12 inches.
A) 456 B) 534 C) 1382 D) 1696 E) none of these
- Determine the surface area of a spherical volleyball that has a 21 cm diameter. Round to the nearest square cm.
A) 1385 B) 4849 C) 5542 D) 38792 E) none of these
- Determine the volume in cubic feet of a regular prism with a right triangular base. The base triangle has a 10-foot hypotenuse with one leg of 6 feet. The prism's height is 1.5 feet.
A) 27 B) 36 C) 45 D) 120 E) none of these
- A square based regular pyramid with overall height of 120 mm has a 20 mm base side length. Find the volume.
A) 8000 mm^3 B) 9600 mm^3 C) 12000 mm^3 D) 16000 mm^3 E) none of these
- Determine the altitude of an isosceles right triangle where each leg is 8 meters long. If needed round to the nearest m.
A) 2 B) 3 C) 4 D) 6 E) none of these
- Determine any altitude of an equilateral triangle given a side length of 12 km. If needed round to the nearest km.
A) 10 B) 12 C) 21 D) 24 E) none of these

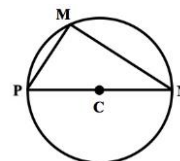
7. In the diagram find the value of x if lines m and n are parallel.

- A) 70 B) 75 C) 110 D) 115 E) none of these



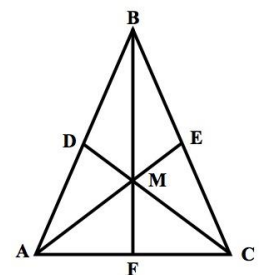
8. Circle C in the diagram has radius of 13. If $MP = 10$ find the length of MN .

- A) 12 B) 18 C) 24
D) 36 E) none of these



9. In the diagram M is the centroid of $\triangle ABC$ with $AM = 36$, $FM = 30$, $CD = 56$. Find the length of BM .

- A) 15 B) 30 C) 36 D) 60 E) none of these



10. Solve the equation $3 \ln \sqrt{4x - 1} = \frac{3}{2} \ln(2x + 3)$ for x .

- A) 0 B) 2 C) $\frac{5}{2}$ D) 4 E) none of these

11. Condense the logarithmic expression. $\log_2 x + 3 \log_2 a - \frac{1}{2} \log_2 y$

- A) $\log_2 \left(\frac{3ax}{0.5y} \right)$ B) $\frac{3 \log_2 a * \log_2 x}{0.5 \log_2 y}$ C) $3.5 \log_2(x + a - y)$ D) $\log_2 \left(\frac{xa^3}{\sqrt{y}} \right)$ E) none of these

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12. A bacteria population is growing at a rate of 15% an hour. Write an exponential population model (y) in terms of hours (x) given an initial population of 20 bacteria.

- A) $y = 15(20)^x$ B) $y = 0.15x + 20$ C) $y = 20(0.15)^x$ D) $y = 20(1.15)^x$ E) none of these

13. A car loses its value exponentially. Two years after it was purchased it is worth \$22000 and four years after it was purchased it is worth \$16500. How much is the car worth 10 years after it was purchased? Round to the nearest tens place.

- A) \$0 B) \$6960 C) \$8250 D) \$8500 E) none of these

14. Water level on the Big Hole River near Wise River was collected in cubic feet per second (cfs) over 5 weeks between May and June. The data is recorded in the table. Find the mean and standard deviation (s) of the data to the nearest tenth.

Week	Water Level (cfs)
1	5630
2	6750
3	8050
4	5080
5	4380

- A) $mean = 5978, s = 1446.6$ B) $mean = 5978, s = 1457.3$
 C) $mean = 5978, s = 1447.9$ D) $mean = 5978, s = 2889.8$ E) none of these

15. What symbol is used to denote the mean of a population?

- A) Σ B) \bar{x} C) x_n D) μ E) none of these

16. What is the reciprocal of a cosine function?

- A) cosecant B) secant C) sine D) arccosine E) none of these

17. Find the exact value of $\sin \theta$ if the terminal side of θ in standard position contains the point $(-2, -5)$.

- A) $\frac{-2\sqrt{29}}{29}$ B) $\frac{5}{2}$ C) $\frac{-5\sqrt{29}}{29}$ D) $\frac{2}{5}$ E) none of these

18. Suppose r varies jointly with s and t . If $s = 20, r = 140,$ and $t = -5$, find s when $r = 7$ and $t = 2.5$.

- A) $-\frac{1}{2}$ B) -2 C) 2 D) 200 E) none of these

19. It takes 9 men 23 hours to set up one section of the Montana Folk Festival. How many hours would it take 13 men to set up the same section? Round to the nearest tenth.

- A) 0.2 hours B) 5.1 hours C) 15.9 hours D) 33.2 hours E) none of these

For 20 – 22, use the graph at right.

20. Evaluate $f(-5) + g(1)$.

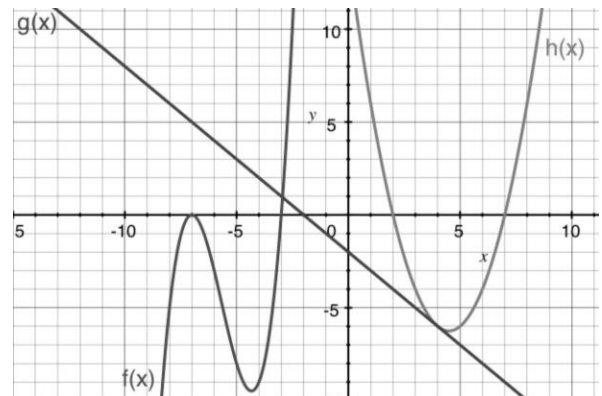
- A) -11 B) -5 C) -4 D) 5 E) none of these

21. Evaluate $g(-10) \div 4h(2)$.

- A) 0 B) 2 C) 4 D) 8 E) none of these

22. Evaluate $f(g(4))$.

- A) -6 B) -3 C) 2 D) 4 E) none of these



ADVANCED 2019 Answer Key

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