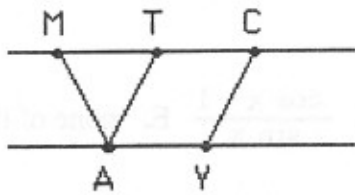


1.



In the figure, $\overline{AT} \parallel \overline{YC}$ and $AM = AT = YC$. If $m\angle AYC = 100^\circ$, then $m\angle MAT =$

- A. 160° B. 100° C. 80° D. 40° E. 20°

2. The graph of the polar equation $r = a \cos 2\theta$ forms 4 enclosed regions in the plane. Which of the following numbers of regions CANNOT be created by the graph of an equation of the form $r = a \cos k\theta$ (k a positive integer)?

- A. 6 B. 7 C. 8 D. 9 E. B or D

3. The lines with equations $\frac{x}{2} + \frac{y}{3} = 1$ and $6x + 2y = 13$ intersect in which quadrant?

- A. I B. II C. III D. IV E. on a coordinate axis

4. Add the x - and y -coordinates of each real solution of the system $\begin{cases} x^2 + y^2 = 20 \\ xy = 2 \end{cases}$. The product of these sums is

- A. 0 B. 24 C. 256 D. 576 E. none of these

5. Correct answers on this test are 2 points, blanks are 0 points, and wrong answers are $-1/2$ points. How many different combinations of correct, blank, and wrong answers produce a score of 8 points?

- A. 2 B. 3 C. 4 D. 5 E. more than 5

6. $\sum_{k=1}^{99} \log \frac{k}{k+1} =$ A. $\log 2$ B. 2 C. $\log \frac{1}{2}$ D. -2 E. none of these

7. Employee A earns \$10,000 in year 1, and a \$1,000 raise at the beginning of each succeeding year. Employee B earns \$5,000 in half-year 1 with a fixed raise at the beginning of each succeeding half-year. What is the smallest raise B must receive each half-year to keep his yearly salary always ahead of A's?

- A. \$500 B. \$300 C. \$250 D. \$200 E. no raise can do that

8. Al, Cy, Ed, and Jo are all different heights. Al says, "I'm tallest," Cy says, "I'm shortest," Ed says, "Jo is tallest," and Jo says, "I'm shorter than Ed." If at least three people are telling the truth, who is the second tallest?

- A. Ed B. Cy C. Al D. Jo E. not enough information to decide

9. $\cot \frac{1}{2}x =$
 A. $\frac{\sin x}{\cos x - 1}$ B. $\frac{\cos x + 1}{\sin x}$ C. $\frac{\sin x}{\cos x + 1}$ D. $\frac{\cos x - 1}{\sin x}$ E. none of these
10. $\log_4 8 + \log_{16} 64 =$
 A. $\log_8 64$ B. $\log_{16} 512$ C. $\log_4 16$ D. $\log_4 64$ E. $\log_8 128$
11. In rectangle ABCD, E is between A and D, F is between B and C, and $\overline{EF} \perp \overline{AD}$. If $m\angle AEB = 2(m\angle ADB)$, then
 A. $DE = AE + AB$ B. $AB = AE$ C. $DE = AE$ D. $DE^2 = AB^2 + AE^2$
 E. $DE + BE = AB + AE$
12. For which of the following functions does $f(a + b) = f(a) + f(b)$ for all real a and b?
 I. $f(x) = x^2$ II. $f(x) = \frac{x}{2}$ III. $f(x) = 2^x$
 A. I only B. II only C. I and II only D. II and III only E. I, II, and III
13. The expression $2 \sin x - \cos^2 x$ has a minimum value of
 A. 0 B. -1 C. -2 D. -3 E. none of these
14. The graph in the xy-plane of the equation $x^3 + y^3 = 1$ has an asymptote with equation
 A. $y = 0$ B. $x + y = 1$ C. $x = y$ D. $x + y = 0$ E. none of these
15. The digits 1, 2, 3, 4, 5, 6, 7 are each used exactly once to create a set of primes whose sum is as small as possible. A number which CANNOT be an element of this set is
 A. 23 B. 41 C. 47 D. 61 E. 67
16. A triangle has two sides of length 6 and 8 respectively and an angle of measure 30° . How many different noncongruent triangles satisfy these conditions?
 A. none B. 1 C. 2 D. 3 E. 4
17. In an arithmetic sequence a_1, a_2, a_3, \dots , if $a_r = s$ and $a_s = r$, then $a_{r+s} =$
 A. $r + s$ B. rs C. $r^2 + s^2$ D. $\frac{r + s}{2}$ E. 0

18. Each letter of a four-letter word is chosen randomly from the letters A, B, C, and D (each letter may be used more than once). The probability that the word has exactly three different letters is
- A. $\frac{9}{16}$ B. $\frac{3}{16}$ C. $\frac{5}{8}$ D. $\frac{3}{8}$ E. none of these
19. If two real numbers x and y are such that xy , $\frac{x}{y}$, and $x + y$ are all equal, then $x - y =$
- A. $\frac{-3}{2}$ B. $\frac{3}{2}$ C. $\frac{1}{2}$ D. $\frac{-1}{2}$ E. none of these
20. We label 200 cards, each with one red side and one blue side, with the consecutive numbers 1 to 200 and lay them out red side up. We also assign the numbers 1 to 200 to 200 people (in no particular order). Each person passes by the cards once, changing the color of every card whose number is a multiple of that person's number. For example, person number 12 changes the color of cards numbered 12, 24, 36, ..., 192. After all 200 people have passed, how many cards have the red side up?
- A. 200 B. 186 C. 100 D. 14 E. none