1. If \( p \wedge \sim r \rightarrow \sim p \wedge q \) is false, then the truth values of \( p, q \) and \( r \) are respectively
   a) T, F and F       b) F, F and T
   c) F, T and T       d) T, F and T

2. If \( \alpha, \beta \) and \( \gamma \) are the roots of equation \( x^2 - 8x + 8 = 0 \), then \( \sum \alpha^2 \) and \( \sum \frac{1}{\alpha \beta} \) are respectively
   a) 0 and -16       b) 16 and 8
   c) -16 and 0       d) 16 and 0

3. The GCD of 1080 and 675 is
   a) 145       b) 135
   c) 225       d) 125

4. If \( a, b \) and \( c \) \( \in \) N, then which one of the following is not true?
   a) \( a | b \) and \( a | c \) \( \Rightarrow \) \( a | 3b + 2c \)
   b) \( a | b \) and \( a | c \) \( \Rightarrow \) \( a | c \)
   c) \( a | b + c \) \( \Rightarrow \) \( a | ba \) and \( a | c \)
   d) \( a | b \) and \( a | c \) \( \Rightarrow \) \( a | b + c \)

5. \( x = 4 + \cos \theta \) and \( y = 1 + \sin \theta \) are the parametric equations of
   a) \( \frac{x-3)^2}{9} + \frac{y+4)^2}{16} = 1 \)
   b) \( \frac{x+4)^2}{16} + \frac{y+3)^2}{9} = 1 \)
   c) \( \frac{x-4)^2}{16} - \frac{y-3)^2}{9} = 1 \)
   d) \( \frac{x-4)^2}{16} + \frac{y-3)^2}{9} = 1 \)

6. If the distance between the foci and the distance between the directrices of the hyperbola \( \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \) are in the ratio 3:2, then \( a:b \) is
   a) \( \sqrt{2} : 1 \)
b  $\sqrt{3} : \sqrt{2}$

c  1:2

7. The ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ have in common

a centre only

b centre, foci and directrices

c centre, foci and vertices

d centre and vertices only

8. If sec $\theta = m$ and tan $\theta = n$, then $\frac{1}{m} + \frac{1}{n}$ is

a  2   b  2m

(c) 2n   (d) m

9. The value of $\frac{\sin 85^0 - \sin 35^0}{\cos 65^0}$ is

a  2   b  -1

(c) 1   (d) 0

10. If the length of the tangent from any point on the circle $x^2 + y^2 - 3x +3y + 2 = 5r^2$ to the circle $x^2 + y^2 - 2x + 2y + 2 = r^2$ is 16 unit, then the area between the two circles in sq unit is

a  $32\pi$   b  $4\pi$

(b) $8\pi$   (d) $256\pi$

11. The equation of the common tangent of the two touching circles $y^2 + x^2 - 6x + 12y + 37 = 0$ and $x^2 + y^2 - 6y + 7 = 0$ is

a  $x + y - 5 = 0$  b  $x - y + 5 = 0$

(c) $x - y - 5 = 0$  (d) $x + y + 5 = 0$

12. The equation of the parabolas with vertex at -1,1 and focus 2,1 is

a  $y^2 - 2y - 12x - 11 = 0$

(b) $x^2 + 2x - 12y + 13 = 0$
c $y^2-2y+12x+11 = 0$

d $y^2-2y-12x+13 = 0$

13. The equation of the line which is tangent to both the circle $x^2+y^2=5$ and the parabola $y^2=40x$ is

a $2x - y \pm 5 = 0$

b $2x - y + 5 = 0$

c $2x - y - 5 = 0$

(d) $2x + y + 5 = 0$

14. If $2A + 3B = \begin{pmatrix} 2 & -1 & 4 \\ 3 & 2 & 4 \end{pmatrix}$ and $A + 2B = \begin{pmatrix} 5 & 0 & 3 \\ 1 & 6 & 2 \end{pmatrix}$, then $B$ is

a $\begin{pmatrix} 8 & -1 & 2 \\ -1 & 10 & -1 \end{pmatrix}$

b $\begin{pmatrix} -1 & 10 & -1 \\ 8 & 1 & 2 \end{pmatrix}$

c $\begin{pmatrix} 8 & 1 & 2 \\ -1 & 10 & -1 \end{pmatrix}$

(d) $\begin{pmatrix} 8 & 1 & 2 \\ 1 & 10 & 1 \end{pmatrix}$

15. If $A = \begin{pmatrix} 1 & -3 \\ -2 & k \end{pmatrix}$ and $A^2 - 4A + 10I = A$, then $k$ is equal to

a $0$

b $-4$

c $4$

d $1$ or $4$

16. The value of $\begin{vmatrix} x+y & y+z & z+x \\ x+y & y+z & z+x \\ x-y & y-z & z-x \end{vmatrix}$ is equal to

a $2x+y+z^2$

b $2x+y+z^3$

c $x+y+z^3$

d $0$

17. On the set $Q$ of all rational numbers the operation $\ast$ which is both associative and commutative is given by $a \ast b$, is

a $a + b + ab$

b $a^2 + b^2$

c $ab + 1$

d $2a + 3b$

18. From an aeroplane flying vertically above a horizontal road, the angles of depression of two consecutive stones on the same side of aeroplane are observed to be $30^\circ$ and $60^\circ$ respectively. The height at which the aeroplane is flying in km is

a $\frac{4}{\sqrt{3}}$

b $\frac{3}{2}$
19. If the angles of a triangle are in the ratio 3:4:5, then the sides are in the ratio
\[ a^2 : \sqrt{3} : \sqrt{3}+1 \quad b^2 : \sqrt{3} : \sqrt{3}+1 \quad c^2 : \sqrt{3} : \sqrt{3}+1 \quad d : \sqrt{3} : \sqrt{3}+1 \]

20. If \( \cos^{-1} x = \alpha \), \( 0 < x < 1 \) and \( \sin^{-1} 2x + \frac{1}{2x^2 - 1} = \frac{2\pi}{3} \), then \( \tan^{-1} 2x \) equals
\[ a \: \frac{\pi}{6} \quad b \: \frac{\pi}{4} \quad c \: \frac{\pi}{3} \quad d \: \frac{\pi}{2} \]

21. If \( a > b > 0 \), then the value of \( \tan^{-1} \left( \frac{\alpha}{b} \right) + \tan^{-1} \left( \frac{a+b}{a-b} \right) \) depends on
\[ a \: \text{both } a \text{ and } b \quad b \: \text{b and not } a \quad c \: \text{a and not } b \quad d \: \text{neither } a \text{ nor } b \]

22. If \( A = \{a, b, c\}, B = \{b, c, d\} \) and \( C = \{a, d, c\} \), then \( A - B \cap B \cap C \) is equal to
\[ a \: \{a, c, a, d\} \quad b \: \{a, b, c, d\} \quad c \: \{c, a, d, a\} \quad d \: \{a, c, a, d, b, d\} \]

23. The function \( f: X \to Y \) defined by \( f(x) = \sin x \) is one-one but not onto, if \( X \) and \( Y \) are respectively equal to
\[ a \: \mathbb{R} \text{ and } \mathbb{R} \quad b \: [0, \pi] \text{ and } [0,1] \quad c \: [0, \frac{\pi}{2}] \text{ and } [-1,1] \quad d \: \left[ \frac{-\pi}{2}, \frac{\pi}{2} \right] \text{ and } [-1,1] \]

24. If \( \log_4 2 + \log_4 4 + \log_4 x + \log_4 16 = 6 \), then value of \( x \) is
\[ a \: 64 \quad b \: 4 \quad c \: 8 \quad d \: 32 \]

25. If \( S_n = \frac{1}{6.11} + \frac{1}{11.16} + \frac{1}{16.21} + \ldots \) to \( n \) terms then \( 6S_n \) equals
26. The remainder obtained when \(1!^2+2!^2+3!^2+\ldots+100!^2\) is divided by \(10^2\) is
   \[a\ 27\quad b\ 28\]
   \[c\ 17\quad d\ 14\]

27. In the group \(G=\{1,5,7,11\}\) under multiplication modulo 12, the solution of \(7^{-1} \otimes_{12} x \otimes_{12} 11= 5\) is equals
   \[a\ 5\quad b\ 1\]
   \[c\ 7\quad d\ 11\]

28. A subset of the additive group of real numbers which is not a subgroup is
   \[a\ \{0\}+.\quad b\ Z+.\]
   \[c\ N-.\quad d\ (d)\]

29. If \( \vec{a} = \hat{i}+\hat{j}, |\vec{a}|=4\hat{k}\) and \( \vec{b} = \hat{i}+\hat{k}, \) then the unit vector in the direction of \(3\vec{a}+\vec{b} -2\hat{k}\) is
   \[a\ \frac{1}{3}(\hat{i}+2\hat{j}+2\hat{k})\]
   \[b\ \frac{1}{3}(\hat{i}-2\hat{j}+2\hat{k})\]
   \[c\ \frac{1}{3}(\hat{i}-2\hat{j}+2\hat{k})\]
   \[d\ \hat{i}+2\hat{j}+2\hat{k}\]

30. If \( \vec{a}\) and \( \vec{b}\) are the two vectors such that \(\vec{a} = 3\hat{i}, |\vec{a}|=4\) and \(\vec{a} + \vec{b} = \frac{\vec{a}}{\sqrt{3}}\), then the angle between \(\vec{a}\) and \(\vec{b}\) is
   \[a\ 120^\circ\quad b\ 60^\circ\]
   \[c\ 30^\circ\quad d\ 150^\circ\]

31. If \(\vec{a}\) is vector perpendicular to both \(\vec{i}\) and \(\vec{j}\), then
   \[a\ \vec{a} + \vec{i} + \vec{j}\]
   \[b\ \vec{a} \times \vec{i} + \vec{j}\]
32. If the area of the parallelogram with \( \vec{a} \) and \( \vec{b} \) as two adjacent sides is 15 sq unit, then the area of the parallelogram having, \( 3\vec{a} + 2\vec{b} \) and \( \vec{a} + 3\vec{b} \) as two adjacent sides in sq unit is

a 120   b 105

c 75   d 45

33. If the lines \( x+3y-9 = 0, 4x+by-2 = 0 \) and \( 2x-y-4 = 0 \) are concurrent, then \( b \) equals

a -5   b 5

c 1   d 0

34. The equation of the circle having \( x-y-2 = 0 \) and \( x+y+2 = 0 \) as two tangents and \( x-y=0 \) as a diameter is

a \( x^2 + y^2 + 2x - 2y + 1 = 0 \)

b \( x^2 + y^2 - 2x + 2y - 1 = 0 \)

c \( x^2 + y^2 = 2 \)

d \( x^2 + y^2 = 1 \)

35. A circular sector of perimeter 60 m with maximum area is to be constructed. The radius of the circular arc in meter must be

a 20   b 5

c 15   d 10

36. \( \int \frac{x^3 + 3x^2 + 3x + 1}{(x+1)^5} \) \( dx \) is equal to

a \( \frac{1}{x+1} + c \)   b \( \frac{1}{5} \log x + 1 + c \)

c \( \log x + 1 + c \)   d \( \tan^{-1} x + c \)

37. \( \int \frac{\tan x}{\cos^2 \frac{1+\log \tan \frac{x}{2}}{2}} \) \( dx \) is equal to

a \( \sin^{-2}[1+\log \tan \frac{x}{2}] + c \)
\[ b \tan(1 + \log \tan \frac{x}{2}) + c \]
\[ c \sec^2(1 + \log \tan \frac{x}{2}) + c \]
\[ d - \tan(1 + \log \tan \frac{x}{2}) + c \]

38. The complex number \( \frac{(-\sqrt{3} + 3i)(1-i)}{3+\sqrt{3}i} \) when represented in the argand diagram is

a in the second quadrant
b in the first quadrant
c on the y-axis imaginary axis
d on the x-axis real axis

39. If \( 2x = -1 + \sqrt{3}i \), then the value of \( -x^2 + x^6 - 1 - x + x^2 \) is equal to

a 32  
\[ b -64 \]
\[ c 64 \]
\[ d 0 \]

40. The modulus and amplitude of \( 1 + i \sqrt{3} \) are respectively

a 256 and \( \frac{\pi}{3} \)
\[ b 256 \text{ and } \frac{2\pi}{3} \]
\[ c 2 \text{ and } \frac{2\pi}{3} \]
\[ d 256 \text{ and } \frac{8\pi}{3} \]

41. The value of \( \lim_{x \to 0} \frac{5^x - 5^{-x}}{2x} \) is

a \( \log 5 \)
\[ b 0 \]
\[ c 1 \]
\[ d 2 \log 5 \]

42. Which one of the following is not true always?

a If \( f(x) \) is not continuous at \( x = a \), then it is not differentiable at \( x = a \)
\[ b \] If \( f(x) \) is continuous at \( x = a \), then it is differentiable at \( x = a \)
\[ c \] If \( f(x) \) and \( g(x) \) are differentiable at \( x = a \), then \( f(x) + g(x) \) is also differentiable at \( x = a \)
d. If a function $f(x)$ is continuous at $x=a$, then $\lim_{x \to a} f(x)$ exists.

43. $\int \frac{dx}{x \sqrt{x^4 - 16}}$ is equal to

a. $\frac{1}{3} \sec^{-1} \left( \frac{x^2}{4} \right) + c$

b. $\cosh^{-1} \left( \frac{x^2}{4} \right) + c$

c. $\frac{1}{12} \sec^{-1} \left( \frac{x^2}{4} \right) + c$

d. $\sec^{-1} \left( \frac{x^2}{4} \right) + c$

44. If $I_1 = \int_0^{\pi/2} x \sin x \, dx$ and $I_2 = \int_0^{\pi/2} x \cos x \, dx$, then which one of the following is true?

a. $I_1 + I_2 = \frac{\pi}{2}$

b. $I_1 - I_2 = \frac{\pi}{2}$

d. $I_1 + I_2 = 0$

d. $I_1 = I_2$

45. If $f(x)$ is defined $[-2,2]$ by $f(x) = 4x^2 - 3x + 1$ and $g(x) = \frac{f(-x) - f(x)}{x^2 + 3}$, then $\int_{-2}^{2} g(x) \, dx$ is equal to

a. 64    b. -48    c. 0    d. 24

46. The area enclosed between the parabola $y = x^2 - x + 2$ and the line $y = x + 2$ in sq unit equals

a. $\frac{9}{2}$    b. $\frac{1}{2}$

c. $\frac{2}{3}$    d. $\frac{4}{3}$

47. The solution of the differential equation $e^y + 1 \, dy + \cos^2 x \, dx = 0$ subjected to the condition that $y = 1$ when $x = 0$ is

a. $y + \log y + e^x \cos^2 x = c$

b. $\log y + 1 + e^x \cos^2 x = 1$

c. $y + \log y = e^x \cos^2 x$

d. $y + 1 + e^x \cos^2 x = 2$

48. If the curve $y = 2x^2 + ax^2 + bx + c$ passes through the origin and the tangents drawn to it at $x = -1$ and $x = 2$ are parallel to the x axis, then the values of $a, b$ and $c$ are respectively

a. 12, -3 and 0    b. -3, 12 and 0

c. -3, 12 and 0    d. 3, -12 and 0
49. The locus of the point which moves such that the ratio of its distance from two fixed point in the plane is always a constant $k(<1$ is

a hyperbola  b ellipse

c straight line  d circle

50. The circles $ax^2+ay^2+2g_1x+2f_1y+c_1=0$ and $bx^2+by^2+2g_2x+2f_2y+c_2=0$ a $\neq 0$ and $b\neq 0$ cut orthogonally if

a $g_1g_2+f_1f_2=ac_1+bc_2$

b $2g_1g_2+f_1f_2=bc_1+ac_2$

c $bg_1g_2+a^2f_1f_2=bc_1+ac_2$

d $g_1g_2+f_1f_2=c_1+c_2$