1) If $f^{-1}(x) = \sqrt{x + a} + b$ is the inverse function of $f(x) = x^2 - 2x$, $x \geq 1$, then $a + b =$

A) 2

B) - 2

C) 0

D) 1

E) - 1

2) If $\log_3(1) = -3 + \left(\frac{1}{3}\right)^{x+2}$, then $3x + 1 =$

A) - 8

B) - 2

C) 0

D) 3

E) 10

3) The graph of the function $f(x) = \left| \log_{\frac{1}{2}}(-x+2) \right|$ is increasing on the interval

A) $(1, 2)$

B) $(1, \infty)$

C) $(-1, -2)$

D) $(-\infty, 2)$

E) $(-\infty, 1)$

4) If $\log_3(5) = y$, then $\log_5(9) =$

A) $\frac{2}{y}$

B) $\frac{3}{y}$

C) $3y$

D) $2y$

E) y^2

5) If the tires on a car have diameter 36 cm and are rotating at 70 revolutions per minute, then the speed of the car in cm per second is equal to:

A) 42π

B) 21π

C) 84π

D) 1260

E) 2520

6) $\sin\left(\frac{2\pi}{3}\right)\cos\left(\frac{5\pi}{6}\right) + \tan\left(\frac{11\pi}{4}\right) =$

A) $-\frac{7}{4}$

B) $\frac{1}{4}$

C) $-\frac{1}{4}$

D) $\frac{5}{4}$

E) $-\frac{5}{4}$

7) The graph of $y = -\sin(\pi x + \pi)$, $-1 \le x \le 1$, is increasing on the interval:

A) $(-\frac{1}{2}, \frac{1}{2})$

B) $(-1, \frac{1}{2})$

C) $(-\frac{1}{2}, 1)$

D) $(0, 1)$

E) $(\frac{1}{2}, 1)$

8) $\sin(\tan^{-1}\frac{3}{4} + \cos^{-1}\frac{5}{13}) =$

A) $\frac{63}{65}$

B) $-\frac{63}{65}$

C) $\frac{54}{65}$

D) $\frac{33}{65}$

E) $-\frac{33}{65}$

9) The range of the graph of $y = 2 - 2 \sec (x + \pi)$ is

A) $(-\infty, 0] \cup [4, \infty)$

B) $(-\infty, -2] \cup [2, \infty)$

C) $(-\infty, 1] \cup [2, \infty)$

D) $[-2, 2]$

E) $[0, 4]$

10) If $\tan \alpha = \frac{3}{2}$ and $\tan \beta = -2$, then $\tan (\alpha - \beta) =$

A) $-\frac{7}{4}$

B) $\frac{7}{2}$

C) $-\frac{1}{2}$

D) $\frac{7}{8}$

E) $\frac{1}{4}$

11) $\frac{\cos\theta}{1+\sin\theta} + \frac{1+\sin\theta}{\cos\theta} =$

A) $2\sec\theta$

B) $2\csc\theta$

C) $2\cos\theta$

D) $2\sin\theta$

E) $2\cot\theta$

12) $\sin\frac{9\pi}{8}\cos\frac{\pi}{8} =$

A) $-\frac{\sqrt{2}}{4}$

B) $-\frac{\sqrt{2}}{2}$

C) $\frac{\sqrt{2}}{8}$

D) $\frac{\sqrt{2}}{4}$

E) $\frac{\sqrt{2}}{2}$

13) The sum of all the solutions of the equation $2 \sin x \cos x + 3 \cos x = 0$ in the interval $[0, 2\pi)$, is equal to

A) 2π

B) $\frac{5\pi}{2}$

C) 3π

D) π

E) $\frac{3\pi}{2}$

14) Let $\alpha = \cos^{-1}\left(-\frac{2}{\sqrt{5}}\right)$ be the smallest positive angle between the vectors u and v. If $|u| = 5$ and $|v| = \sqrt{5}$ are the magnitudes of u and v, then the dot product $u \cdot v =$

A) -10

B) $-\frac{25}{2}$

C) $-\frac{1}{2}$

D) -5

E) $-\sqrt{5}$

15) The sum of all the possible values of k for which the system

$$\begin{cases} k^2x + 2x - 6y = 2 \\ kx + 2y = 12 \end{cases}$$ is inconsistent , is equal to

A) - 3

B) 1

C) - 1

D) 3

E) - 2

16) If (m, n) is the solution of the system $\begin{cases} 3x = y \\ 5x + 2y = 22 \end{cases}$, then $m + n =$

A) 8

B) 4

C) - 4

D) 6

E) - 2

17) If (a, b) is the solution of the system $\begin{cases} y = e^x - 5 \\ y = -2e^x + 1 \end{cases}$, then $e^a =$

A) 2

B) -3

C) 4

D) 0

E) -2

18) If $A = \begin{bmatrix} 2 & -1 & 3 \\ 4 & 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 \\ 0 & 3 \\ 2 & 1 \end{bmatrix}$, then the sum of all the elements of the matrix $AB =$

A) 9

B) 14

C) -5

D) 5

E) 3

19) If $A = \begin{bmatrix} 1 & 2 & -5 \\ 2 & 4 & 3 \\ 3 & -1 & -2 \end{bmatrix}$, then the element in the second row and third column of A^2 is equal to:

A) -4

B) 4

C) -5

D) 11

E) 19

20) If the augmented matrix $\left[\begin{array}{ccc|c} 1 & 1 & 1 & 1 \\ 3 & 4 & -1 & 13 \\ 2 & 2 & 0 & 6 \end{array}\right]$ is written in the echelon form as $\left[\begin{array}{ccc|c} 1 & 1 & 1 & 1 \\ 0 & 1 & k & m \\ 0 & 0 & 1 & n \end{array}\right]$, then $k + m + n =$

A) 4

B) 8

C) 6

D) 16

E) 10

21) If $A = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$, $BA = \begin{bmatrix} -1 & 2 \\ 4 & 3 \end{bmatrix}$, then the sum of all the elements of matrix B is equal to:

A) 1

B) -4

C) 3

D) 2

E) -2

22) If $A = \begin{bmatrix} 1 & 0 & -1 \\ 0 & 2 & 4 \\ -1 & 0 & 2 \end{bmatrix}$, then the sum of all the elements in the second row of A^{-1} is equal to

A) $-\frac{7}{2}$

B) $\frac{3}{2}$

C) $\frac{1}{2}$

D) 0

E) 2

23) The sum of all the solutions of $\begin{vmatrix} 0 & x & 2 \\ x-1 & 1 & -1 \\ 1 & 2 & -1 \end{vmatrix} = 2$, is equal to:

A) -2

B) -4

C) 1

D) 4

E) 2

24) If $A = \begin{bmatrix} 1 & -1 & 0 & 3 \\ 2 & 1 & 3 & -2 \\ 3 & 0 & 1 & 4 \\ 0 & 2 & 0 & -1 \end{bmatrix}$, then the cofactor A_{23} is

A) -7

B) 7

C) -8

D) 10

E) -10

25) Let A and B be 3 x 3 matrices. If $|A| = \frac{1}{2}$ and $|B| = \frac{1}{3}$ are the determinants of A and B, then $|2AB| - 2|B^{-1}| =$

A) $-\frac{14}{3}$

B) $\frac{14}{3}$

C) $-\frac{68}{3}$

D) $\frac{1}{3}$

E) $-\frac{1}{3}$

26) The equation of the directrix of the parabola $2y^2 - 8y - 8x = 0$, is

A) $x = -2$

B) $x = 0$

C) $x = -1$

D) $y = 1$

E) $y = 3$

27) The equation of the ellipse with foci $(-2, 7)$ and $(-2, 1)$ and minor axis of length 8 is

A) $\frac{(x+2)^2}{16} + \frac{(y-4)^2}{25} = 1$

B) $\frac{(x-2)^2}{16} + \frac{(y+4)^2}{25} = 1$

C) $\frac{(x-2)^2}{25} + \frac{(y+4)^2}{16} = 1$

D) $\frac{(x+2)^2}{25} + \frac{(y-4)^2}{16} = 1$

E) $\frac{(x+2)^2}{25} + \frac{(y+4)^2}{16} = 1$

28) If $[a, b]$ is the domain and $[c, d]$ is the range of the equation $4x = \sqrt{1 - \frac{y^2}{9}}$, then $a + b + c + d =$

A) $\frac{1}{4}$

B) $-\frac{1}{4}$

C) 0

D) 3

E) -3

29) The equation of one of the asymptotes of the hyperbola
$9x^2 - 4y^2 - 18x + 24y - 63 = 0$, is

A) $3x + 2y - 9 = 0$

B) $3x - 2y - 3 = 0$

C) $3x + 2y - 3 = 0$

D) $2x - 3y + 7 = 0$

E) $2x + 3y - 7 = 0$

30) One of the foci of the hyperbola with vertices at $(9, -2)$ and $(-7, -2)$, and eccentricity $e = \frac{5}{4}$, is

A) $(-9, -2)$

B) $(-4, -2)$

C) $(-11, -2)$

D) $(6, -2)$

E) $(12, -2)$