1. If the lines $x-y-1=0$, $4x+3y=k$ and $2x-3y+1=0$ are concurrent, then $k$ is
   a 1    b -1
c 25    d 5

2. The number of common tangents to the circles $x^2+y^2 = 4$ and $x^2+y^2-8x+12 = 0$ is
   a 1    b 2    c 3    d 4

3. The centroid of a triangle formed by the points $0,0, \cos \theta, \sin \theta$ and $\sin \theta, -\cos \theta$ lie on the line $y = 2x$; then $\theta$ is
   a $\tan^{-1} 2$    b $\tan^{-1} \frac{1}{3}$
c $\tan^{-1} \frac{1}{2}$    d $\tan^{-1} -3$

4. The orthocentre of the triangle formed by 8,0 and 4,6 with the origin, is
   a 4, $\frac{8}{3}$    b 3, -4
   b 4,3    d 3,4

5. If the angle between two lines represented by $2x^2+5xy+3y^2+7y+4 = 0$ is $\tan^{-1} m$, then $m$ is equal to
   a $\frac{1}{5}$    b 1
   c $\frac{7}{5}$    d 7

6. If $xy-4x+3y-\lambda = 0$ represents the asymptotes of $xy-4x+3y = 0$, then $\lambda$ is
   a 3    b -6    c 8    d 12

7. The equation of the chord of the parabola $y^2 = 8x$ which is bisected at the point 2, -3, is
   a $4x+3y+1 = 0$
b $3x+4y -1 = 0$
c $4x -3y-1 = 0$
d $3x -4y+1 =0$

8. If $x+y+1 = 0$ touches the parabola $y^2 = \lambda x$, then $\lambda$ is equal to
9. The equations \( x = \frac{e^t + e^{-t}}{2}, \ y = \frac{e^t - e^{-t}}{2} \) where \( t \) is real number, represents

a) an ellipse  b) a parabola  
c) a hyperbola  d) a circle

10. If \( e_1 \) and \( e_2 \) are the eccentricities of two conics with \( e_1^2 + e_2^2 = 3 \), then the conics are

a) ellipses  b) parabolas  
c) circles  d) hyperbolas

11. The sum of the distances of any point on the ellipse \( 3x^2 + 4y^2 = 24 \) from its foci, is

a) \( 8 \sqrt{2} \)  b) \( 8 \)  
c) \( 16 \sqrt{2} \)  d) \( 4 \sqrt{2} \)

12. In \( \triangle ABC \), if \( a \) tends to \( 2c \) and \( b \) tends to \( 3c \), then \( \cos B \) tends to

a) \(-1\)  b) \( \frac{1}{2} \)  c) \( \frac{1}{3} \)  d) \( \frac{2}{3} \)

13. If \( \sin \pi \cos \theta = \cos \pi \sin \theta \), then which of the following is correct

a) \( \cos \theta = \frac{3}{2 \sqrt{2}} \)  
b) \( \cos \left( \theta - \frac{\pi}{2} \right) = \frac{1}{2 \sqrt{2}} \)  
c) \( \cos \left( \theta - \frac{\pi}{4} \right) = \frac{1}{\sqrt{2}} \)  
d) \( \cos \left( \theta + \frac{\pi}{4} \right) = -\frac{1}{\sqrt{2}} \)

14. The value of \( \sin 12^0 \sin 48^0 \sin 54^0 \) is equal to

a) \( \frac{2}{3} \)  b) \( \frac{1}{2} \)  
(c) \( \frac{1}{8} \)  (d) \( \frac{1}{3} \)

15. If \( 3 \sin^{-1} \left( \frac{2x}{1+x^2} \right) - 4 \cos^{-1} \left( \frac{1-x^2}{1+x^2} \right) + 2 \tan^{-1} \left( \frac{2x}{1-x^2} \right) = \frac{\pi}{3} \), then \( x \) is equal to

a) \( \frac{1}{\sqrt{3}} \)  b) \( -\frac{1}{\sqrt{3}} \)
16. The shadow of a pole is $\sqrt{3}$ times longer. The angle of elevation is equal to:
   a) 40°  b) 45°  c) $\frac{\pi}{3}$  d) 30°

17. The point of contact of the line $x - y + 2 = 0$ with the parabola $y^2 - 8x = 0$ is:
   a) 2, 4  b) -2, 4  c) 2, -4  d) 2, 2

18. If the sides of a triangle are $x^2 + x + 1$, $x^2 - 1$, and $2x + 1$, then the greatest angle is:
   a) 90°  b) 135°  c) 115°  d) 120°

19. The value of $\cos 10^\circ \cdot \cos 20^\circ \cdot \cos 30^\circ \cdots \cos 1790^\circ$ is equal to:
   a) $\frac{1}{\sqrt{2}}$  b) 0  c) 1  d) -1

20. If $\cot \alpha + \beta = 0$, then $\sin \alpha + 2\beta$ is equal to:
   a) $\sin \alpha$  b) $\cos \alpha$  c) $\sin \beta$  d) $\cos 2\beta$

21. The value of $4 \sin A \cos^3 A - 4 \cos A \sin^3 A$ is equal to:
   a) $\cos 2A$  b) $\sin 3A$  c) $\sin 2A$  d) $\sin 4A$

22. If the solutions for $q$ of $\cos q + \cos p = 0$, $0 < q < p$ are in AP, then the numerically smallest common difference of AP is:
   a) $\frac{\pi}{p + q}$  b) $\frac{2\pi}{p + q}$  c) $\frac{\pi}{2(p + q)}$  d) $\frac{1}{p + q}$

23. The value of $k$ for which $\cos x + \sin x - 2 + k \sin x \cos x - 1 = 0$ is an identity is:
   a) -1  b) -2  c) 0  d) 1
24. If $4 \cos^{-1} x + \sin^{-1} x = \pi$, then the value of $x$ is
   a $\frac{1}{2}$  b $\frac{1}{\sqrt{2}}$
   c $\frac{\sqrt{3}}{2}$  d $\frac{2}{\sqrt{3}}$

25. A problem in mathematics is given to 3 students whose chances of solving individually are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$. The probability that the problem will be solved at least by one, is
   a $\frac{1}{4}$  b $\frac{1}{24}$
   c $\frac{23}{24}$  d $\frac{3}{4}$

26. In a non-leap year the probability of getting 53 Sundays or 53 Tuesdays or 53 Thursdays is
   a $\frac{1}{7}$  b $\frac{2}{7}$
   c $\frac{3}{7}$  d $\frac{4}{7}$

27. The probability for a randomly chosen month to have its 10th day as Sunday, is
   a $\frac{1}{36}$  b $\frac{10}{12}$
   c $\frac{10}{84}$  d $\frac{1}{7}$

28. If the mean of numbers $27+x, 31+x, 89+x, 107+x, 156+x$ is 82, then the mean of $130+x, 126+x, 68+x, 50+x, 1+x$ is
   a 79  b 157
   c 82  d 75

29. If $\mu$ is the mean distribution of $\{Y_i, f_i\}$, then $\sum f_i(y_i - \mu)$ is equal to
   a MD  b SD
   c 0  d relative frequency

30. Two cards are drawn successively with replacement from a well-shuffled pack of 52 cards. The probability of drawing two aces is
   a $\frac{1}{13}$  b $\frac{1}{13} \times \frac{1}{17}$
   c $\frac{1}{52} \times \frac{1}{51}$  d $\frac{1}{13} \times \frac{1}{13}$
31. If \( \sec \left( \frac{x+y}{x-y} \right) = a \), then \( \frac{dy}{dx} \) is

\[ a \quad \frac{x}{y} \quad \text{b} \quad \frac{y}{x} \quad \text{c} \quad \frac{y}{d \quad x} \]

32. If \( x^y = e^x \), then \( \frac{dy}{dx} \) is equal to

\[ a \quad \frac{\log x}{x \log x} \quad \text{b} \quad \frac{\log x}{x - \log x} \quad \text{c} \quad \frac{\log x}{x + \log x} \quad \text{d} \quad \frac{y \log x}{x (1 + \log x)} \]

33. For \( y = \cos x \sin^{-1} x \) which of the following is true?

\[ a \quad 1 - x^2 y_2 + xy_1 - m^2 y = 0 \]
\[ b \quad 1 - x^2 y_2 - xy_1 + m^2 y = 0 \]
\[ c \quad 1 + x^2 y_2 + xy_1 - m^2 y = 0 \]
\[ d \quad 1 - x^2 y_2 + xy_1 + m^2 y = 0 \]

34. If \( f(x) = \begin{cases} x + 1 & \text{for} \quad x \leq 1 \\ 3 - ax^2 & \text{for} \quad x > 1 \end{cases} \) is continuous at \( x = 1 \), then the value of \( a \) is

\[ a \quad -1 \quad \text{b} \quad 2 \quad \text{c} \quad -3 \quad \text{d} \quad 1 \]

35. \( \lim_{x \to 2} \frac{\alpha \cot x - \alpha \cot x}{\cot x - \cos x} \) is equal to

\[ a \quad \log a \quad \text{b} \quad \log 2 \quad \text{c} \quad \log a \quad \text{d} \quad \log x \]

36. If \( f'(0) = k \), then \( \lim_{x \to 0} \frac{2f(x) - 3f(2x) + f(4x)}{x^2} \) is equal to

\[ a \quad k \quad \text{b} \quad 2k \quad \text{c} \quad 3k \quad \text{d} \quad 4k \quad \text{e} \quad k \]

37. If \( g \) is the inverse function of \( f \) and \( f'(x) = \frac{1}{1 + x^2} \), then \( g'(x) \) is equal to

\[ a \quad 1+gx \quad \text{b} \quad 1 - gx \quad \text{c} \quad 1+gx \quad \text{d} \quad 1 - gx \]

38. The curves \( 4x^2 + 9y^2 = 72 \) and \( x^2 - y^2 = 5 \) at \( 3,2 \)
39. The velocity \( v \) m/s of a particle is proportional to the cube of the time. If the velocity after 2 s is 4 m/s, then \( v \) is equal to

\[
\frac{t^3}{2}
\]

40. The minimum value of \( x \log x \) is equal to

\[
\frac{1}{e}
\]

41. A particle moves along the x-axis so that its position is given \( x = 2t^3 - 3t^2 \) at a time \( t \) second. What is the time interval during which particle will be on the negative half of the axis?

\[
0 < t < \frac{3}{2}
\]

42. A stone thrown vertically upwards satisfies the equations \( s = 80t - 16t^2 \). The time required to reach the maximum height is

\[
2 s
\]

43. If \( f(x+y = f(x, f(y, f(3 = 3, f'0 = 11. Then \( f'3 \) is equal to

\[
11.33
\]

44. If \( y = x \tan y \), then \( \frac{dy}{dx} \) is equal to

\[
\frac{\tan y}{x^2-y^2}
\]

45. The product of the lengths of subtangent and subnormal at any point \( x,y \) of a curve is
46. The equation of tangent to the curve

\[ \left( \frac{x}{a} \right)^n + \left( \frac{y}{b} \right)^n = 2 \]

a x_a^2 \quad b y^2 \quad c a constant \quad d x

47. If \( \int_0^\infty \frac{x^2dx}{x^2+a^2(x^2+b^2)(x^2+c^2)} = \frac{\pi}{2(a+b)(b+c)(c+a)} \), then the value of \( \int_0^\infty \frac{1}{x^2+4(x^2+9)} \) is

\[ a \frac{\pi}{60} \quad b \frac{\pi}{20} \quad c \frac{\pi}{40} \quad d \frac{\pi}{80} \]

48. \( \int e^{a \log x} + e^{x \log a} \) dx is equal to

\[ a \frac{x^{a+1}}{a+1} + c \quad b \frac{x^{a+1}}{a+1} + \frac{a^x}{\log a} + c \quad c \quad d \frac{x^{a+1}}{a-1} + \frac{\log x}{a^x} + c \]

49. \( \int_0^a \frac{dx}{x+\sqrt{a^2-x^2}} \) is

\[ (a) \frac{\pi}{4} \quad b \frac{\pi}{2} \quad c \frac{\pi}{4} \quad (c) \pi \]

50. If \( \int_{-1}^1 f(x) \) dx = 4 and \( \int_2^4 [3 - f(x) \) dx = 7, then the value of \( \int_{-1}^a f(x) \) dx is

\[ a \quad -2 \quad b \quad 3 \quad c \quad 5 \quad d \quad 8 \]