Shiksha Classes Bhandara

Mathematics **Topic : Differential Equations** **MM 100**

Q.1 If solution of differential equation $\frac{dy}{dx} - y = 1 - e^{-x}$ and $y(0) = y_0$ has a finite value. When $x \to \infty$ then, y_0 is equal to
(A) –1/2 (B) 0
(C) 1 (D) –1

Q.2 If $\int_a^x t\,y(t)dt = x^2 + y(x)$ then y as a function of x is
(A) $y = 2 - (2 + a^2)e^{\frac{x^2 - a^2}{2}}$ (B) $y = 1 - (2 + a^2)e^{\frac{x^2 - a^2}{2}}$
(C) $y = 2 - (1 + a^2)e^{\frac{x^2 - a^2}{2}}$ (D) none

Q.3 The equation of the curve satisfying the differential equation $y(x + y^3)\,dx = x(y^3 - x)\,dy$ and passing through the point (1, 1) is
(A) $y^3 - 2x + 3x^2y = 0$ (B) $y^3 + 2x + 3x^2y = 0$
(C) $y^3 + 2x - 3x^2y = 0$ (D) None of these

Q.4 The differential equation representing the family of hyperbolas $a^2x^2 - b^2y^2 = c^2$ is
(A) $\frac{y''}{y'} + \frac{y'}{y} = \frac{1}{x}$ (B) $\frac{y''}{y'} + \frac{y'}{y} = \frac{1}{x^2}$
(C) $\frac{y''}{y'} - \frac{y'}{y} = \frac{1}{x}$ (D) $\frac{y''}{y'} = \frac{y}{y'} - \frac{1}{x}$

Q.5 Solution of the differential equation $\frac{dy}{dx} + \frac{y}{x} = \sin x$ is
(A) x (y + cos x) = cos x + C
(B) x (y – cos x) = sin x + C(C) x
(y + cos x) = sinx + C
(D) None of these

Q.6 If $y = \frac{x}{\ln|cx|}$ (where c is an arbitrary constant) is the general solution of the differential equation $\frac{dy}{dx} = \frac{y}{x} + \phi\left(\frac{x}{y}\right)$ then the function $\phi\left(\frac{x}{y}\right)$ is :
(A) $\frac{x^2}{y^2}$ (B) $-\frac{x^2}{y^2}$
(C) $\frac{y^2}{x^2}$ (D) $-\frac{y^2}{x^2}$

Q.7 The solution of the differential equation,
$2x^2y\frac{dy}{dx} = \tan(x^2y^2) - 2xy^2$ given $y(1) = \sqrt{\frac{\pi}{2}}$ is
(A) $\sin x^2y^2 = e^{x-1}$ (B) $\sin(x^2y^2) = x$
(C) $\cos x^2y^2 + x = 0$ (D) $\sin(x^2y^2) = e.e^x$

Q.8 The solution of the differential equation $\frac{dy}{dx} + 1 = e^{x+y}$ is
(A) $(x + y)\,e^{x+y} = 0$ (B) $(x + c)\,e^{x+y} = 0$
(C) $(x - c)\,e^{x+y} = 1$ (D) $(x - c)\,e^{x+y} + 1 = 0$

Q.9 The general solution of the differential equation
$(1 + y^2)\,dx + (1 + x^2)\,dy = 0$ is
(A) mx – y = C (1 – xy) (B) x – y = C (1 + xy)
(C) (x + y) = C (1 – xy) (D) x + y = C (1 + xy)

Q.10 The curve which satisfies the differential equation y'= 3x/y and passes through (1, 1) is a-
(A) Pair of lines through the origin
(B) Hyperbola with eccentricity 2
(C) Hyperbola with eccentricity $2/\sqrt{3}$
(D) None of these

Q.11 A population grows at the rate of 5% per year. Then the population will be doubled in –
(A) 10 log 2 years (B) 20 log 2 years
(C) 30 log 2 years (D) None of these

Q.12 The differential equation of all ellipses centred at the origin having major and minor axes along coordinate axes is
(A) $xyy_2 - xy_1^2 + yy_1 = 0$ (B) $xyy_2 + xy_1^2 - yy_1 = 0$
(C) $xyy_2 + xy_1^2 + yy_1 = 0$ (D) none of these

Q.13 The x-intercept of the tangent to a curve is equal to the ordinate of the point of contact. The equation of the curve through the point (1, 1) is
(A) $ye^{\frac{x}{y}} = e$ (B) $xe^{\frac{x}{y}} = e$
(C) $xe^{\frac{y}{x}} = e$ (D) $ye^{\frac{y}{x}} = e$

Q.14 Spherical rain drop evaporates at a rate proportional to its surface area. The differential equation corresponding to the rate of change of the radius of the rain drop if the constant of proportionality is K > 0, is
(A) $\frac{dr}{dt} + K = 0$ (B) $\frac{dr}{dt} - K = 0$
(C) $\frac{dr}{dt} = Kr$ (D) none

Q.15 The differential equation of the system of circles touching the x-axis at origin is –
(A) $(x^2 - y^2)\frac{dy}{dx} + 2xy = 0$
(B) $(x^2 - y^2)\frac{dy}{dx} - 2xy = 0$
(C) $(x^2 + y^2)\frac{dy}{dx} + 2xy = 0$
(D) a second order differential equation

Q.16 Differential equation $\frac{dy}{dx} + \frac{9x}{4y} = 0$ represents a family of
(A) parallel straight lines whose slope is $\tan^{-1}(3/2)$
(B) concentric circles with centre at (3, 2)
(C) ellipses with eccentricity $\sqrt{5}/3$
(D) hyperbolas with eccentricity $\sqrt{5}/2$

Q.17 The solution of the differential equation
$e^x(x + 1)\,dx + (ye^y - xe^x)\,dy = 0$ with initial conditions f (0) = 0 is –
(A) $xe^x + 2y^2e^y = 0$ (B) $2xe^x + y^2e^y = 0$
(C) $xe^x - 2y^2e^x = 0$ (D) $2xe^x - y^2e^y = 0$

Q.18 The differential equation of the curve given by $y = ax + (b/x)$ is

(A) $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$

(B) $x^2 \frac{d^2y}{dx^2} + 2x\frac{dy}{dx} + 2y = 0$

(C) $x^2 \frac{d^2y}{dx^2} V + x\frac{dy}{dx} - y = 0$

(D) $x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 0$

Q.19 The curve in which the slope of the tangent at any point equals the ratio of the abscissa to the ordinate of the point is

(A) an ellipse (B) a parabola
(C) a rectangular hyperbola (D) none of these

Q.20 If the curve $y = f(x)$ passes through (1, 2) and satisfies the differential equation $y(1 + xy)dx - xdy = 0$, then

(A) $f(x) = \frac{2x}{2-x^2}$ (B) $f(x) = \frac{x+1}{x^2+1}$

(C) $f(x) = \frac{x-1}{4-x^2}$ (D) $f(x) = \frac{4x}{1-2x^2}$

For Q.21-Q.25 :

The answer to each question is a NUMERICAL VALUE.

Q.21 The degree of the differential equation, of which $y^2 = 4a(x + a)$ is a solution, is –

Q.22 The degree of differential equation

$$x = 1 + \left(\frac{dy}{dx}\right) + \frac{1}{2!}\left(\frac{dy}{dx}\right)^2 + \frac{1}{3!}\left(\frac{dy}{dx}\right)^3 + ...$$

Q.23 The degree of the differential equation

$$\left(\frac{d^4y}{dx^4}\right)^{3/5} - 5\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 5 = 0$$ is –

Q.24 A tank contains 30 lit. of a chemical solution prepared by dissolving 120 gm of a soluble substance in the fresh water. Fluid containing 4 gm. of this substance per lit. runs in at the rate of 4 lit./min. and the well–stirred mixture runs out at the same rate. The amount (in gm) of substance in the tank after 30 min. is

Q.25 The order of the differential equation associated with the primitive $y = c_1 + c_2e^x + c_3e^{-2x+c_4}$, where c_1, c_2, c_3, c_4 are arbitrary constants, is


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