MATHS

BOOKS - DISHA PUBLICATION MATHS (HINGLISH)

DIFFERENTIAL EQUATIONS

Jee Main 5 Years At A Glance

1. Let $y = g(x)$ be the solution of the differential equation $\frac{\sin(dy)}{dx} + y\cos x = 4x, x \in (0, \pi)$ If y(pi/2)=0, $then$y(pi/6)` is equal to

A. $\frac{-8}{9\sqrt{3}}\pi^2$

B. $-\frac{8}{9}\pi^2$

C. $-\frac{4}{9}\pi^2$

D. $\frac{4}{9\sqrt{3}}\pi^2$

Answer: B

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2. The differential equation representing the family of ellipse having foci either on the x-asix or on the y-axis centre at the origin and passing through the point (0,3) is :

A. $xyy' + y^2 - 9 = 0$

B. $x + yy'' = 0$

C. $xyy'' + x(y')^2 - yy' = 0$

D. $xyy' - y^2 + 9 = 0$

Answer: C

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3. If $(2+\sin x)\frac{dy}{dx}+(y+1)\cos x=0$ and $y(0)=1$, then $y\left(\frac{\pi}{2}\right)$ is equal to :

A. $\frac{4}{3}$

B. $\frac{1}{3}$

C. $-\frac{2}{3}$

D. $-\frac{1}{3}$

Answer: B

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4. The curve satisfying the differential equation, $ydx-\left(x+3y^2\right)dy=0$ and passingthrough the point $(1,1)$, also passes through the point.

A. $\left(\frac{1}{4},-\frac{1}{2}\right)$

B. $\left(-\frac{1}{3},\frac{1}{3}\right)$

C. $\left(\frac{1}{3},-\frac{1}{3}\right)$

D. $\left(\frac{1}{4}, \frac{1}{2}\right)$

Answer: B

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5. If a curve $y = f(x)$ passes through the point $(1, -1)$ and satisfies the differential equation , $y(1 + xy)dx = xdy$, then $f\left(-\frac{1}{2}\right)$ is equal to:

(1) $-\frac{2}{5}$ (2) $-\frac{4}{5}$ (3) $\frac{2}{5}$ (4) $\frac{4}{5}$

A. $\frac{2}{5}$

B. $\frac{4}{5}$

C. $-\frac{2}{5}$

D. $-\frac{4}{5}$

Answer: B

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6. Let $f(x)$ be differentiable on the interval $(0, \infty)$ such that $f(1) = 1$ and $\lim_{t \to x} \frac{t^2 f(x) - x^2 f(t)}{t - x} = 1$ for each $x > 0$. Then $f(x) =$

A. $\frac{23}{18}$

B. $\frac{13}{6}$

C. $\frac{25}{9}$

D. $\frac{31}{18}$

Answer: D

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7. Let y(x) be the solution of the differential equation $(x \log x) \frac{dy}{dx} + y = 2x \log x, (x > 1)$. then y (e) is equal to :

A. 2

B. 2e

C. e

D. 0

Answer: A

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8. If $y(x)$ is the solution of the differential equation $(x+2)\frac{dy}{dx} = x^2 + 4x - 9, x \neq -2$ and $y(0) = 0,$ then $y(-4)$ is equal to

A. 0

B. 2

C. 1

D. -1

Answer: A

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9. Let the population of rabbits surviving at a time t be governed by the differential equation $\left(dp\frac{t}{dt} = \frac{1}{2}p(t) - 200.\right.$ If $p(0) = 100$, then p(t) equals (1) $400 - 300e^{t/2}$ (2) $300 - 200e^{-t/2}$ (3) $600 - 500e^{t/2}$ (4) $400 - 300e^{-t/2}$

A. $600 - 500e^{t/2}$

B. $400 - 300e^{-t/2}$

C. $400 - 300e^{t/2}$

D. $300 - 200e^{-t/2}$

Answer: C

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10. If the differential equation representing the family of all circles touching x-axis at the origin is $\left(x^2 - y^2\right)\frac{dy}{dx} = g(x)y$ then $g(x)$ equals, (A) $\frac{x}{2}$ (B) $2x^2$ (C) $2x$ (D) $\frac{x^2}{2}$

A. $\frac{1}{2}x$

B. $2x^2$

C. $2x$

D. $\frac{1}{2}x^2$

Answer: C

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Exercise 1 Concept Builder Topicwise

1. If the function $y = e^{4x} + 2e^{-x}$ satisfies the differential equation $\frac{d^3y}{dx^3} + A\frac{dy}{dx} + By = 0$, then $(A, B) \equiv$

A. $-13, 14$

B. $-13, \ -12$

C. $-13, 12$

D. $12, \ -13$

Answer: B

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2. The form of the differential equation of the central conics $ax^2 + by^2 = 1$ is (a) $(b)(c)x = y(d)\frac{(e)dy}{f}((g)dx)(h)(i)(j)$ (k) (b) $(l)(m)x + y(n)\frac{(o)dy}{p}((q)dx)(r)(s) = 0(t)$ (u) (c) *[Math Processing Error]* (oo) (d) None of these

A. $xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$

B. $xy\frac{d^2y}{dx^2} - x\left(\frac{dy}{dx}\right)^2 + y\frac{dy}{dx} = 0$

C. $xy\frac{d^2y}{dx^2} - x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$

D. None of these

Answer: A

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3. Find the differential equation of all the circles which pass through the origin and whose centres lie on y-axis.

A. $\left(x^2 - y^2\right)\frac{dy}{dx} + 2xy = 0$

B. $\left(x^2 - y^2\right)\frac{dy}{dx} = 2xy$

C. $\left(x^2 - y^2\right)\frac{dy}{dx} = xy$

D. $\left(x^2 - y^2\right)\frac{dy}{dx} + xy = 0$

Answer: B

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4. Find the differential equation of system of cocentric circles with centre (1,2)

A. $(x - 2) + (y - 1)\frac{dy}{dx} = 0$

B. $(x - 1) + (y - 2)\frac{dy}{dx} = 0$

C. $(x + 1)\frac{dy}{dx} + (y - 2) = 0$

D. $(x+2)\frac{dy}{dx}+(y-1)=0$

Answer: B

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5. Find the equation of the curve passing through the point $(1, 1)$ whose differential equation is : $xdy = \left(2x^2+1\right)dx$.

A. $x^2 = y + \log|x|$

B. $y = x^2 + \log|x|$

C. $y^2 = x + \log|x|$

D. $y = x + \log|x|$

Answer: B

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6. If $xy = A\sin x + B\cos x$ is the solution of the differential equation $x\frac{d^2y}{dx^2} - 5a\frac{dy}{dx} + xy = 0$ then the value of a is equal to

A. $\frac{2}{5}$

B. $\frac{5}{2}$

C. $\frac{-2}{5}$

D. $\frac{-5}{2}$

Answer: C

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7. The differential equation of $\tan(x-y) = cx$ is

A. $2x\left(1 - \frac{dy}{dx}\right) = \sin 2(x-y)$

B. $2y\left(1 - \frac{dy}{dx}\right) = \cos 2(x-y)$

C. $x\left(1 - \frac{dy}{dx}\right) = \cos 2(x-y)$

D. $y\left(1-\frac{dy}{dx}\right)=\sin 2(x-y)$

Answer: A

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8. The differential equation whose solution is $Ax^2+By^2=1$, where A and B are arbitrary constants, is of (a) second order and second degree (b) first order and second degree (c) first order and first degree (d) second order and first degree

A. second order and second degree

B. first order and second degree

C. first order and first degree

D. second order and first degree

Answer: D

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9. The order and degree of the differential equation $\left(1+3\frac{dy}{dx}\right)^{2/3}=4\frac{d^3y}{dx^3}are$

A. $\left(1,\frac{2}{3}\right)$

B. (3,1)

C. (3,3)

D. (1,2)

Answer: C

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10. The order and degree of the differential equation $\frac{d^4y}{dx^4}+\sin(y'''')=0$ are respectively

A. 4 and 1

B. 1 and 2

C. 4 and 4

D. 4 and not defined

Answer: D

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11. Consider the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^{-3/2}=k\left(\frac{d^2y}{dx^2}\right)$

The degree and order of the equation is :

A. (2,2)

B. (3,2)

C. (2,3)

D. None of these

Answer: A

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12. The differential equation of the family of straight lines whose slope is equal to y - intercept ,is

A. $(x+1)\frac{dy}{dx}-y=0$

B. $(x+1)\frac{dy}{dx}+y=0$

C. $\frac{dy}{dx}=\frac{x-1}{y-1}$

D. $\frac{dy}{dx}=\frac{x+1}{y+1}$

Answer: A

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13. Differential equation of the family of curves $v=\frac{A}{r}+B,$ where A and B are arbitrary constants, is (a) $(b)(c)(d)\frac{(e)(f)d^{(g)2(h)}(i)v}{j}\left((k)d(l)r^{(m)2(n)}(o)\right)(p)(q)+(r)\frac{1}{s}r(t)(u)(v$ (cc) (b) $(dd)(ee)(ff)\frac{(gg)(hh)d^{(ii)2(jj)}(kk)v}{ll}\left((mm)d(\cap)r^{(oo)2(pp)}(qq)\right)(rr)(ss$ (eee) (c) *[Math Processing Error]* (ee) (d) None of these

A. $\frac{d^2v}{dr^2} + \frac{1}{r} \cdot \frac{dv}{dr} = 0$

B. $\frac{d^2v}{dr^2} - \frac{2}{r}\frac{dv}{dr} = 0$

C. $\frac{d^2v}{dr^2} + \frac{2}{r} \cdot \frac{dv}{dr} = 0$

D. None of these

Answer: C

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14. The differential equation representing the family of curves $y^2 = 2c(x + \sqrt{c})$ where $c > 0$ is a parameter, is of order and degree as follows: (A) order 1, degree 3 (B) order 2, degree 2 (C) order 1, degree 2 (D) order 1, degree 1

A. order 1 , degree 2

B. order 1 , degree 1

C. order 1 , degree 3

D. order 2, degree 2

Answer: C

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15. The degree of the differential equation

$$\left(\frac{d^3y}{dx^3}\right)^4 + \left(\frac{d^2y}{dx^2}\right) + \frac{dy}{dx} + y = 0 \text{ is}$$

A. 2

B. 4

C. 6

D. 8

Answer: B

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16. Write the order of the differential equation whose solution is

$y = a\cos x + bs \in \ x + ce^{-x}.$

A. 3

B. 2

C. 1

D. None of these

Answer: A

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17. A differential equation associated to the primitive $y = a + be^{5x} + ce^{-7x}$ is (where y_n is nth derivative w.r.t. x) (a) $(b)(c)(d)y_e3(f)(g) + 2(h)y_i2(j)(k) - (l)y_m1(n)(o) = 0(p)$ (q) (r) *[Math Processing Error]* (hh) (ii) *[Math Processing Error]* (yy) (d) none of these (zz) *[Math Processing Error]* (ddd) y_n reprersents $(eee)(fff)nth(ggg)$ (hhh) order derivative.

A. $y_3 + 2y_2 - y_1 = 0$

B. $y_3 + 2y_2 - 35y_1 = 0$

C. $4y_3 + 5y_2 - 20y_1 = 0$

D. None of these

Answer: B

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18. The family of curves $y = e^{a \sin x}$ where a is an arbitrary constant , is represented by the differential equation

A. $\log y = \tan x \frac{dy}{dx}$

B. $y \log y = \tan x \frac{dy}{dx}$

C. $y \log y = \sin x \frac{dy}{dx}$

D. $\log y = \cos x \frac{dy}{dx}$

Answer: B

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19. The differential equation of all non-horizontal lines in a plane is (a) $(b)(c)(d)\frac{(e)(f)d^{(g)2(h)}(i)y}{j}\left((k)d(l)x^{(m)2(n)}(o)\right)(p)(q)(r)$ (s) (b) $(t)(u)(v)\frac{(w)(x)d^{(y)2(z)}(aa)x}{bb}\left((cc)d(dd)y^{(ee)2(ff)}(gg)\right)(hh)(ii) = 0(jj)$ (kk) (c) $(d)(e)(f)\frac{(g)dy}{h}((i)dx)(j)(k) = 0(l)$ (m) (d) $(n)(o)(p)\frac{(q)dx}{r}((s)dy)(t)(u) = 0(v)$ (w)

A. $\frac{d^2y}{dx^2}$

B. $\frac{d^2y}{dy^2} = 0$

C. $\frac{dy}{dx} = 0$

D. $\frac{dx}{dy} = 0$

Answer: B

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20. The normal to a given curve at each point (x, y) on the curve passes through the point $(3, 0)$. If the curve contains the point $(3, 4)$, find its equation.

A. $x^2 + y^2 + 6x - 7 = 0$

B. $2\left(x^2 + y^2\right) - 12x - 7 = 0$

C. $x^2 + y^2 - 6x - 7 = 0$

D. None of these

Answer: C

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21. The solution of $\frac{dy}{dx} = e^x \frac{\sin^2 x + \sin 2x}{y(2\log y + 1)}$ is-

A. $y^2(\log y) - e^x \sin^2 x + c = 0$

B. $y^2(\log y) - e^x \cos^2 x + c = 0$

C. $y^2(\log y) + e^x \cos^2 x + c = 0$

D. None of these

Answer: A

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22. The curve in the first quadrant for which the normal at any point (x, y) and the line joining the origin to that point form an isosceles triangle with the x-axis as base is (a) an ellipse (b) a rectangular hyperbola (c) a circle (d) None of these

A. an ellipse

B. a rectangular hyperbola

C. a circle

D. None of these

Answer: B

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23. The solution of differential equation

$$\left[\frac{e^{-2\sqrt{2}}}{\sqrt{x}} - \frac{y}{\sqrt{xy}}\right]\frac{dx}{dy} = 1, (x \neq 0) \text{ is}$$

A. $ye^{2\sqrt{x}} + 2\sqrt{x} + C$

B. $ye^{\sqrt{x}} = \sqrt{x} + C$

C. $ye^{2\sqrt{x}} = \sqrt{y} + C$

D. $ye^{2\sqrt{x}} = 2\sqrt{x} + C$

Answer: A

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24. The equation of the curve which passes through the point (2a, a) and for which the sum of the cartesian sub tangent and the abscissa is equal to the constant a , is

A. $y(x - a) = a^2$

B. $y(x + a) = a^2$

C. $x(y - a) = a^2$

D. $x(y + a) = a^2$

Answer: A

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25. The solution of $(y+x+5)dy=(y-x+1)dx$ is (a) *[Math Processing Error]* (jj) (kk) $(ll)(mm)\log\Big((nn)(\infty)(pp)(qq)((rr)(ss)y+3(tt))^{(uu)2(vv)}(ww)+(xx)(y$ $+(ggg)(hhh)\tan^{(iii)(jjj)-1(kkk)}(lll)(mmm)\frac{(nnn)y-3}{ooo}((ppp)y-2)(qq$ (ttt) (uuu) *[Math Processing Error]* (ddddd) (eeeee) *[Math Processing Error]* (nnnnnn)

A. $\log\left((y+3)^2+(x+2)^2\right)+\frac{\tan^{-1}(y+3)}{y+2}+C$

B. $\log\left((y+3)^2+(x-2)^2\right)+\frac{\tan^{-1}(y-3)}{x-2}=C$

C. $\log\left((y+3)^2+(x+2)^2\right)+2\frac{\tan^{-1}(y+3)}{x+2}=C$

D. $\log\left((y+3)^2+(x+2)^2\right)-2\frac{\tan^{-1}(y+3)}{x+2}=0$

Answer: C

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26. The acceleration of a sphere falling through a liquid is $(30-3v)cm/s^2$ where v is its speed in cm/s . The maximum possible velocity of the sphere and the time when it is achieved are

A. 10 cm /s after 10 second

B. 10 cm/s instantly

C. 10 cm/s , will never be achieved

D. 30 cm/s , after 30 second

Answer: C

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27. The solution of

$$e^{x\frac{(y^2-1)}{y}}\{xy^2dy+y^3dx\}+\{ydx-xdy\}=0,\text{ is}$$

A. $e^{xy}+e^{x/y}+C=0$

B. $e^{xy} - e^{x/y} + C = 0$

C. $e^{xy} + e^{y/x} + C = 0$

D. $e^{xy} - e^{y/x} + C = 0$

Answer: A

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28. The differential equation $\frac{dy}{dx} = \frac{3y}{2x}$ represents a family of hyperbolas (except when it represents a pair of lines) with eccentricity. $\sqrt{\frac{3}{5}}$ (b) $\sqrt{\frac{5}{3}}$ $\sqrt{\frac{2}{5}}$ (d) $\sqrt{\frac{5}{2}}$

A. $\sqrt{\frac{3}{5}}$

B. $\sqrt{\frac{5}{2}}$

C. $\sqrt{\frac{5}{4}}$

D. $\sqrt{5}$

Answer: B

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29. The sum of the squares of the perpendicular drawn from the points (0,1) and $(0, -1)$ to any tangent to a curve is 2. The equation of the curve, is

A. $2y' = c(x+2)$

B. $y = c'(x+1)$

C. $2y = c'(x+2)$

D. $yy' = c(x+1)$

Answer: B

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30. The solution of differential equation

$$\frac{dt}{dx} = \frac{t\left[\frac{d}{dx}\{g(x)\}\right] - t^2}{g(x)}$$ is

A. $t = \frac{g(x)}{x} + c$

B. $t = \frac{g(x)}{x^2} + c$

C. $t = \frac{g(x)}{x + c}$

D. $t = g(x) + x + c$

Answer: C

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31. The differential equation $\frac{dy}{dx} = x + \frac{1 + y^2}{y(1 + x^2)}$ represents a family of

A. ellipses of constant eccentricity

B. ellipses of variable eccentricity

C. hyperbolas of constant eccentricity

D. hyperbolas of variable eccentricity

Answer: D

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32. Find the general solution of the differential equations $(e^x + e^{-x})dy - (e^x - e^{-x})dx = 0$

A. $y = \log|e^x + e^{-x}| + c$

B. $y = \log|e^x - e^{-x}| - c$

C. $y = -\log|e^x - e^{-x}| + c$

D. None of these

Answer: A

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33. The solution of differential equation $4xdy - ydx = x^2dy$ is

A. $y = Ce^{4x}$

B. $(x - 4)y^4 = Cx$

C. $x^4 - y^4 = Cxy$

D. None of these

Answer: B

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34. 8 The solution of differential equation $\frac{dy}{dx} = \frac{y}{x} + \frac{\phi\left(\frac{y}{x}\right)}{\phi'\left(\frac{y}{x}\right)}$ is

A. $x\phi(y/x) = k$

B. $\phi(y/x) = kx$

C. $y\phi(y/x) = k$

D. $\phi(y/x) = ky$

Answer: B

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35. The equation of the curve through the point (1,2) and whose slope is $\frac{y-1}{x^2+x}$, is

A. $(y-1)(x+1)-2x=0$

B. $2x(y-1)+x+1=0$

C. $x(y-1)(x+1)+2=0$

D. None of these

Answer: A

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36. The solution of the differential eqaution $(x^2-yx^2)\frac{dy}{dx}+y^2+xy^2=0$, is

A. $\log\left(\frac{x}{y}\right)=\frac{1}{x}+\frac{1}{y}+c$

B. $\log\left(\frac{y}{x}\right)=\frac{1}{x}+\frac{1}{y}+c$

C. $\log(xy)=\frac{1}{x}+\frac{1}{y}+c$

D. $\log(xy) + \frac{1}{x} + \frac{1}{y} = c$

Answer: A

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37. Find the equation of the curve passing through the point $\left(0, \frac{\pi}{4}\right)$ whose differential equation is $s \in x \cos y \, dx + \cos x \, s \in y \, dy = 0$.

A. $\sec x \sec y = \sqrt{2}$

B. $\cos x \cos y = \sqrt{2}$

C. $\sec x = \sqrt{2} \cos y$

D. $\cos y = \sqrt{2} \sec y$

Answer: A

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38. The solution of differential equation $x^2 = 1 + \left(\frac{x}{y}\right)^{-1} \frac{dy}{dx} + \frac{\left(\frac{x}{y}\right)^2 \left(\frac{dy}{dx}\right)^2}{2!} + \frac{\left(\frac{x}{y}\right)^{-1} \left(\frac{dy}{dx}\right)^3}{3!} + is$ (a) $(b)(c)(d)y^{(e)2(f)}(g) = (h)x^{(i)2(j)}(k)\Big((l)(m)1n(n)x^{(o)2(p)}(q) - 1(r)\Big)($ (t) (u) *[Math Processing Error]* (ff) (gg) $(hh)(ii)(jj)y^{(kk)2(ll)}(mm) = x((nn)(\infty)1nx - 1(pp))(qq)$ (rr) (d) *[Math Processing Error]* (iii)

A. $y^2 = x^2\left(\ln x^2 - 1\right) + C$

B. $y = x^2(\ln x - 1) + C$

C. $y^2 = x(\ln x - 1) + C$

D. $y = x^2 e^{x^2} + C$

Answer: A

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39. General solution of differential equation of $f(x)\frac{dy}{dx} = f^2(x) + f(x)y + f'(x)y$ is : (c being arbitrary constant) .

A. $y = f(x) + ce^x$

B. $y = -f(x) + ce^x$

C. $y = -f(x) + ce^x f(x)$

D. $y = cf(x) + e^x$

Answer: C

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40. The female- male ratio of a village decreases continuously at the rate proportional to their ratio at any time. If the ratio of female : male of the villages was 980:1000 in 2001 and 920 : 1000 in 2011. What will be the ratio in 2021 ?

A. 864:1000

B. 864 : 100

C. 1000 : 864

D. 100 : 864

Answer: A

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41. 8 The solution of differential equation $\frac{dy}{dx} = \frac{y}{x} + \frac{\phi\left(\frac{y}{x}\right)}{\phi'\left(\frac{y}{x}\right)}$ is

A. $x\phi(y/x) = k$

B. $\phi(y/x) = kx$

C. $y\phi(y/x) = k$

D. $\phi(y/x) = ky$

Answer: B

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42. The solution of the primitive integral equation $(x^2 + y^2)dy = xydx$ is $y = y(x)$. If $y(1) = 1$ and $y(x_0) = e$, then x_0 is (a)

$(b)(c)2\sqrt{(d)(e)\left((f)(g)(h)e^{(i)2(j)}(k)-1(l)\right)(m)(n)(o)}$ (p) (b)

$(q)(r)2\sqrt{(s)(t)\left((u)(v)(w)e^{(x)2(y)}(z)+1(aa)\right)(bb)(cc)(dd)}$ (ee) (c)

$(d)(e)\sqrt{(f)3(g)}(h)e(i)$ (j) (d)

$(k)(l)\sqrt{(m)(n)(o)\frac{(p)(q)e^{(r)2(s)}(t)+1}{u}2(v)(w)(x)(y)(z)}$ (aa)

A. $\sqrt{2(e^2-1)}$

B. $\sqrt{2(e^2+1)}$

C. $\sqrt{3}e$

D. $\sqrt{\frac{e^2+1}{2}}$

Answer: C

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43. If $\phi(x)$ is a differentiable function, then the solution of the different equation $dy+\{y\phi'(x)-\phi(x)\phi'(x)\}dx=0,$ is

A. $y=\{\phi(x)-1\}+ce^{-\phi(x)}$

B. $y\phi(x) = \{\phi(x)\}^2 + c$

C. $ye^{\phi(x)} = \phi(x)e^{\phi(x)} + c$

D. None of these

Answer: A

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44. The equation of the curve which is such that the portion of the axis of x cut-off between the origin and tangent at any point is proportional to the ordinate of that point is

A. $x = y(a - b\log x)$

B. $\log x = by^2 + a$

C. $x^2 = y(a - b\log y)$

D. None of these

Answer: A

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45. A curve passing through $(2, 3)$ and satisfying the differential equation

$\int_0^x ty(t)dt = x^2y(x), (x > 0)$ is (a)

$(b)(c)(d)x^{(e)2(f)}(g) + (h)y^{(i)2(j)}(k) = 13(l)$ (m) (b)

$(n)(o)(p)y^{(q)2(r)}(s) = (t)\frac{9}{u}2(v)(w)x(x)$ (y) (c)

$(d)(e)(f)\frac{(g)(h)x^{(i)2(j)}(k)}{l}8(m)(n) + (o)\frac{(p)(q)y^{(r)2(s)}(t)}{u}((v)18)(w)(x)$

(z) (d) *[Math Processing Error]* (dd)

A. $x^2 + y^2 = 13$

B. $y^2 = \frac{9}{2}x$

C. $\frac{x^2}{8} + \frac{y^2}{18} = 1$

D. xy=c

Answer: D

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46. Solve:

$$\frac{dy}{dx} = \frac{yf'(x) - y^2}{f(x)}$$

A. $f(x) = y(x + c)$

B. $f(x) = cxy$

C. f(x) = c(x+y)

D. yf(x) = cx

Answer: A

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47. The equation of the curve passing through the point $(3a, a)(a > 0)$ in the form $x = f(y)$ which staisfy the differential equation : $\frac{a^2}{xy} \cdot \frac{dx}{dy} = \frac{x}{y} + \frac{y}{x} - 2$, is

A. $x = y + a\left(\frac{1 + e^{y-k}}{1 - 2e^{y-k}}\right)$

B. $x = y + a\left(\frac{1 + e^{y-k}}{1 - e^{y-k}}\right)$

C. $y = x + a\left(\frac{1 + e^{y-k}}{1 - e^{y-k}}\right)$

D. None of these

Answer: B

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48. A function $y = f(x)$ satisfies the condition $f'(x)\sin x + f(x)\cos x = 1$, $f(x)$ being bounded when $x \to 0$. If $I = \int_0^{\frac{\pi}{2}} f(x)dx$ then (A) $\frac{\pi}{2} < I < \frac{\pi^2}{4}$ (B) $\frac{\pi}{4} < I < \frac{\pi^2}{2}$ (C) $1 < I < \frac{\pi}{2}$ (D)$0 < I < 1$

A. $\frac{\pi}{2} < l < \frac{\pi^2}{4}$

B. $\frac{\pi}{4} < l < \frac{\pi^2}{2}$

C. $1 < l < \frac{\pi}{2}$

D. $0 < l < 1$

Answer: A

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49. The solution of the differential equation $x \sin d\frac{dy}{dx} + (x\cos x + \sin x)y = \sin x$. When $y(0) = 0$ is

A. $xy\sin x = 1 - \cos x$

B. $xy\sin x + \cos x = 0$

C. $x\sin x + y\cos x = 0$

D. $x\sin x + y\cos x = 1$

Answer: A

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50. The gradient of the curve passing through $(4, 0)$ is given by $\frac{dy}{dx} - \frac{y}{x} + \frac{5x}{(x+2)(x-3)} = 0$ if the point (5,a) lies on the curve then the value of a is

A. $\frac{67}{12}$

B. $5\sin\frac{7}{12}$

C. $5\log\frac{7}{12}$

D. None of these

Answer: C

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51. Intergrating factor of the differential equaiton $(x^2+1)\frac{dy}{dx}+2xy=x^2-1$ is

A. x^2+1

B. $\frac{2x}{x^2+1}$

C. $\frac{x^2-1}{x^2+1}$

D. None of these

Answer: A

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52. Solve $\dfrac{x+y\frac{dy}{dx}}{y-x\frac{dy}{dx}}=x^2+2y^2+\dfrac{y^4}{x^2}$

A. $\dfrac{y}{4}+\dfrac{1}{x^2+y^2}=c$

B. $\dfrac{y}{x}-\dfrac{1}{x^2+y^2}=c$

C. $\dfrac{x}{y}-\dfrac{1}{x^2+y^2}=c$

D. None of these

Answer: B

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53. The equation of curve passing through origin and satisfying the differential equation $\left(1+x^2\right)\dfrac{dy}{dx}+2xy=4x^2$, is

A. $\left(1+x^2\right)y=x^3$

B. $3(1+x^2)y = 2x^3$

C. $(1+x^2)y = 3x^3$

D. $3(1+x^2)y = 4x^3$

Answer: D

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54. The general solution of the differential equation, $y' + y\varphi'(x) = 0$, where $\varphi(x)$ is a known function, is (a) $(b)(c)y = c(d)e^{(e)(f)-\varphi((g)x(h))(i)}(j) + \varphi((k)x(l)) - 1(m)$ (n) (o) $(p)(q)y = c(r)e^{(s)(t)+\varphi((u)x(v))(w)}(x) + \varphi((y)x(z)) - 1(aa)$ (bb) (cc) $(dd)(ee)y = c(ff)e^{(gg)(hh)-\varphi((ii)x(jj))(kk)}(ll) - \varphi((mm)x(\cap)) + 1(o$ (pp) (d) $(qq)(rr)y = c(ss)e^{(tt)(\cup)-\varphi((vv)x(ww))(xx)}(yy) + \varphi((zz)x(aaa)) + 1(b$ (ccc)

A. $y = ce^{-\phi(x)} + \phi(x) - 1$

B. $y = ce^{+\phi(x)} + \phi(x) - 1$

C. $y = ce^{-\phi(x)} - \phi(x) + 1$

D. $y = ce^{-\phi(x)} + \phi(x) + 1$

Answer: A

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55. Find the curve for which area of triangle formed by x-axis, tangent drawn at any point on the curve and radius vector of point of tangency is constant, equal to a^2

A. $x = cy \pm \frac{a^2}{y}$

B. $y = cx \pm \frac{a^2}{x}$

C. $x^2 \pm ay^2 = cy$

D. $a^2x^2 \pm y^2 = cy$

Answer: A

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56. Solution of the differential equation $2y\sin x\frac{dy}{dx} = 2\sin x\cos x - y^2\cos x$ satisfying $y\left(\frac{\pi}{2}\right) = 1$ is given by :

A. $y^2 = \sin x$

B. $y = \sin^2 x$

C. $y^2 = \cos x + 1$

D. $y^2\sin x = 4\cos^2 x$

Answer: A

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57. An integrating factor of the differential equation

$\sin x\frac{dy}{dx} + 2y\cos x = 1$ is

A. $\sin^2 x$

B. $\frac{2}{\sin x}$

C. $\log|\sin x|$

D. $\frac{1}{\sin^2 x}$

Answer: A

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58. The solution of $ydx - xdy + 3x^2y^2e^{x^3}$ dx = 0 is

A. $\frac{x}{y} + e^{x^3} = c$

B. $\frac{x}{y} - e^{x^3} = c$

C. $\frac{y}{x} + e^{x^3} = c$

D. $\frac{y}{x} - e^{x^3} = c$

Answer: A

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59. If $y + \frac{d}{dx}(xy) = x(\sin x + \log x), f \in dy(x)$.

A. $y = \cos x + \frac{2}{x}\sin x + \frac{2}{x^2}\cos x + \frac{x}{3}\log x - \frac{x}{9} + \frac{c}{x^2}$

B. $y = -\cos x - \frac{2}{x}\sin x + \frac{2}{x^2}\cos x + \frac{x}{3}\log x - \frac{x}{9} + \frac{c}{x^2}$

C. $y = -\cos x + \frac{2}{x}\sin x + \frac{2}{x^2}\cos x - \frac{x}{3}\log x - \frac{x}{9} + \frac{c}{x^2}$

D. None of these

Answer: C

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60. The equation of the curve satisfying the equation $(1 + y^2)dx + \left(x - e^{-\tan^{-1} y}\right)dy = 0$ and passing through origin is

A. $xe^{-\tan^{-1} y} = \cos^{-1} y$

B. $xe^{-\cot^{-1} y} = \tan^{-1} y$

C. $y \tan^{-1} y = \tan^{-1} x$

D. $xe^{\tan^{-1} y} = \tan^{-1} y$

Answer: D

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Exercise 2 Concept Applicator

1. The differential equation of all conics whose axes coincide with the coordinate axes, is

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

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

C. $xy\frac{d^2y}{dx^2}+x\left(\frac{dy}{dx}\right)^2-y\frac{dy}{dx}=0$

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

Answer: C

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2. Tangent to a curve intercepts the y-axis at a point P. A line perpendicular to this tangent through P passes through another point (1,0). The differential equation of the curve is (a) $(b)(c)y(d)\frac{(e)dy}{f}((g)dx)(h)(i) - x(j)(k)\left((l)(m)(n)\frac{(o)dy}{p}((q)dx)(r)(s)(t\right.$ (y) (b) *[Math Processing Error]* (eee) (c) $(d)(e)y(f)\frac{(g)dx}{h}((i)dy)(j)(k) + x = 1(l)$ (m) (d) None of these

A. $y\frac{dy}{dx} - x\left(\frac{dy}{dx}\right)^2 = 1$

B. $\frac{xd^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$

C. $y\frac{dx}{dy} + x = 1$

D. None of these

Answer: A

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3. The differential equation of family of curves whose tangent form an angle of $\frac{\pi}{4}$ with the hyperbola $xy = C^2$ is

A. $\frac{dy}{dx} = \frac{x^2 + C^2}{x^2 - C^2}$

B. $\frac{dy}{dx} = \frac{x^2 - C^2}{x^2 + C^2}$

C. $\frac{dy}{dx} = -\frac{C^2}{x^2}$

D. None of these

Answer: B

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4. If the solution of the differential equation $y\left(1 + 2xy\sec^2\left(x^2 - y\right)\right)dx - \left(x + y^2\sec^2\left(x^2 - y\right)\right)dy = 0$ is f(x,y)=c (where c is integration constant) , then f(2,1) is equal to

A. $2 - \tan 3$

B. $2 + \tan 3$

C. $-2 + \tan 1$

D. None of these

Answer: B

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5. A ray of light coming from origin after reflectiion at the point $P(x, y)$ of any curve becomes parallel to x-axis, the , equation of the curve may be :

A. $y^2 = x$

B. $y^2 = 2x + 1$

C. $y^2 = 4x$

D. $y^2 = 4x + 1$

Answer: B

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6. The differential equation of the family of circles with fixed radius 5 units and centre on the line y=2 is

A. $(y-2)y'^2 = 25-(y-2)^2$

B. $(y-2)^2y'^2 = 25-(y-2)^2$

C. $(x-2)^2y'^2 = 25-(y-2)^2$

D. $(x-2)y'^2 = 25-(y-2)^2$

Answer: B

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7. If $y = \left(x+\sqrt{1+x^2}\right)^n$ then $\left(1+x^2\right)\frac{d^2y}{dx^2}+x\frac{dy}{dx}$

A. n^2y

B. $-n^2y$

C. $-y$

D. $2x^2y$

Answer: A

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8. The solution of differential equation $xy' = x\left(\frac{y^2}{x^2} + \frac{f\left(\frac{y^2}{x^2}\right)}{f'\left(\frac{y^2}{x^2}\right)}\right)$ is (a) $(b)(c)f\left((d)(e)(f)\frac{(g)(h)y^{(i)2(j)}(k)}{l}\left((m)(n)x^{(o)2(p)}(q)\right)(r)(s)(t)\right) = c($ (z) (b) *[Math Processing Error]* (ggg) (c) $(d)(e)(f)x^{(g)2(h)}(i)f\left((j)(k)(l)\frac{(m)(n)y^{(o)2(p)}(q)}{r}\left((s)(t)x^{(u)2(v)}(w)\right)($ (bb) (d) *[Math Processing Error]* (bbb)

A. $f\left(y^2/x^2\right) = cx^2$

B. $x^2f\left(y^2/x^2\right) = c^2y^2$

C. $x^2f\left(y^2/x^2\right) = c$

D. $f\left(y^2/x^2\right) = cy/x$

Answer: A

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9. The solution of the differential equation $\frac{dy}{dx} = \frac{1-3y-3x}{1+x+y}$ is

A. $x + y - \ln|x + y| = c$

B. $3x + y + 2\ln|1 - x - y| = c$

C. $x + 3y - 2\ln|1 - x - y| = c$

D. None of these

Answer: B

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10. The solution of the equation $\frac{dy}{dx} = \frac{(y^2 - y - 2)}{x^2 + 2x + 3}$ is

A. $\frac{1}{3}\log\left|\frac{y-2}{y+1}\right| = \frac{1}{4}\log\left|\frac{x+3}{x-1}\right| + c$

B. $\frac{1}{3}\log\left|\frac{y+1}{y-2}\right| = \frac{1}{4}\log\left|\frac{x-1}{x+3}\right| + c$

C. $4\log\left|\frac{y-2}{y+1}\right| = 3\log\left|\frac{x-1}{x+3}\right| + c$

D. None of these

Answer: C

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11. The solution of differential equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ is

A. $y = e^{x-y} - x^2 e^{-y} + c$

B. $e^y - e^x = \frac{1}{3}x^3 + c$

C. $e^x + e^y = \frac{1}{3}x^3 + c$

D. $e^x - e^y = \frac{1}{3}x^3 + c$

Answer: B

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12. Let f be a non-negative function defined on the interval $[0, 1]$. If $\int_0^x \sqrt{1-(f'(t))^2}dt = \int_0^x f(t)dt, 0 \leq x \leq 1$ and $f(0) = 0$, then (A) $f\left(\frac{1}{2}\right) < \frac{1}{2}$ and $f\left(\frac{1}{3}\right) > \frac{1}{3}$ (B) $f\left(\frac{1}{2}\right) > \frac{1}{2}$ and $f\left(\frac{1}{3}\right) > \frac{1}{3}$ (C) $f\left(\frac{1}{2}\right) < \frac{1}{2}$ and $f\left(\frac{1}{3}\right) < \frac{1}{3}$ (D) $f\left(\frac{1}{2}\right) > \frac{1}{2}$ and $f\left(\frac{1}{3}\right) < \frac{1}{3}$

A. $f(1/2) < 1/2$ and $f(1/3) > 1/3$

B. $f(1/2) > 1/2$ and $f(1/3) > 1/3$

C. $f(1/2) < 1/2$ and $f(1/3) < 1/3$

D. $f(1/2) > 1/2$ and $f(1/3) < 1/3$

Answer: C

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13. Solution of the differential equation $\left(1+e^{\frac{x}{y}}\right)dx + e^{\frac{x}{y}}\left(1-\frac{x}{y}\right)dy = 0$ is

A. $ye^x + x = C$

B. $xe^{y} + y = C$

C. $ye^{\frac{y}{x}} + y = C$

D. $ye^{\frac{x}{y}} + y = C$

Answer: D

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14. In a culture, the bacteria count is 1,00,000. The number is increased by 10% in 2 hours. In how many hours will the count reach 2,00,000, if the rate of growth of bacteria is proportional to the number present?

A. $\dfrac{2}{\log \frac{11}{10}}$

B. $\dfrac{2\log 2}{\log\left(\frac{11}{10}\right)}$

C. $\dfrac{\log 2}{\log 11}$

D. $\dfrac{\log 2}{\log\left(\frac{11}{10}\right)}$

Answer: B

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15. The solution of the differential equation $\frac{dy}{dx} = (4x + y + 1)^2$, is

A. $4x + y + 1 = 2\tan(2x + c)$

B. $(4x + y + 1)^2 = \tan^{-1} x + c$

C. $\tan^{-1}(4x + y + 1) = cx$

D. None of these

Answer: A

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16. The solution of the differential equation $x^3 \frac{dy}{dx} + 4x^2 \tan y = e^x \sec y$ satisfying $y(1) = 0$, is

A. $\tan y = (x - 2)e^x \log x$

B. $\sin y = e^x (x - 1)x^{-4}$

C. $\tan y = (x-1)e^x x^{-3}$

D. $\sin y = e^x(x-1)x^{-3}$

Answer: B

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17. Solution of the differential equation $\left(\frac{x+y-1}{x+y-2}\right)\frac{dy}{dx} = \left(\frac{x+y+1}{x+y+1}\right)$, given that y = 1 when x = 1, is

A. $\log\left|\frac{(x-y)^2-2}{2}\right| = 2(x+y)$

B. $\log\left|\frac{(x-y)^2+2}{2}\right| = 2(x-y)$

C. $\log\left|\frac{(x+y)^2+2}{2}\right| = 2(x-y)$

D. None of these

Answer: D

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18. Solve $\left(1+e^{\frac{x}{y}}\right)dx+e^{\frac{x}{y}}\left(1-\frac{x}{y}\right)dy=0$

A. $x-ye^{x/y}=c$

B. $y-xe^{x/y}=c$

C. $x+ye^{x/y}=c$

D. $y+xe^{x/y}=c$

Answer: C

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19. The function $f(x)$ satisfying the equation $f^2(x)+4f'(x)f(x)+(f'(x))^2=0$

A. $f(x)=C.e^{\left(2-\sqrt{3}\right)x}$

B. $f(x)=C.e^{\left(2+\sqrt{3}\right)x}$

C. $f(x)=C.e\left(\left(\sqrt{3}-2\right)x\right)$

D. $f(x)=C.e\left(\left(2+\sqrt{3}\right)x\right)$

Answer: C

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20. v34

A. $y = \log(x^2 + cx)$

B. $\log y = x\left(cx^2 + \frac{1}{2}\right)$

C. $x = \log y\left(cx^2 + \frac{1}{2}\right)$

D. None of these

Answer: C

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21. Solve: $\frac{dy}{dx} = \frac{yf'(x) - y^2}{f(x)}$, where $f(x)$ is a given function of x

A. $f(x) = y(x + c)$

B. $f(x) = cxy$

C. $f(x) = c(x + y)$

D. $yf(x) = cx$

Answer: A

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22. The solution of the differential equation

$(x + y)^2 \frac{dy}{dx} = a^2$ is

A. $x + y = a \tan\left(\frac{y + c}{a}\right)$

B. $y = a \tan^{-1}(x + y) + c$

C. $y\left(1 - \frac{x}{4}\right) = \tan \frac{y}{a} + c$

D. None of these

Answer: A

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23. The particular solution of the differential equation $\sin^{-1}\left(\frac{d^2y}{dx^2}-1\right)=x$, where $y=\frac{dy}{dx}=0$ when x=0 , is

A. $y=x^2+x-\sin x$

B. $y=\frac{x^2}{2}+x-\sin x$

C. $y=\frac{x^2}{2}+\frac{x}{2}-\sin x$

D. $2y=x^2+x-\sin x$

Answer: B

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24. Solution of differential equation $\left(x^2-2x+2y^2\right)dx+2xydy=0$ is

A. $y^2=2x-\frac{1}{4}x^2+\frac{c}{x^2}$

B. $y^2=\frac{2}{3}x-x^2+\frac{c}{x^2}$

C. $y^2=\frac{2}{3}x-\frac{x^2}{4}+\frac{c}{x^2}$

D. None of these

Answer: C

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25. Solution of differential equation $\frac{dy}{dx} + \frac{x}{1-x^2}y = x\sqrt{y}$ is

A. $\sqrt{y} + \frac{1}{3}(1-x^2) = c(1-x^2)^{\frac{1}{4}}$

B. $y(1-x^2)^{\frac{1}{4}} = c(1-x^2)$

C. $\sqrt{y}(1-x^2)^{\frac{1}{4}} = \frac{1}{3}(1-x^2) + c$

D. None of these

Answer: A

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26. Find the general solution of the differential equation: $(\tan^{-1} y - x)dy = (1 + y)dx.$

A. $x = (\tan^{-1} y + 1) + Ce^{-\tan^{-1} y}$

B. $x = (\tan^{-1} y - 1) + Ce^{-\tan^{-1} y}$

C. $x = (\tan^{-1} x - 1) + Ce^{-\tan^{-1} x}$

D. $x = (\tan^{-1} x + 1) + Ce^{-\tan^{-1} x}$

Answer: B

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27. Which of the following is a second order differential equatoin

A. $(y')^2 + x = y^2$

B. $y'y'' + y = \sin x$

C. $y''' + (y'')^2 + y = 0$

D. $y' = y^2$

Answer: B

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28. The curve that satisfies the differential equation $y' = \frac{x^2 + y^2}{2xy}$ and passes through (2,1) is a hyperbola with eccentricity :

A. $\sqrt{2}$

B. $\sqrt{3}$

C. 2

D. $\sqrt{5}$

Answer: A

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29. If $\phi(x) = \int (\phi(x))^{-2} dx$ and $\phi(1) = 0$ then $\phi(x)$ is

A. $\{2(x-1)\}^{1/6}$

B. $\{5(x-2)\}^{1/-2}$

C. $\{3(x-1)\}^{1/8}$

D. None of these

Answer: D

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30. Solution of the differential equation $\frac{dx}{dy} - \frac{xInx}{1+Inx} = \frac{e^y}{1+Inx}$ if $y(1) = 0$ is (A) $x^x = r^{ye^y}$ (B) $e^y = x^{e^y}$ (C) $x = ye^y$ (D) $y = e^{x^y}$

A. $x^x = e^{ye^y}$

B. $e^y = x^{e^y}$

C. $x^x = ye^y$

D. None of these

Answer: A

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