Q1. The integrating factor of the differential equation $(1-x^2)\frac{dy}{dx}+xy=ax, -1<x<1$, is: **1 Mark**

A $\frac{1}{x^2-1}$ **B** $\frac{1}{\sqrt{x^2-1}}$

C $\frac{1}{1-x^2}$ **D** $\frac{1}{\sqrt{1-x^2}}$

Q2. $\int_1^e \frac{\log x}{x}dx$, is equal to:

A $\frac{e^2}{2}$ **B** 1

C $\frac{1}{2}$ **D** $-\infty$

Q3. The maximum value of slope of the curve $y=-x^3+3x^2+12x-5$ is **1 Mark**

A 15 **B** 12 **C** 9 **D** 0

Q4. Which of the following statements is true for the function $f(x)=\begin{cases} x+3, & x\neq 0 \\ & ? \\ 1 & , \quad x=0 \end{cases}$ **1 Mark**

A f(x) is continuous and differentiable $\forall\, x \in \mathbb{R}$ **B** f(x) is continuous $\forall\, x \in \mathbb{R}$

C f(x) is continuous and differentiable $\forall\, x \in \mathbb{R}-(0)$ **D** f(x) is discontinuous at infinitely many points

Q5. The value of k for which $f(x)=\begin{cases} 3x+5, & x\geq 2 \\ kx^2, & x<2 \end{cases}$ is a continuous function, is: **1 Mark**

A $-\frac{11}{4}$ **B** $\frac{4}{11}$ **C** 11 **D** $\frac{11}{4}$

Q6. The function f(x) = |x| - x is: **1 Mark**

A Continuous but not differentiable at x = 0. **B** Continuous and differentiable at x = 0.

C Neither continuous nor differentiable at x = 0. **D** Differentiable but not continuous at x = 0.

Q7. $\int x^2e^{x^3}dx$ equals: **1 Mark**

A $\frac{1}{3}e^{x^3}+C$ **B** $\frac{1}{3}e^{x^4}+C$

C $\frac{1}{2}e^{x^3}+C$ **D** $\frac{1}{2}e^{x^2}+C$

Q8. The sum of the order and the degree of the differential equation $\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)=\sin y$ is: **1 Mark**

A 5 **B** 2 **C** 3 **D** 4

Q9. For what value of k may the function $\begin{cases} k(3x^2-5x), & x\leq 0 \\ \cos x, & x>0 \end{cases}$ become continuous? **1 Mark**

A 0 **B** 1 **C** $-\frac{1}{2}$ **D** No value

Q10. The derivative of log x with respect to $\frac{1}{x}$ is **1 Mark**

A $-\frac{1}{x^3}$ **B** $-\frac{1}{x}$

C $-x$ **D** $\frac{1}{x}$

Q11. The interval in which the function f given by $f(x)=x^2e^{-x}$ is strictly increasing, is: **1 Mark**

A $(-\infty,\infty)$ **B** $(-\infty,0)$ **C** $(2,\infty)$ **D** $(0,2)$

Q12. $\int_0^{\frac{\pi}{6}} \sec^2\left(x-\frac{\pi}{6}\right)dx$ is equal to: **1 Mark**

A $\frac{1}{\sqrt{3}}$ **B** $-\frac{1}{\sqrt{3}}$ **C** $\sqrt{3}$ **D** $-\sqrt{3}$

Q13. If $\frac{d}{dx}(f(x)) = \log x$, then f(x) equals: **1 Mark**

A $-\frac{1}{x} + C$ **B** $x(\log x - 1) + C$

C $x(\log x + x) + C$ **D** $\frac{1}{x} + C$

Q14. The value of k so that f defined by $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & \text{if} \quad x \neq 0 \\ k & \text{if} \quad x = 0 \end{cases}$ is continuous at x = 0 is **1 Mark**

A 0 **B** $\frac{1}{2}$ **C** 1 **D** 2

Q15. $\int \frac{1}{x \log x} dx$ is equal to: **1 Mark**

A $\frac{(\log x)^2}{2} + c$ **B** $\log|\log x| + c$

C $\log|x \log x| + c$ **D** $\frac{1}{\log x} + c$

Q16. The order of the differential equation of the family of circles touching x-axis at the origin is: **1 Mark**

A 1 **B** 2 **C** 3 **D** 4

Q17. $\int 4^x 3^x dx$ equals:

A $\frac{12^x}{\log 12} + C$ **B** $\frac{4^x}{\log 4} + C$

C $\left(\frac{4^x.3^x}{\log 4.\log 3}\right) + C$ **D** $\frac{3^x}{\log 3} + C$

Q18. The primitive of $\frac{2}{1+\cos 2x}$ is:

A $\sec^2 x$ **B** $2 \sec^2 x \tan x$ **C** $\tan x$ **D** $-\cot x$

Q19. $\int \frac{1+\tan x}{1-\tan x} dx$ is equal to: **1 Mark**

A $\sec^2\left(\frac{\pi}{4} + x\right) + C$ **B** $\sec^2\left(\frac{\pi}{4} - x\right) + C$

C $\log\left|\sec\left(\frac{\pi}{4} + x\right)\right| + C$ **D** $\log\left|\sec\left(\frac{\pi}{4} - x\right)\right| + C$

Q20. If f(x) = a(x - cos x) is strictly decreasing in R, then 'a' belongs to: **1 Mark**

A {0} **B** (0, ∞) **C** (-∞, 0) **D** (-∞, ∞)

Q21. If $y = \log_e\left(\frac{x^2}{e^2}\right)$, then $\frac{d^2y}{dx^2}$ is equal to: **1 Mark**

A $-\frac{1}{x}$ **B** $-\frac{1}{x^2}$

C $\frac{2}{x^2}$ **D** $-\frac{2}{x^2}$

Q22. The number of arbitrary constants in the particular solution of a differential equation of second order is (are): **1 Mark**

A 0 **B** 1 **C** 2 **D** 3

Q23. The general solution of the differential equation x dy - (1 + x^2) dx = dx is: **1 Mark**

A $y = 2x + \frac{x^3}{3} + C$ **B** $y = 2\log x + \frac{x^3}{3} + C$

C $y = \frac{x^2}{2} + C$ **D** $y = 2\log x + \frac{x^2}{2} + C$

Q24. The integrating factor of the differential equation $(x + 3y^2)\frac{dy}{dx} = y$ is: **1 Mark**

A y **B** $-y$ **C** $\frac{1}{y}$ **D** $-\frac{1}{y}$

Q25. $\int e^x\left(\frac{x \log x + 1}{x}\right) dx$ is equal to: **1 Mark**

A $\log(e^x \log x) + c$ **B** $\frac{e^x}{x} + c$

C $x \log x + e^x + c$ **D** $e^x \log x + c$

Q26. **1 Mark**

The degree of the differential equation $x^2\frac{d^2y}{dx^2} = \left(x\frac{dy}{dx} - y\right)^3$ is

A 1 **B** 2 **C** 3 **D** 6

Q27. The function $f(x) = \frac{x-1}{x(x^2-1)}$ is discontinuous at **1 Mark**

A Exactly one point. **B** Exactly two points. **C** Exactly three points. **D** No point.

Q28. $\int \frac{e^x(1+x)}{\cos^2(xe^x)}dx$ is equal to **1 Mark**

A $\tan(xe^x) + c$ **B** $\cos(xe^x) + c$

C $\cot(e^x) + c$ **D** $\tan[e^x(1+x)] + c$

Q29. $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sec^2 x\, dx$ is equal to: **1 Mark**

A -1 **B** 0 **C** 1 **D** 2

Q30. The function f: R → R given by f(x) = – |x – 1| is: **1 Mark**

A Continuous as well as differentiable at x = 1. **B** Not continuous but differentiable at x = 1.

C Continuous but not differentiable at x = 1. **D** Neither continuous nor differentiable at x = 1.

Q31. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{1}{x^2}\sin\left(\frac{1}{x}\right)dx$, wheere $x \neq 0$ is equal to: **1 Mark**

A -2 **B** 0 **C** 1 **D** π

Q32. $\int_a^b f(x)\,dx$ is equal to: **1 Mark**

A $\int_a^b f(a-x)dx$ **B** $\int_a^b f(a+b-x)dx$

C $\int_a^b f(x-(a+b))dx$ **D** $\int_a^b f((a-(a-x))+(b-x))dx$

Q33. A tank, as shown in the figure below, formed using a combination of a cylinder and a cone, offers better drainage as compared to a flat bottomed tank. **4 Marks**

A tap is connected to such a tank whose conical part is full of water. Water is dripping out from a tap at the bottom at the uniform rate of $2cm^3/s$. The semi-vertical angle of the conical tank is 45°.

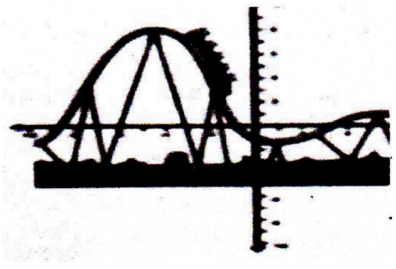
On the basis of given information, answer the following questions:

1. Find the volume of water in the tank in terms of its radius r.
2. Find rate of change of radius at an instant when $r = 2\sqrt{2}cm$.
3. Find the rate at which the wet surface of the conical tank is decreasing at an instant when radius $r = 2\sqrt{2}cm$.

OR

3. Find the rate of change of height 'h' at an instant when slant height is 4cm.

Q34. The equation of the path traced by a roller-coaster is given by the polynomial f(x) = a (x + 9) (x + 1) (x - 3). If the roller-coaster crosses y-axis at a point (0, -1), answer the following: **4 Marks**



1. Find the value of ‘a’.
2. Find f"(x) at x = 1.