MATHS

BOOKS - NTA MOCK TESTS

DIFFERENTIAL EQUATIONS TEST

Single Choice

1. The differential equation $\frac{dy}{dx} = \frac{\sqrt{1-y^2}}{y}$ determines a family of circles with

A. variables radii and a fixed centre at (0,1)

B. Variable radii and a fixed centre at (0,-1)

C. Fixed radius 1 and variable centres along the x-axis

D. Fixed radius 1 and variable centres along the y-axis

Answer: C

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2. The population p(t) at a time t of a certain mouse species satisfies the differential equation

$\frac{dp(t)}{dt} = 0.5p(t) - 450$. If p(0)=850 then the time at which the population becomes zero si

A. $\frac{1}{2}In18$

B. $In18$

C. $2In18$

D. $In9$

Answer: C

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3. The solution of the differential equation $\frac{dy}{dx} = y\tan x = e^x \sec x$ is

A. $y = e^x \cos x + c$

B. $y\cos x = e^x + c$

C. $y = e^x \sin x + c$

D. $y\sin x = e^x + c$

Answer: B

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4. The curve for which the x-intercept of the tangent drawn at any point P on the curve is three times the x-coordinate of the point P, is equal to (where C is an arbitrary constant)

A. $xy = C$

B. $xy^2 = C$

C. $xy^3 = C$

D. None of these

Answer: B

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5. Let the population of rabbits surviving at a time t be governed by the differential equation $\frac{dp(t)}{dt} = \frac{1}{2}p(t) - 200$. IF $p(0) = 100$, then p(t) equals

A. $600 - 600e^{\frac{t}{2}}$

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

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

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

Answer: C

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6. The solution of the differential equation $\frac{dy}{dx} = \frac{1}{x + y^2}$ is { Where C is an arbitrary constant}

A. $y = -x^2 - 2x - 2 + ce^x$

B. $y = x^2 + 2x + 2 - ce^x$

C. $x = -y^2 - 2y + 2 - ce^y$

D. $x = -y^2 - 2y - 2 + ce^y$

Answer: D

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7. The solution of the differential equation $\left(e^{-2\sqrt{x}} - \frac{y}{\sqrt{x}}\right)\frac{dx}{dy} = 1$ is given by

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

B. $ye^{-2\sqrt{x}} = \sqrt{x} + c$

C. $y = \sqrt{x}$

D. $y = 3\sqrt{x}$

Answer: A

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8. If $\frac{xdy}{dx} + y = x\frac{f(xy)}{f'(xy)}$ then f(xy) is equal to (where k is an arbitrary constant)

A. $ke^{x^2/2}$

B. $ke^{\frac{y^2}{2}}$

C. $ke^{(xy)^2/2}$

D. $ke^{xy/2}$

Answer: A

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9. Differenttial equation of all family of lines $y = mx + \frac{4}{m}$ by eliminating the arbitrary constant m is

A. $\frac{d^2y}{dx^2} = 0$

B. $x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} + 4 = 0$

C. $x\left(\frac{dy}{dx}\right)^2 + y\frac{dy}{dx} + 4 = 0$

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

Answer: B

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10. The solution of the differential equation $(x+y)^2\frac{dy}{dx}=a^2$ is { C is an arbitray constant}

A. $(x+y)^2=\frac{a^2x}{2}+c$

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

C. $(x+y)^2=2a^2x+c$

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

Answer: D

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11. The integrating facto of the differential equation $\frac{dy}{dx} + \frac{y}{(1-x)\sqrt{x}} = 1 - \sqrt{x}$ may be

A. $\frac{1-\sqrt{x}}{1+\sqrt{x}}$

B. $\frac{1+\sqrt{x}}{1-\sqrt{x}}$

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

D. $\frac{\sqrt{x}}{1-\sqrt{x}}$

Answer: B

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12. The integrating factor of the differential equation $(y\log y)dx = (\log y - x)dy)$ is

A. $\frac{1}{\log y}$

B. $1 + \log y$

C. $\frac{1}{\log(\log y)}$

D. $\log y$

Answer: D

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13. A curve having the condition that the slope of tangent at some point is two times the slope of the straight line joining the same point to the origin of coordinates, is a/an

A. Circle

B. Ellipse

C. Parabola

D. Hyperbola

Answer: C

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14. The equation of curve passing through the point $\left(1, \frac{\pi}{4}\right)$ and having slope of tangent at any point (x, y) as $\frac{y}{x} - \cos^2\left(\frac{y}{x}\right)$, is

A. $x = e^{1+\tan\left(\frac{y}{x}\right)}$

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

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

D. $x = e^{1-\tan\left(\frac{x}{y}\right)}$

Answer: B

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15. The solution of the differential equation

$$\frac{dy}{dx} + \frac{2x}{1+x^2}.y = \frac{1}{(1+x^2)}$$ is

A. $y\left(1-x^2\right) = \tan^{-1}x + c$

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

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

D. $y\left(1-x^2\right)^2 = \tan^{-1}x + c$

Answer: B

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16. A curve $y = f(x)$ passes through the point $P(1, 1)$. The normal to the curve at point P is $a(y - 1) + (x - 1) = 0$. If the slop of the tangent at any point on the curve is proportional to the ordinate at that point, then the equation of the curve is

A. $y = e^{ax} - 1$

B. $y = e^{ax} + 1$

C. $y = e^{ax} - a$

D. $y = e^{a(x-1)}$

Answer: D

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17. The general solution of the differential equation $\frac{dy}{dx} + \sin\left(\frac{x+y}{2}\right) = \sin\left(\frac{x-y}{2}\right)$ is (where c is an arbitrary constant)

A. $In\tan\left(\frac{y}{2}\right) = c - 2\sin x$

B. $In\tan\left(\frac{y}{4}\right) = c - 2\sin\left(\frac{x}{2}\right)$

C. $In\tan\left(\frac{y}{2} + \frac{\pi}{4}\right) = c - 2\sin x$

D. $In\tan\left(\frac{y}{4} + \frac{\pi}{4}\right) = c - 2\sin\left(\frac{x}{2}\right)$

Answer: B

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18. Solution of the differential equation $\left(2x\cos y + y^2\cos x\right)dx + \left(2y\sin x - x^2\sin y\right)dy = 0$ is {C is an arbitrary constant}

A. $x^2.\cos y + y^2.\sin x = C$

B. $x.\cos y - y.\sin x = C$

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

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

Answer: A

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19. Tangent to a curve intersects the y-axis at a point P. A line perpendicular to this tangent through P passes through the point (1,0). The differential equation of the curve is

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

B. $x\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 1$

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

D. None of these

Answer: A

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20. The differntial equation $y\frac{dy}{dx} + x = k(k \in R)$ represents

A. family of circles centered at y-axis

B. family of circles centered at x-axis

C. family of rectangular hyperbola's

D. family of paabola's whose axis is x-axis

Answer: B

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21. The differential equation representing the family of hyperbola $a^2x^2 - b^2y^2 = c^2$ is (a,b are arbitrary constant)

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. $\frac{y''}{y'} = \frac{y}{y'} - \frac{1}{x}$

Answer: A

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22. The general solution of the differntial equation $\left[2\sqrt{xy}-x\right]dy+ydx=0$ is (here $x, y>0$)

A. $\log x+\sqrt{\frac{y}{x}}=c$

B. $\log y-\sqrt{\frac{x}{y}}=c$

C. $\log y+\sqrt{\frac{x}{y}}=c$

D. None of these

Answer: C

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23. The general solution of the differential equation $(1+\tan y)(dx-dy)+2xdy=0$ is {C is an arbitray constant}

A. $x(\sin y+\cos y)=\sin y+ce^{y}$

B. $x(\sin y+\cos y)=\sin y+ce^{-y}$

C. $y(\sin x+\cos x)=\sin x+ce^{x}$

D. None of these

Answer: B

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24. 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 years

C. 30 log 2 years

D. None of these

Answer: B

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25. A normal is drawn at a point P(x,y) of a cuve. It meets the positive x-axis and the positive y-axis at point Aand B, respectively such that $\frac{1}{OA}+\frac{1}{OB}=1$, where O is the origin then theequation of such a curve passing through (5,4) is

A. $(x-1)^2+(y-1)^2=16$

B. $(x-1)^2+(y-1)^2=25$

C. $(x-2)^2+(y-2)^2=9$

D. None of these

Answer: B

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26. A normal at P(x,y) on a cruve meets the x-axis at Q and N is the foot of the ordinate at P. If $NQ = \frac{x\left(1+y^2\right)}{\left(1+x^2\right)}$ the equation of the curve is (given that it passes through the point (3,1))

A. $5\left(1+y^2\right) = \left(1+x^2\right)$

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

C. $\left(1+y^2\right) = 5\left(1+x^2\right)$

D. None of these

Answer: A

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27. The differential equation of family of circles passing through the point (0,0) and (a,0) is (where a is a arbitrary constant)

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

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

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

D. None of these

Answer: A

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28. If m and n ae the order and degee of the differential equation

$$\left(\frac{d^2y}{dx^2}\right)^5 + 4\frac{\left(\frac{d^2y}{dx^2}\right)^3}{\left(\frac{d^3y}{dx^3}\right)} + \frac{d^3y}{dx^3} = x^2 - 1, \text{ then}$$

A. $m = 3, n = 1$

B. $m = 3, n = 3$

C. $m = 3, n = 2$

D. $m = 2, n = 3$

Answer: C

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29. The geneal solution of the diffeential equation

$(2x - y + 1)dx + (2y - x + 1)dy = 0$ is

A. $x^2 + y^2 + xy - x + y = c$

B. $x^2 + y^2 - xy + x + y = c$

C. $x^2 - y^2 + 2xy - x + y = c$

D. $x^2 - y^2 - 2xy + x - y = c$

Answer: B

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

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

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

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

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

Answer: A

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