

- If 2 is a zero of $x^3 + kx^2 + kx + 6$, then $k =$
 a) $-\frac{7}{3}$ b) -1 c) 1 d) $\frac{7}{3}$ e) none of these
- If $f(3x+2) = x^2 - 4x$, then $f(-4) =$
 a) $\frac{28}{9}$ b) 32 c) 12 d) 2 e) none of these
- The mean of eight numbers is 32. Three more numbers are added to the collection. The mean of the new collection is 40. What is the mean of the three numbers added?
 a) 48 b) 43 c) 64 d) $61\frac{1}{3}$ e) none of these
- A cube and a sphere have the same volume. If the length of the side of the cube is doubled and the radius of the sphere is doubled, what is the ratio of the volume of the new sphere to the volume of the new cube?
 a) $\frac{3}{4}$ b) π c) $\frac{4}{3}\pi$ d) $\frac{4}{3}$ e) 1
- The number of vertical asymptotes for the graph of $y = \frac{x^2 - 4}{x^4 - 16}$ is
 a) 0 b) 1 c) 2 d) 3 e) 4
- If f is an even function defined on $(-\infty, +\infty)$, which of the following **must** equal $f(x)$ for all x ?
 a) $\sqrt{[f(x)]^2}$ b) $\frac{1}{f(x)}$ c) $-f(-x)$ d) $-f(x)$ e) $f(-x)$
- In $\triangle ABC$, $m\angle A = 30^\circ$, $\angle C$ is acute, $\overline{AB} = 6$, and $\overline{BC} = 5$. $\overline{AC} =$
 a) 1 b) $3\sqrt{3} - 4$ c) $4 + 3\sqrt{3}$ d) $\frac{\sqrt{10}}{3}$ e) $\frac{11}{9}$
- The sum of the squares of the solutions to $x^2 = 2x + 6$ is
 a) 16 b) 36 c) 40 d) -8 e) -6
- A bag of letters contains four A's, two M's, three T's, one Y, and two C's. Six letters are drawn at random. What is the probability that the six letters spell, in the order drawn, A-M-A-T-Y-C?
 a) $\frac{1}{360}$ b) $\frac{1}{3465}$ c) $\frac{1}{4620}$ d) $\frac{1}{20736}$ e) $\frac{1}{15552}$
- What is the area of the region enclosed by the graph of $|x| + 2|y| = 10$?
 a) 25 b) 50 c) 75 d) 100 e) none of these
- An airplane flies from one city to another in two hours, aided by a 30 MPH tail wind. Later in the day, a head wind, twice as strong as earlier in the day, causes the return trip to take 3 hours. If the air speed of the airplane was constant, how far apart are the cities?
 a) 360 miles b) 540 miles c) 180 miles d) 240 miles e) 300 miles

12. Which polynomial has the greatest number of distinct, real zeros?
 a) $(x-1)^4(x-2)^3(x^2-3x+3)^{10}$ b) $(x-1)^4(x-2)^3(x^2-3x+2)^{10}$
 c) x^3-5x^2+8x-4 d) x^3-x^2+x-1 e) $x^3-6x^2+11x-6$
13. $\cos(\sin^{-1}(\frac{1}{3})) + \tan^{-1}(5) =$
 a) $\frac{10\sqrt{2}-1}{3\sqrt{26}}$ b) $\frac{10\sqrt{2}+1}{3\sqrt{26}}$ c) $\frac{4\sqrt{13}+15}{3\sqrt{26}}$ d) $\frac{2\sqrt{2}+5}{3\sqrt{26}}$
 e) $\frac{2\sqrt{2}-5}{3\sqrt{26}}$
14. Which of the following has as its graph three concurrent lines?
 a) $(y-2x)(y+2x)(x+y+1) = 0$ b) $(y-2x)(x+y-3)(3x-y-1) = 0$
 c) $(y-2x)(y-2x+1)(y-2x+2) = 0$ d) $x^3 = y^3$ e) none of these
15. Which of the following has no root greater than 100?
 a) $x^2 - 1000x + 1 = 0$ b) $x^2 - 100x + 100 = 0$ c) $x^2 - 100x - 100 = 0$
 d) $x^2 - x - 10,000 = 0$ e) $x^2 + 100x - 100,000 = 0$
16. The number of (real) solutions for the system $\begin{cases} y = \sin x \\ x + 3y = 3 \end{cases}$ is
 a) 0 b) 1 c) 2 d) 3 e) 4
17. A collection of nuts and bolts weighs 348 grams. Nuts weigh 7 grams each and bolts weigh 11 grams each. The number of possible values for the number of bolts in the collection is
 a) 1 b) 3 c) 5 d) 7 e) infinite
18. The sides of a balanced cube are labeled with the numbers 3, 5, 7, 11, 13, and 17. If the cube is rolled three times, what is the probability that the sum of the three numbers rolled is less than 20?
 a) $\frac{1}{6}$ b) $\frac{1}{3}$ c) $\frac{1}{18}$ d) $\frac{19}{108}$ e) $\frac{13}{72}$
19. If $A = \begin{bmatrix} a & b \\ c & 2a \end{bmatrix}$, where a, b, and c are integers, and $A^2 + 3A = \begin{bmatrix} -2 & 0 \\ 3 & 4 \end{bmatrix}$, then $a^2 + b^2 + c^2 =$
 a) 2 b) 5 c) 6 d) 10 e) 13
20. Three ducks start swimming across a pond 300 ft wide. Halfway across one of the ducks turns back. Then, one minute later, another duck turns back. Just as this duck returns to the halfway point, the other two ducks reach opposite shores. All three ducks always swam at a common constant rate. What was that common rate?
 a) 50 ft/min b) 60 ft/min c) 75 ft/min d) 100 ft/min e) none of these