1. The **degree** of a polynomial of **lowest degree** with **real coefficients** and has **zeros** 3 (of multiplicity 2), $2-i$ (of multiplicity 4), and $1+\sqrt{2}$ is

(a) 6

(b) 11

(c) 8

(d) 12

(e) 5

2. The **sum** of all **integer zeros** of the polynomial $f(x)=x^3-\frac{4}{3}x^2-\frac{5}{3}x+\frac{2}{3}$ is

(a) 0

(b) 3

(c) -3

(d) -1

(e) 1

3. A polynomial $p(x)$ of **least degree** such that the graph of $p(x)$ **crosses** x-axis at $x = 3$, **touches** x-axis at $x = 1$, and has ***y*-intercept** 6 is

$(a)\ -2x^3+10x^2-14x+6$

$(b)\ -2x^3+2x^2+10x+6$

$(c)\ \dfrac{2}{3}(x^3-7x^2+15x+9)$

$(d)\ -2x^3-5x^2+7x+6$

$(e) 2x^2-8x+6$

4. Which one of the following equations represents the given graph?

$(a)\ y=-3\cos\left(2x+\dfrac{p}{2}\right)$

$(b)\ y=-3\cos x$

$(c)\ y=\sin\left(2x-\dfrac{p}{2}\right)$

$(d)\ y=-3\sin\left(2x+\dfrac{p}{2}\right)$

$(e)\ y=3\sin\left(x-\dfrac{p}{4}\right)$

5. If $\left(\frac{2}{3}\right)^{|k-5|} = \left(\frac{81}{16}\right)^{-|k|}$, then the **sum** of all **possible values** of k is equal to

(a) $\frac{5}{3}$

(b) $\frac{-5}{3}$

(c) $\frac{-2}{3}$

(d) 2

(e) $\frac{8}{3}$

6. The **domain** D and the **range** R of the function $f(x) = \frac{e^x + e^{-x}}{2}$ equal to

(a) $D = (-\infty, \infty),\ R = [\frac{1}{2}, \infty)$

(b) $D = (-\infty, 0),\ R = (-\infty, 1]$

(c) $D = (-\infty, \infty),\ R = (-\infty, \infty)$

(d) $D = [0, \infty),\ R = [0, \infty)$

(e) $D = (-\infty, \infty),\ R = [1, \infty)$

7. If $\log 2 = x$ and $\log 3 = y$, then $\log\left(\frac{9}{25}\right) =$

(a) $2x + 2y - 2$

(b) $2x - 2y - 2$

(c) $2y - 2x + 1$

(d) $2y - 2x + 2$

(e) $2y + \frac{2}{x}$

8. The **solution set** of the equation $\log_8(x+5) + \log_8(3x-1) = \log_4 16$ **consists of**

(a) one negative integer only

(b) two positive integers

(c) two negative integers

(d) one integer and one irrational number

(e) one positive integer only

9. The **radian measure** of the angle q that is **complementary** to the angle $58^{\circ}45'$ is **equal to**

$(a)\ \dfrac{25p}{36}$

$(b)\ \dfrac{25p}{144}$

$(c)\ \dfrac{144p}{25}$

$(d)\ \dfrac{21p}{120}$

$(e)\ \dfrac{5625}{p}$

10. A bicycle has wheels with **radius** 10 **inches**. If the wheels make 90 **revolutions** per **minute**, then the **linear speed** of the bicycle in inches per **minute** is

$(a) 900$

$(b) 450p$

$(c) 10800p$

$(d) 1800p$

$(e) 5400p$

11. The **exact value** of $\cos\frac{29\pi}{3}-\tan\frac{21\pi}{4}+\csc\left(-210^{\circ}\right)$ is

$(a)\ \frac{\sqrt{3}+1}{2}$

$(b)\ \frac{3}{2}$

$(c)\ \frac{-3}{2}$

$(d)\ \frac{-5}{2}$

$(e)\ \frac{\sqrt{3}-1}{2}$

12. The **graph** of $y=-\sin\left(2x-\frac{\pi}{2}\right), x\in\left[\frac{\pi}{4},\frac{9\pi}{4}\right]$, has

(a) 2 x-intercepts, 1 maximum value and 1 minimum value.

(b) 3 x-intercepts, 2 maximum values and 2 minimum values.

(c) 5 x-intercepts, 2 maximum values and 2 minimum values.

(d) 3 x-intercepts, 1 maximum value and 1 minimum value.

(e) 2 x-intercepts, 2 maximum values and 2 minimum values.

13. The **rectangular coordinates** (x, y) of the **point** $\mathrm{P}\left(\frac{-16p}{3}\right)$ on the **unit circle** are

(a) $\left(\frac{1}{2}, \frac{-\sqrt{3}}{2}\right)$

(b) $\left(\frac{-\sqrt{3}}{2}, \frac{1}{2}\right)$

(c) $\left(\frac{-\sqrt{3}}{2}, \frac{-1}{2}\right)$

(d) $\left(\frac{\sqrt{2}}{2}, \frac{-\sqrt{2}}{2}\right)$

(e) $\left(\frac{-1}{2}, \frac{\sqrt{3}}{2}\right)$

14. The **number** of **vertical asymptotes** of the **graph** of

$$y = 3\tan\left(\frac{1}{3}x - \frac{p}{6}\right), \text{ for } -6p \le x \le 6p$$

is

(a) 3

(b) 1

(c) 4

(d) 2

(e) 5

15. When **simplified** the **expression** $\dfrac{1}{\cos q} - \dfrac{\cos q}{1 + \sin q}$ is **identical** to

(a) $\tan q$
(b) $\sin q$
(c) $\cot q$
(d) $\sec q$
(e) $\csc q$

16. If $x = a$ and $y = b$ satisfy the system of the equations

$$\frac{1}{x} - \frac{2}{y} = 3$$

$$\frac{3}{x} + \frac{4}{y} = 14$$

then $a + b$ is equal to

(a) 0
(b) $\dfrac{7}{4}$
(c) $\dfrac{9}{4}$
(d) $-\dfrac{3}{2}$
(e) -6

17. The **value** of $\dfrac{(1-\tan 12^\circ \tan 33^\circ)}{\tan 12^\circ + \tan 33^\circ}(\cos 13^\circ \cos 17^\circ - \cos 77^\circ \cos 73^\circ)$ is equal to

(a) $\dfrac{-\sqrt{3}}{2}$

(b) $\dfrac{\sqrt{3}}{2}$

(c) $\dfrac{-\sqrt{2}}{2}$

(d) $\dfrac{\sqrt{2}}{2}$

(e) $\dfrac{-1}{2}$

18. If $\sin q = \dfrac{4}{5}$ and q in **quadrant II**, then $\cot 2q$ is **equal** to

(a) $\dfrac{-24}{25}$

(b) $\dfrac{-25}{7}$

(c) $\dfrac{5}{3}$

(d) $\dfrac{7}{24}$

(e) $\dfrac{-3}{5}$

19. The **sum** of **all solutions** of $\sin 4x \cos x - \cos 4x \sin x = 1$, for $0 \le x < 2p$, is **equal** to

(a) $\frac{5p}{2}$

(b) $\frac{15p}{2}$

(c) $\frac{9p}{2}$

(d) $\frac{p}{2}$

(e) $3p$

20. The **solution** of the equation $\sin^{-1}\frac{3}{5} + \cos^{-1} x = p$ is given by $x =$

(a) $\frac{-3}{5}$

(b) $\frac{4}{5}$

(c) $\frac{-4}{5}$

(d) $\frac{3}{5}$

(e) $\frac{-2}{5}$

21. Suppose that the <u>vector</u> **u** $=\overrightarrow{PQ}$, where the initial point is $P(5,\ 4)$ and terminal point is Q $(5,11)$. If **v** = $\sqrt{3}\,\mathbf{i}\ -8\mathbf{j}$, then the **magnitude** M and the **direction angle** $\boldsymbol{a}$ of the <u>vector</u> **u** + **v** are

(a) $M=4,\quad \boldsymbol{a}=\dfrac{\boldsymbol{p}}{6}$

(b) $M=2,\quad \boldsymbol{a}=\dfrac{11\boldsymbol{p}}{6}$

(c) $M=2,\quad \boldsymbol{a}=\dfrac{7\boldsymbol{p}}{6}$

(d) $M=2,\quad \boldsymbol{a}=\dfrac{5\boldsymbol{p}}{6}$

(e) $M=2,\quad \boldsymbol{a}=\dfrac{5\boldsymbol{p}}{36}$

22. If the **system** of **linear equations**

$$x+Ky=5$$
$$3x+5y=0$$

is **inconsistent**, then $K=$

(a) $\dfrac{-3}{5}$

(b) $\dfrac{-1}{5}$

(c) $\dfrac{1}{5}$

(d) $\dfrac{4}{5}$

(e) $\dfrac{5}{3}$

23. In a certain triangle, the **largest angle** is 20° **less than** the **sum** of the **other two angles**. Also, the **largest angle** is 10° **less than** twice of the **smallest angle**. Then the **largest angle** is **equal** to
[Hint: The sum of three angles in a triangle is 180°]

(a) 75°
(b) 55°
(c) 85°
(d) 80°
(e) 90°

24. If $A = \begin{bmatrix} 0 & -2 & 7 \\ 5 & 4 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 1 \\ -1 & 5 \\ 6 & 0 \end{bmatrix}$, $C = \begin{bmatrix} 40 & -10 \\ 28 & 23 \end{bmatrix}$, and $D = AB - C$, then the **element** in the **second row** and **second column** of the matrix D is equal to

(a) 2
(b) 48
(c) 0
(d) 28
(e) -10

25. Consider the **augmented matrix** of a **linear system**

$$\begin{bmatrix} 1 & -2 & -2 & \mathrm{M} & -1 \\ 1 & 1 & 1 & \mathrm{M} & 2 \\ 1 & 2 & 2 & \mathrm{M} & 1 \end{bmatrix}$$

Which one of the following statements is **TRUE** ?

(a) The system is independent.

(b) The system is dependent

(c) The system has the solution set $\left\{\left(2, 1, \frac{1}{2}\right)\right\}$

(d) The system has the solution set $\{(5, -1, -1)\}$

(e) The system has no solution.

26. Suppose that $A = \begin{bmatrix} 3 & 2 \\ 2 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 22 \\ 10 \end{bmatrix}$, and $X = \begin{bmatrix} x \\ y \end{bmatrix}$. If $AX = B$, then the **matrix** X is **equal** to

(a) $\begin{bmatrix} 2 & 2 \\ -2 & -3 \end{bmatrix}\begin{bmatrix} 22 \\ 10 \end{bmatrix}$

(b) $\begin{bmatrix} -2 & 2 \\ 2 & -3 \end{bmatrix}\begin{bmatrix} 22 \\ 10 \end{bmatrix}$

(c) $\begin{bmatrix} 11 \\ 5 \end{bmatrix}\begin{bmatrix} 2 & -2 \\ -2 & 3 \end{bmatrix}$

(d) $\begin{bmatrix} 2 & -2 \\ -2 & 3 \end{bmatrix}\begin{bmatrix} 11 \\ 5 \end{bmatrix}$

(e) $\begin{bmatrix} 22 \\ 10 \end{bmatrix}\begin{bmatrix} 1 & -1 \\ -1 & \frac{3}{2} \end{bmatrix}$

27. The **minor** and the **cofactor** of the **element** 0 in the **matrix** $\begin{bmatrix} -3 & 2 & 1 \\ -5 & 6 & 0 \\ -2 & -1 & 3 \end{bmatrix}$ are respectively

(a) 7 and -7

(b) -7 and 7

(c) 7 and 7

(d) -7 and -7

(e) 0 and -7

28. If A and B are two matrices of **order** 3×3 and $|A| = 4$ and $|B| = 5$, then the **value** of $2|A| - |2B^{-1}| =$

(a) -72

(b) -2

(c) $\frac{32}{5}$

(d) 7

(e) $\frac{38}{5}$