

- 1) A square has a side length x and diagonal D . The area of the square as a function of D is
- a) $2D^2$ b) $\frac{D^2}{2}$ c) D^2 d) $\sqrt{2}D^2$ e) none of these
- 2) Joe and Jim can run around a track in 6 minutes and 10 minutes respectively. If they start at the same instant from the same place, in how many minutes will they pass each other if they run in the same direction?
- a) 10 minutes b) 12 minutes c) 15 minutes d) 20 minutes e) none of these
- 3) The value of z in the solution of the system $2x - y + z = 3$, $x + 3y - 2z = 11$, $3x - 2y + 4z = 1$ is
- a) -2 b) 1 c) 2 d) 3 e) none of these
- 4) The product of the coordinates of one of the solutions of the system $x + 2y = 4$, $y^2 - xy = 7$ is
- a) -4 b) -6 c) 5 d) 6 e) none of these
- 5) Consider the arithmetic sequence 5, 14, 23, \dots , 239 where $a_1 = 5$, $a_2 = 14$, \dots , $a_n = 239$. The sum of the digits of n is
- a) 5 b) 7 c) 9 d) 11 e) none of these
- 6) The sum of the even integers between 17 and 99 is
- a) 2088 b) 2204 c) 2320 d) 2378 e) none of these
- 7) $\sqrt{x^2}$ is equivalent to
- a) x b) $-x$ if $x \geq 0$ c) x if $x \leq 0$ d) $|\sqrt{x}|$ e) none of these
- 8) In the polar form of $\sqrt{3} - i$, the value of the radius is
- a) 2 b) 3 c) 4 d) 9 e) none of these
- 9) If r is a root of $f(x)$, then a factor of $f(x)$ is
- a) r b) x c) $x + r$ d) $x - r$ e) none of these
- 10) If $f(x)$ is a polynomial with real coefficients and if $3 - 2i$ is a root, then another root is
- a) $-3 + 2i$ b) $-3 - 2i$ c) $-2i$ d) $2i$ e) none of these
- 11) The minimum value of the function $f(x) = -2(x - 1)^2 + 2$ is
- a) -4 b) -2 c) 1 d) 2 e) none of these

- 12) The sum of the infinite series $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4}$ is
- a) 2 b) 3 c) $\frac{5}{2}$ d) $\frac{7}{2}$ e) none of these
- 13) A definition of e is
- a) $\lim_{n \rightarrow \infty} (1 + \frac{1}{n})^n$ b) $\lim_{n \rightarrow 0} (1 + \frac{1}{n})^n$ c) $\lim_{n \rightarrow \infty} (1 - \frac{1}{n})^n$ d) $\lim_{n \rightarrow \infty} (\frac{n^2+1}{n})^n$ e) none of these
- 14) The value of $\tan(\arccos \frac{\sqrt{2}}{2})$ is
- a) -1 b) 1 c) $\frac{\pi}{4}$ d) $\frac{5\pi}{4}$ e) none of these
- 15) In lowest terms, the denominator of one of the acute radian solutions of the equation $2 \cos 3x + 1 = 0$ is
- a) 1 b) 3 c) 6 d) 9 e) none of these
- 16) The graph of the parametric equations $x = 4t, y = \frac{2}{t}$ is
- a) a line b) a circle c) an ellipse d) a hyperbola e) none of these
- 17) If the equation $x^2 + 2(k + 2)x + 9k = 0$ has equal roots, then the sum of the possible values of k is
- a) 1 b) 5 c) 6 d) 7 e) none of these
- 18) The numerical coefficient of the x^2 term in the expansion of $(2 - 3x)^7$
- a) 128 b) 256 c) 2056 d) 6048 e) none of these
- 19) The sum of the values in the $(x + y)^5$ row of Pascal's triangle is
- a) 14 b) 16 c) 30 d) 32 e) none of these
- 20) The value of $a^{4 \log_a b}$ is
- a) a^b b) b^a c) 4^a d) b^4 e) none of these
- 21) The value of $\begin{vmatrix} 1 & 3 & 4 \\ -2 & 4 & 5 \\ 3 & 1 & 6 \end{vmatrix}$ is
- a) -6 b) 4 c) 44 d) 156 e) none of these
- 22) If the graph of the function g is the reflection about the line $y = x$ of the graph of the function f , and if $f(x) = (x + 1)^3$, then $g(x) =$
- a) $-(x + 1)^3$ b) $\frac{1}{(x+1)^3}$ c) $\frac{1}{(x-1)^3}$ d) $x^{\frac{1}{3}} - 1$ e) none of these

- 23) If we decompose $\frac{3x^2+2x-2}{x^3-1}$ into partial fractions, where the partial fractions are of the form $\frac{A}{\text{linear factor}} + \frac{Bx+C}{\text{irreducible quadratic factor}}$ then the value of C is
- a) 1 b) 2 c) 3 d) 4 e) none of these
- 24) The value of $\tan(-510^\circ)$ is
- a) $-\frac{\sqrt{3}}{3}$ b) $\frac{\sqrt{3}}{3}$ c) $-\sqrt{3}$ d) $\sqrt{3}$ e) none of these
- 25) The value of $\sin 105^\circ$
- a) $\frac{\sqrt{6}-\sqrt{2}}{4}$ b) $\frac{\sqrt{6}-\sqrt{3}}{4}$ c) $\frac{\sqrt{6}+\sqrt{3}}{4}$ d) $\frac{\sqrt{3}+\sqrt{2}}{6}$ e) none of these
- 26) The product of the coordinates of the focus of the parabola described by $(x-2)^2 = -8(y+3)$ is
- a) -6 b) -8 c) -10 d) 12 e) none of these
- 27) The sum of all coordinates of the two vertices of the ellipse $x^2 + 4x + 4y^2 - 8y + 4 = 0$ is
- a) -3 b) -2 c) -1 d) 1 e) none of these
- 28) Matrix $A = \begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$. The row 2, column 2 value of A^{-1} is
- a) -3 b) -1 c) 1 d) 2 e) none of these
- 29) Equation G is defined by $3x + xy + 1 = 0$. The expression that provides the slope of the tangent line at a point (x, y) on the graph of G is: $Slope = \frac{-y-3}{x}$. The slope of the tangent line at $x = 1$ is
- a) -2 b) -1 c) 1 d) 2 e) none of these
- 30) The graph of $13x^2 - 10xy + 12y^2 - 72 = 0$ is
- a) a parabola b) an ellipse or circle c) a hyperbola d) a line e) none of these

