

- The point P is symmetric to the point (2,3) with respect to the line $y = x$, and the point Q is symmetric to the point P with respect to the y-axis. The coordinates of Q are
 A. (2,-3) B. (-2,3) C. (-3,2) D. (3,-2) E. (-3,-2)
- $\sqrt{18} + \sqrt{32} =$
 A. $7\sqrt{2}$ B. $5\sqrt{2}$ C. $2\sqrt{3} + 4\sqrt{2}$ D. $25\sqrt{2}$ E. none of these
- Let the largest prime factor of 1992 equal $10a + b$ (a and b are decimal digits). Which of the following are factors of 1992?
 A. a B. b C. $a^{1/b}$ D. both A and B E. all of these
- The term of the expansion of $(x^2 - 2)^7$ which is of degree 4 is
 A. $21x^4$ B. $672x^4$ C. $-672x^4$ D. $280x^4$ E. $-280x^4$
- If $f(x) = x^2$, then $\frac{f(x+1) - f(x)}{2} =$
 A. $x + 1$ B. $\frac{1}{2}$ C. $x + \frac{1}{2}$ D. $x + \frac{1}{4}$ E. none of these
- The solution of $\sqrt[3]{1 + \sqrt{x}} + \sqrt[3]{1 - \sqrt{x}} = \sqrt[3]{5}$ is
 A. $\frac{3}{4}$ B. $\frac{4}{3}$ C. $\frac{4}{5}$ D. $\frac{5}{4}$ E. none of these
- From a point A outside a circle with center F and radius 4, \overline{AB} and \overline{AC} are tangent to the circle at B and C respectively. If \overline{DE} is also tangent to the circle with D between A and B and E between A and C, and the perimeter of $\triangle ADE$ is 16, then $AF =$
 A. $4\sqrt{5}$ B. 8 C. $4\sqrt{3}$ D. 10 E. $2\sqrt{5}$
- A population grows exponentially. If the population grows from 20,000 on July 1, 1989 to 40,000 on July 1, 1991, in what year will the population reach 100,000?
 A. 1993 B. 1994 C. 1995 D. 1997 E. none of these
- If $f(x) = \csc x$ and $g(x) = \cot x$, which of the following is true about $f(x) - g(x)$ on the interval $(0, \pi)$?
 A. always positive B. always negative C. positive for some x, negative for others
 D. zero for exactly one x E. none of these

10. A firm charges \$5 per poster to put up 10 posters. For each poster over 10, the firm reduces the cost per poster by 15¢ for all posters (for example, the charge is \$4.70 per poster for 12 posters). For what quantity of posters does the firm earn the most money?
- A. $11\frac{2}{3}$ B. 12 C. 21 D. $21\frac{2}{3}$ E. 22
11. An imaginary number is a complex number whose imaginary part is nonzero. The product of all imaginary sixth roots of 64 is
- A. -4 B. 4 C. -16 D. 16 E. none of these
12. Let u be the x -intercept and v the y -intercept of the line with equation $y = 3x - 5$. The equation of the line with x -intercept v and y -intercept u is
- A. $x - 3y = 5$ B. $3y - x = 5$ C. $x + 3y = 5$ D. $3x - y = 5$ E. $3x + y = 5$
13. If $AMA \div TYC = 5$, where each different letter represents a different decimal digit, then the sum of all possible values of M is
- A. 4 B. 5 C. 7 D. 8 E. none of these
14. The remainder when $5x^{56} - 3x^{47} - x^{20} - 4x^5 - 2$ is divided by $x + 1$ is
- A. -5 B. -2 C. 9 D. 1 E. none of these
15. The product of all solutions of the equation $|x - 1| + |2x - 3| = |x + 2|$ is
- A. $\frac{3}{2}$ B. 3 C. $\frac{1}{2}$ D. 0 E. none of these
16. John must enroll in two required courses chosen from Bio 1, Chem 1, Geo 1, and Math 3; he must also enroll in one elective chosen from Econ 1, Psych 1, and Soc 1. Assuming all courses are available at 10, 11, and 12 o'clock, in how many ways can he schedule his classes in these three time periods?
- A. 30 B. 36 C. 48 D. 108 E. 144
17. A point P inside rectangle $ABCD$ is chosen so that $PA = 14$, $PB = 2$, and $PC = 8$. Then PD is
- A. 16 B. 20 C. 8 D. $2\sqrt{34}$ E. not determined
18. The number of solutions of the system $\begin{cases} y = \frac{x^2 - 4}{x + 2} \\ y = \frac{4}{3 - x} \end{cases}$ is
- A. none B. 1 C. 2 D. 3 E. an infinite number

19. Subtracting 1, 2, and 2 respectively from the first three terms of an arithmetic sequence with common difference 4 produces the first three terms of a geometric sequence. The common ratio of this geometric sequence is

A. $\frac{3}{4}$ B. $\frac{4}{3}$ C. $\frac{4}{5}$ D. $\frac{5}{4}$ E. none of these

20. $\cos \frac{7\pi}{12} =$

A. $\frac{-\sqrt{3}}{4}$ B. $\frac{\sqrt{6} + \sqrt{2}}{4}$ C. $\frac{\sqrt{6} - \sqrt{2}}{4}$ D. $\frac{-\sqrt{2} - \sqrt{6}}{4}$ E. none of these