MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

DIFFERENTIAL EQUATION

Solved Examples And Exercises

1. Solve the following differential equations:

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

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2. Solve the differential equation $\frac{dy}{dx}=\frac{x(2\log x+1)}{\sin y+y\cos y}$, given that $y=0, when x=1.$

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3. Solve the following differential equations: $\frac{dy}{dx} = e^{x+y} + e^y x^3$

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4. Solve the following differential equations: $\frac{dy}{dx} = \frac{e^x\left(\sin^2 x + \sin 2x\right)}{y(2\log y + 1)}$

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5. Solve: $(x+y)^2 \frac{dy}{dx} = a^2$

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6. Find the solution of the differential equation $\cos y dy + \cos x \sin y dx = 0$ given that $y = \pi/2$, when $x = \pi/2$.

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7. Find the particular solution of the differential equation $\frac{dy}{dx} = -4xy^2$ given that $y = 1, when x = 0.$

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8. Solve the initial value problem: $\cos(x+y)dy = dx, y(0) = 0.$

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9. Solve: $\frac{dy}{dx} = \sin(x+y) + \cos(x+y)$

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

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11. A curve $y = f(x)$ has the property that the perpendicular distance of the origin from the normal at any point P of the curve is equal to the distance of the point P from the x-axis. Then the differential equation of the curve

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12. The slope of a curve at any point is the reciprocal of twice the ordinate at that point and it passes through the point(4,3). The equation of the curve is:

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13. The slope of the tangent to a curve at any point (x, y) on its given by $\frac{y}{x} - \cot\left(\frac{y}{x}\right).\cos\left(\frac{y}{x}\right), (x > 0, y > 0)$ and the curve passes though the point $\left(1, \frac{\pi}{4}\right)$. Find the equation of the curve.

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14. The slope of the tangent any point on a curve is λ times the slope of the joining the point of contact to the origin. Formulate the differential equation and hence find the equation of the curve.

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15. Show that the curve for which the normal at every point passes through a fixed point is a circle.

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16. The slope of the tangent at (x, y) to a curve passing through a point $(2, 1)$ is $\frac{x^2 + y^2}{2xy}$, then the equation of the curve is

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17. Find the equation of a curve passing through the point $(1, 1)$, given that the segment of any tangent drawn to the curve between the point of tangency and the y-axis is bisected at the x-axis.

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18. Solve the differential equation $(x + y)dy + (x - y)dx = 0$; given that y = 1 when x = 1.

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19. Solve the following differential equations: $\frac{dy}{dx} + 1 = e^{x+y}$

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20. Solve: $\left(x^3 - 3xy^2\right)dx = \left(y^3 - 3x^2y\right)dy$.

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21. Solve: $x^2 y dx = \left(x^3 + y^3\right) dy = 0$

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22. Solve the following differential equations: $(x + y)^2 \frac{dy}{dx} = 1$

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23. Solve the following differential equations: $\frac{dy}{dx} = \frac{(x - y) + 3}{2(x - y) + 5}$

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24. Solve the following differential equations: $(x + y + 1) \frac{dy}{dx} = 1$

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25. Solve the following differential equations:

$(x+y)(dx-dy)=dx+dy$

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26. Solve $x\frac{dy}{dx}\sin\left(\frac{y}{x}\right)+x-y\sin\left(\frac{y}{x}\right)=0$ given $y(1)=\frac{\pi}{2}$

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27. Solve: $x\frac{dy}{dx}=y-x\tan\left(\frac{y}{x}\right)$.

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28. A thermometer reading $80^\circ F$ is taken outside. Five minutes later the thermometer reads $60^\circ F$. After another 5 minutes the thermometer reads $50^\circ F$. What is the temperature outside?

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29. The doctor took the temperature of a dead body at 11.30 Pm which was $94.6^{\circ}F$. He took the temperature of the body again after one hour, which was $93.4^{\circ}F$. If the temperature of the room was $70^{\circ}F$, estimate the time of death. Taking normal temperature of human body as $98.6^{\circ}F$. [Given: $\log\left(\frac{143}{123}\right) = 0.15066, \log\left(\frac{123}{117}\right) = 0.05$]

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30. If is given that radium decomposes at a rate proportional to the amount present. If $p\%$ of th original amount of radium disappears in l years, what percentageof it will remain after $2l$ years?

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31. A radioactive substance disintegrates at as rate proportional to the amount of substance present. If 50% f the given amount disintegrates in

1600 years. What percentage of the substance disintegrates i 10 years ?

$\frac{-\log 2}{160}$ Take $e = 0.9957$

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32. If is known that, if the interest i s compounded continuously, the principal changes f the rate equal to the product of the rate of bak interest per annum, and the principal. If the interest is compounded continuously at 5% per annum, in how many years will Rs. 100 double itself? At what interest rate will Rs. 100 double itself in 10 years $\left((\log)_e 2 = 0.6931\right)$ How much will Rs. 1000 be worth at 5% interest after 10 years? $\left(e^{0.5} = 1.648\right)$.

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33. Bacteria multiply at a rate proportional to the number present. If the original number N double in 3 hours, the number of the bacteria will be 4N is (in hours).

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34. A spherical rain drop evaporates at a rate proportional to its surface area at any instant t. The differential equation giving the rate of change of the radius of the rain drop is _____

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35. Water at temperature $100^\circ C$ cools in 10 minutes to $88^\circ C$ in a room of temperature $25^\circ C$. Find The temperature of water after 20 minutes

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36. Solve the following differential equations: $\frac{dy}{dx} = \sin^3 x \cos^2 x + xe^x$

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37. Solve: $\frac{dy}{dx} = \frac{1}{\sin^4 x + \cos^4 x}$

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38. Solve the initial value problem $e^{(dy/dx)} = x + 1; y(0) = 5.$

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39. Solve the following initial value problems: $(22 - 26)$ $\sin\left(\frac{dy}{dx}\right) = k; y(0) = 1$

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40. Solve the initial value problem $e^{(dy/dx)} = x + 1; y(0) = 5.$

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41. Solve the following initial value problems: $(22-26)$

$x\left(x^2-1\right)\frac{\mathrm{dy}}{\mathrm{d}x}=1; y(2)=0$

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42. Solve: 1.$(x+1)\frac{dy}{dx}=2xy$ 2.

$\cos x(1+\cos y)dx-s\in y(1+\sin x)dy=0$

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43. Solve the following differential equations: $y-x\frac{dy}{dx}=a\left(y^2+\frac{dy}{dx}\right)$

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44. Solve: $\log\left(\frac{dy}{dx}\right)=ax+by$

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45. Solve the initial value problem $y' = y\cot 2x, y\left(\frac{\pi}{4}\right) = 2.$

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46. if a, b are two positive numbers such that $f(a+x) = b + \left[b^3 + 1 - 3b^2 f(x) + 3b\{f(x)\}^2 - \{f(x)\}^3\right]^{\frac{1}{3}}$ for all real x, then prove that $f(x)$ is peroidic and find its peroid?

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47. Solve the initial value problem: $dy = e^{2x+y}dx, y(0) = 0.$

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48. Solve the initial value problem: $x(xdy + ydx) = ydx, y(1) = 1.$

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49. Solve: $\frac{dy}{dx} = y \sin 2x$ it being given that $y(0) = 1$.

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50. Solve the initial value problem: $(xdy + ydx) = xydx, y(1) = 1$.

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51. Find the equation of the curve passing through origin if the slope of the tangent to the curve at any point $(x, y) is$ equal to the square of the difference of the abscissa and ordinate of the point.

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52. Find the equation of the curve passing through the point $(1, 0)$ if the slope of the tangent to the curve at any point $(x, y) is \frac{y-1}{x^2+x}$.

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53. Find the equation of the curve passing through the point $(-2, 3)$ given that the slope of the tangent to the curve at any point $(x, y) is \frac{2x}{y^2}$.

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54. Find the equation of the curve passing through the point $(1, 1)$ whose differential equation is : $x dy = (2x^2 + 1) dx$.

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55. Solve the following differential equation : $x \cos y \, dy = (xe^x \log x + e^x) dx$

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56. Solve the following differential equations: $x \cos^2 y \, dx = y \cos^2 x \, dy$

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57. Experiments show that the rate of inversion of cane sugar in dilute solution is proportional to the concentration $y(t)$ of the unaltered solution. Suppose that the concentration is $\frac{1}{100}$ at $t = 0$ and $\frac{1}{300}$ at $t = 10$ hrs. Find $y(t)$

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58. 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?

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59. A bank pays interest by continuous compounding, that is ,by treating the interest rate as the instantaneous rate of change of principal. Suppose in an account interest accrues at 8% per year, compounded

continuously. Calculate the percentage increase in such an account over one year. [take $e^{0.08} \approx 1.0833$]

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60. Experiments show that radius disintegrates at a rate proportional to the amount of radium present at the moment. Its half life is 1590 years. What percentage will disappear in one year? [Use $e^{-\frac{\log 2}{1590}} = 0.9996$]

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

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62. Find the equation to the curve satisfying $x(x+1)\frac{dy}{dx} - y = x(x+1)$ and passing through $(1, 0)$.

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63. The curve is such that the length of the perpendicular from the origin on the tangent at any point P of the curve is equal to the abscissa of P. Prove that the differential equation of the curve is $y^2 - 2xy\frac{dy}{dx} - x^2 = 0$, and hence find the curve.

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64. 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.

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65. Find the equation of a curve passing through the point (0, 1). If the slope of the tangent to the curve at any point (x, y) is equal to the sum of

the x coordinate (abscissa) and the product of the x coordinate and y coordinate (ordinate) of that point.

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66. Form the differential equation corresponding to $y^2 = m(a^2 - x^2)$ by eliminating parameters m and a

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67. Form the differential equation not containing the arbitrary constants and satisfied by the equation $y = ae^{bx}$, a and b` are arbitrary constants.

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68. if $(\log)_a$x=b for permissible values of a and x then identify the statements which can be correct.

(a) If a and b are two irrational numbers then x can be rational

(b) if a is rational and b is irrational, then x can be rational

(c) if a is irrational and b is rational, then x can be rational

(d) If a and b are two rational numbers then x can be rational .

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69. Form the differential equation corresponding to $y^2 = a(b - x)(b + x)$ by eliminating parameters $a$and$b$.

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70. In each of the following differential equations indicate its degree, wherever possible. Also, give the order of each of them. $\frac{dy}{dx} + \sin\left(\frac{dy}{dx}\right) = 0$

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71. Form the differential equation of the family of curves represented $c(y+c)^2 = x^3$, *where* is a parameter.

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72. Determine the order and degree of each of the following differential equations. State also if they are linear or non-linear. (i)

$$\frac{\left\{1+\left(\frac{dy}{dx}\right)^2\right\}^{3/2}}{\frac{d^2y}{dx^2}} = k$$

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73. Show that the differential equation that represents the family of all parabolas having their axis of symmetry coincident with the axis of $\xi syy_2 + y12 = 0.$

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74. Find the differential equation of All non-vertical lines in a plane.

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75. Solve the following differential equations: $\frac{dy}{dx} = y\tan x - 2\sin x$

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76. Solve the following differential equations:

$\frac{dy}{dx} + y\cot x = x^2\cot x + 2x$

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77. Solve the following differential equations:

$\frac{dy}{dx} + \frac{4x}{x^2+1}y + \frac{1}{(x^2+1)^2} = 0$

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78. Solve the following differential equations: $x\frac{dy}{dx} - y = (x-1)e^x$

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79. Solve each of the following initial value problems $\sqrt{1-y^2}dx = \left(\sin^{-1}y - x\right)dy, y(0) = 0$

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80. Solve the following differential equations: $x\frac{dy}{dx} + y = xe^x$

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81. If $y(t)$ is a solution of $(1+t)\frac{dy}{dt} - ty = 1 and y(0) = -1$ then show that $y(1) = -\frac{1}{2}$.

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82. Solve: $\left(x+2y^3\right)dy=ydx$.

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83. Solve each of the following initial value problems:

$x\frac{dy}{dx}+y=x\log x, y(1)=\frac{1}{4}$

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84. Solve each of the following initial value problems:

$\frac{dy}{dx}+\frac{2x}{x^2+1}y=\frac{1}{\left(x^2+1\right)^2}, y(0)=0$

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85. Solve the following differential equations: $\left(2x-10y^3\right)\frac{dy}{dx}+y=0$

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86. Solve the following differential equations: $\frac{dy}{dx} + y\cot x = x^2\cot x + 2x$

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87. Solve the following differential equations: $\frac{dy}{dx} + y\cos x = \sin x\cos x$

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88. Solve the following differential equations: $(x + \tan y)dy = \sin 2ydx$

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89. Solve the following differential equations: $\frac{dy}{dx} - y = xe^x$

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90. Solve the following differential equations:

$$(1+x^2)\frac{dy}{dx} - 2xy = (x^2+2)(x^2+1)$$

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91. The surface are of a balloon being inflated changes at a constant rate. If initially, its radius is3 units sand after 2 seconds, it s 5 units, find the radius after t seconds.

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92. Solve the following differential equations: $\frac{dy}{dx} + 2y = xe^{4x}$

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93. Suppose the growth of a population is proportional the umber present. If the population of a colony double in 25 days, in how many

days will the population become triple?

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94. A population grows at the rate of 8% per year. How long does it take for the population to double? Use differential equation for it.

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95. Verify that $y = \log\left(x + \sqrt{x^2 + a^2}\right)^2$ satisfies the differential equation $\left(a^2 + x^2\right)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0.$

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96. Verify that $y = ce^{tan-1_x}$ is a solution of differential equation $\left(1 + x^2\right)\frac{d^2y}{dx^2} + (2x - 1)\frac{dy}{dx} = 0.$

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97. Show that the differential equation of which $y = 2(x^2 - 1) + ce^{-x^2}$ is a solution, is $\frac{dy}{dx} + 2xy = 4x^3$.

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98. Form the differential equation corresponding to $y^2 - 2ay + x^2 = a^2$ by eliminating a.

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99. Show that $y = Ax + \frac{B}{x}, x \neq 0$ is a solution of the differential equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = 0$

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100. Form the differential equation having $y = \left(\sin^{-1} x\right)^2 + A\cos^{-1} x + B$ where A and B are arbitrary constants,

as its general solution

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101. Show that $y = ae^{2x} + be^{-x}$ is a solution of the differential equation $\frac{d^2y}{dx^2} - \left(\frac{dy}{dx}\right) - 2y = 0.$

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102. Show that the function $y = (A + Bx)e^{3x}$ is a solution of the equation $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 0.$

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103. Show that $y = cx + \frac{a}{c}$ is a solution of the differential equation $y = x\frac{dy}{dx} + \frac{a}{\frac{dy}{dx}}.$

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104. Show that $y = a\cos(\log x) + b\sin(\log x)$ is a solution of the differential equation $x^2\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = 0.$

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105. Solve the following differential equations:

$(x^2 + 3xy + y^2)dx - x^2dy = 0$

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106. Solve the differential equation: $(x^2 + y^2)dx - 2xydy = 0$

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107. Solve the following differential equations: $\frac{dy}{dx} = \frac{y}{x} - \sqrt{\frac{y^2}{x^2} - 1}$

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108. Solve the following differential equations:

$$\left[x\sqrt{x^2+y^2}-y^2\right]dx+xy\,dy=0$$

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109. Solve the following differential equations:

$$\frac{y}{x}\cos\left(\frac{y}{x}\right)dx-\left\{\frac{x}{y}\sin\left(\frac{y}{x}\right)+\cos\left(\frac{y}{x}\right)\right\}dy=0$$

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110. Solve the following differential equations: $\frac{dy}{dx}=\frac{x+y}{x-y}$

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111. Solve the following differential equations: $x\frac{dy}{dx}=x+y$

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112. Solve the following differential equations: $xy\frac{dy}{dx} = x^2 + y^2$

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113. Solve the following differential equations: $ye^{x/y}dx = \left(xe^{\frac{x}{y}} + y\right)dy$

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114. Solve: $\frac{dy}{dx} = -\frac{x + y\cos x}{1 + \sin x}$

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115. Solve: $\frac{dy}{dx} + x\sin 2y = x^3\cos^2 y$

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116. Solve: $\frac{dy}{dx} + \frac{y}{x} = \cos x + \frac{\sin x}{x}$

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117. Solve: $\frac{dy}{dx} + y \tan x = 2x + x^2 \tan x$.

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118. Solve: $\frac{dy}{dx} + y = \cos x - \sin x$

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119. Solve: $\left(1 + x^2\right) \frac{dy}{dx} + 2xy - 4x^2 = 0$ subject to the initial condition $y(0) = 0$.

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120. Solve: $\frac{dy}{dx} - 2y = \cos 3x$

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121. Solve the differential equation: $\frac{dy}{dx} + \frac{y}{2x} = 3x^2$

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122. Solve the following differential equation:

$y\,dx + x\log\left(\frac{y}{x}\right)dy = 2x\,dy$

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123. Determine the order and degree of the following differential equation. State also whether they are linear or non-linear:

$\frac{d^3x}{dt^3} + \frac{d^2x}{dt^2} + \left(\frac{dx}{dt}\right)^2 = e^t$

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124. Determine the order and degree of the following differential equation. State also whether they are linear or non-linear: $\frac{d^2y}{dx^2} + 4y = 0$

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125. Determine the order and degree of the following differential equation. State also whether they are linear or non-linear: $\frac{d^3x}{dt^3} + \frac{d^2x}{dt^2} + \left(\frac{dx}{dt}\right)^2 = e^t$

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126. Determine the order and degree of the following differential equation. State also whether they are linear or non-linear: $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 + x\,y = 0$

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127. Determine the order and degree of the following differential equation. State also whether they are linear or non-linear:

$$\left(\frac{dy}{dx}\right)^2 + \frac{1}{dy/dx} = 2$$

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128. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$$\frac{d^4y}{dx^4} = \left\{c + \left(\frac{dy}{dx}\right)^2\right\}^{3/2}$$

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129. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$$y\frac{d^2x}{dy^2} = y^2 + 1$$

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130. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear: $x^2\left(\frac{d^2y}{dx^2}\right)^3 + y\left(\frac{dy}{dx}\right)^4 + y^4 = 0$

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131. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear: $(xy^2 + x)dx + (y - x^2y)dy = 0$

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132. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear: $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^{2/3}$

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133. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$y = px + \sqrt{a^2p^2 + b^2},\ where\ p = \dfrac{dy}{dx}$

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134. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$\left(\dfrac{d^2y}{dx^2}\right)^2 + \left(\dfrac{dy}{dx}\right)^2 = x\sin\left(\dfrac{d^2y}{dx^2}\right)$

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135. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$\dfrac{d^2y}{dx^2} + 5x\left(\dfrac{dy}{dx}\right) - 6y = \log x$

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136. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$$\frac{d^2y}{dx^2} + 3\left(\frac{dy}{dx}\right)^2 = x^2 \log\left(\frac{d^2y}{dx^2}\right)$$

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137. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$$\sqrt{1 + \left(\frac{dy}{dx}\right)^2} = \left(c\,\frac{d^2y}{dx^2}\right)^{1/3}$$

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138. Determine the order and degree of the following differential equation. State also whether they are linear or non-linear:

$$\sqrt[3]{\frac{d^2y}{dx^2}} = \sqrt{\frac{dy}{dx}}$$

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139. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$$s^2\frac{d^2t}{ds^2} + st\frac{dt}{ds} = s$$

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140. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$$\frac{d^3y}{dx^3} + \left(\frac{d^2y}{dx^2}\right)^5 + \frac{dy}{dx} + 4y = s \in x$$

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141. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$$\sqrt{1-y^2}dx + \sqrt{1-x^2}dy = 0$$

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142. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$$2\frac{d^2y}{dx^2} + 3\sqrt{1 - \left(\frac{dy}{dx}\right)^2} - y = 0$$

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143. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$$y = x\frac{dy}{dx} + a\sqrt{1 + \left(\frac{dy}{dx}\right)^2}$$

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144. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear: $\frac{dy}{dx} + e^y = 0$

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145. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear: $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^2 = x \sin\left(\frac{d^2y}{dx^2}\right)$

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146. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear: $(y'')^2 + (y')^3 + \sin y = 0$

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147. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear: $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} + \frac{dy}{dx} + y \sin y = 0$

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148. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear: $\left(\frac{dy}{dx}\right)^3 - 4\left(\frac{dy}{dx}\right)^2 + 7y = s \in x$

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149. Form the differential equation representing the family of curves $y = A\cos(x + B)$ where A and B are parameters.

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150. Form the differential equation of the family of curves $y = a\sin(bx + c),\ a\ and\ c$ being parameters.

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151. Find the differential equation of all circles touching the (i) x-axis at the origin (ii) y-axis at the origin

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152. Find the differential equation of all the circles in the first quadrant which touch the coordinate axes.

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153. Find the area bounded by the curve $y^2 = 4ax$ and the lines $y = 2\ and$ y-axis.

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154. Show that the differential equation representing one parameter family of curves

$(x^2 - y^2) = c(x^2 + y^2)^2 is (x^3 - 3xy^2)dx = (y^3 - 3x^2y)dy$

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155. Represent the following family of curves by forming the corresponding differential equations (a, b are parameters) (i) $\frac{x}{a} + \frac{y}{b} = 1$ (ii) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

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156. Obtain the differential equation of all circles of radius r.

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157. Form the differential equation of the family of curves represented by $y^2 = (x - c)^3$.

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158. Form the differential equation corresponding to $y = e^{mx}$ by eliminating m.

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159. Form the differential equation from the following primitives where constants are arbitrary: $y^2 = 4ax$

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160. Form the differential equation from the following primitives where constants are arbitrary: $y = cx + c^2 + c^3$

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161. Form the differential equation from the following primitives where constants are arbitrary: $xy = a^2$

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162. Form the differential equation from the following primitives where constants are arbitrary:$y = ax^2 + bx + c$

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163. Find the differential equation of the family of curves $y = Ae^{2x} + Be^{-2x}$, where A and B are arbitrary constants.

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164. Find the differential equation of the family of curves, $x = A\cos nt + B\sin nt,$ where A and B are arbitrary constants.

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165. Form the differential equation corresponding to $y^2 = a(b - x^2)$ by eliminating a and b.

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166. Form the differential equation corresponding to $(x - a)^2 + (y - b)^2 = r^2$ by eliminating a and b.

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

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168. Find the differential equation of all the circles which pass thorough the origin and whose centres lie on x-axis.

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169. Assume that a rain drop evaporates at a rate proportional to its surface area. Form a differential equation involving the rate of change of the radius of the rain drop.

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170. Find the differential equation of all the parabolas with latus rectum $4a$ and whose axes are parallel to x-axis.

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171. Form the differential equation of the family of curves represented by the equation $(x-a)^2+2y^2=a^2$, (a being the parameter)

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172. Represent the following families of curves by forming the corresponding differential equations (a, b being parameters): (i) $x^2 + y^2 = a^2$ (ii) $x^2 - y^2 = a^2$

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173. Represent the following families of curves by forming the corresponding differential equations (a being parameter): (i) $(x - a)^2 - y^2 = 1$ (ii) $x^2 + y^2 = ax^3$

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174. Represent the following families of curves by forming the corresponding differential equations (a, b being parameters): (i) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ (ii) $y = e^{ax}$

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175. Represent the following families of curves by forming the corresponding differential equations (a, b being parameters): (i) $y^2 = 4ax$ (ii) $y^2 = 4a(x - b)$

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176. Represent the following families of curves by forming the corresponding differential equations (a, b being parameters): (i) $x^2 + (y - b)^2 = 1$ (ii) $y = ax^3$

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177. Represent the following families of curves by forming the corresponding differential equations (a, b being parameters): (i) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ (ii) $y = e^{ax}$

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178. Form the differentials equation representing the family of ellipse having center at the origin and foci ion x-axis.

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179. Form the differential equation of the family of hyperbola having foci on x-axis and center at the origin.

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180. Form the differential equation of the family of circles in the second quadrant and touching the coordinate axes.

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181. Show that $xy = ae^x + be^{-x} + x^2$ is a solution of the differential equation $x\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - xy + x^2 - 2 = 0.$

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182. Verify that the function $y = C_1 e^{ax} \cos bx + C_2 e^{ax} \sin bx,\ C_1, C_2,$ are arbitrary constants is a solution of the differential equation $\frac{d^2y}{dx^2} - 2a\frac{dy}{dx} + (a^2 + b^2)y = 0$

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183. Show that $y = be^x + ce^{2x}$ is a solution of the differential equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 0.$

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184. Verify that $y = 4\sin 3x$ is a solution of the differential equation $\frac{d^2y}{dx^2} + 9y = 0.$

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185. Show that $y = ae^{2x} + be^{-x}$ is a solution of the differential equation

$$\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 0$$

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186. Show that the function $y = A\cos x + B\sin x$ is as solution of the differentia equation $\frac{d^2y}{dx^2} + y = 0.$

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187. Show that the function $y = A\cos 2x - B\sin 2x$ is a solution of the differentia equation $\frac{d^2y}{dx^2} + 4y = 0.$

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188. Show that $y = Ae^{Bx}$ is as solution of the differential equation $\frac{d^2y}{dx^2} = \frac{1}{y}\left(\frac{dy}{dx}\right)^2.$

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189. Verity that $y = \frac{a}{x} + b$ is a solution of the differential equation $\frac{d^2y}{dx^2} + \frac{2}{x}\left(\frac{dy}{dx}\right) = 0.$

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190. Verify that $y^2 = 4ax$ is a solution of the differential equation $y = x\frac{dy}{dx} + a\frac{dx}{dy}.$

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191. Show that $Ax^2 + By^2 = 1$ is a solution of the differential equation $x\left\{y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2\right\} = y\frac{dy}{dx}.$

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192. Show that $y = ax^3 + bx^2 + c$ is a solution of the differential equation $\frac{d^3y}{dx^3} = 6a$.

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193. Show that $y = \frac{c - x}{1 + cx}$ is a solution of the different equation $(1 + x^2)\frac{dy}{dx} + (1 + y^2) = 0$.

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194. Show that $y = e^x(A\cos x + B\sin x)$ is the solution of the differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$.

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195. Verify that $y = cx + 2c^2$ is a solution of the differential equation $2\left(\frac{dy}{dx}\right)^2 + x\frac{dy}{dx} - y = 0$.

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196. Verify that $y = -x - 1$ is a solution of the differential equation $(y - x)dy - (y^2 - x^2)dx = 0.$

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197. Verity that $y^2 = 4a(x + a)$ is a solution of the differential equation $y\left\{1 - \left(\frac{dy}{dx}\right)^2\right\} = 2x\frac{dy}{dx}.$

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198. Verify that $y = e^{m\cos^{-1}x}$ satisfies the differential equation $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - m^2y = 0$

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199. Show that the differential equation of which $y = 2(x^2 - 1) + ce^{-x}\ \hat{}\ 2$ is a solution, is $\frac{dy}{dx} + 2xy = 4x^3$.

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200. Verify the solution problems: Show that $y = e^{-x} + ax + b$ is solution of the differential equation $e^x \frac{d^2y}{dx^2} = 1$

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201. For each of the following differential equations verify that the accompanying functions a solution. (i) $x\frac{dy}{dx} = y \Rightarrow y = ax$ (ii) $x + y\frac{dy}{dx} = 0 \Rightarrow y = \pm\sqrt{a^2 - x^2}$ (iii) $x\frac{dy}{dx}y + y^2 \Rightarrow y = \frac{a}{x + a}$ (iv) $x^3\frac{d^2y}{dx^2} = 1 \Rightarrow y = ax + b + \frac{1}{2x}$ (v) $y = \left(\frac{dy}{dx}\right)^2 \Rightarrow y = \frac{1}{4}(x \pm a)^2$

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202. Verify that the function defined by $y = \sin x - \cos x$ is a solution of the initial value problem $\frac{dy}{dx} = \sin x + \cos x$; such that $y(0) = -1$

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203. Show that the function φ defined by $\varphi(x) = \cos x \ (x \in \mathbb{R})$; satisfies the initial value problem $\frac{d^2y}{dx^2} + y = 0, y(0) = 1, \ y'(0) = 0.$

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204. For each of the following initial value problems verify that the accompanying functions is a solution. (i) $x\frac{dy}{dx} = 1, \ y(1) = 0 \Rightarrow y = \log x$ (ii) $\frac{dy}{dx} = y, \ y(0) = 1 \Rightarrow y = e^x$ (iii) $\frac{d^2y}{dx^2} + y = 0, \ y(0) = 0, \ y'(0) = 1 \Rightarrow y = \sin x$ (iv) $\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0, \ y(0) = 2, \ y'(0) = 1 \Rightarrow y = e^x + 1$ (v) $\frac{dy}{dx} + y = 2, \ y(0) = 3 \Rightarrow y = e^{-x} + 2$

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205. Solve: $\frac{dy}{dx} = \frac{x}{x^2+1}$

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206. Solve: $\left(e^x + e^{-x}\right)\frac{dy}{dx} = \left(e^x - e^{-x}\right)$

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207. Solve the following differential equation:

$\frac{dy}{dx} = x^2 + x - \frac{1}{x},\ x \neq 0$

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208. Solve the following differential equation: $\frac{dy}{dx} + 2x = e^{3x}$

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209. Solve the following differential equation: $\frac{dy}{dx} = \frac{1 - \cos x}{1 + \cos x}$

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210. Solve the following differential equation: $\frac{dy}{dx} = \tan^{-1} x$

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211. Solve the following differential equation: $\frac{1}{x}\frac{dy}{dx} = \tan^{-1} x,\ x \neq 0$

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212. Solve the following differential equation:

$(\sin x + \cos x)dy + (\cos x - \sin x)dx = 0$

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213. Solve the following differential equation: $\frac{dy}{dx} - x \sin^2 x = \frac{1}{x \log x}$

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214. Solve the following differential equation: $\sin^4 x \frac{dy}{dx} = \cos x$

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215. Solve the following differential equation: $\sqrt{1 - x^4} dy = x \, dx$

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216. Solve the following differential equation: $\left(1 + x^2\right) \frac{dy}{dx} - x = 2 \tan^{-1} x$

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217. Solve the following differential equation: $\frac{dy}{dx} = x \log x$

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218. Solve the following differential equation: $\left(x^3 + x^2 + x + 1\right) \frac{dy}{dx} = 2x^2 + x$

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219. Solve the following differential equation: $\frac{dy}{dx} = x^5 + x^2 - \frac{2}{x}, \ x \neq 0$

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220. Solve the following differential equation: $(x + y + 1) \frac{dy}{dx} = 1$

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221. Solve the following differential equation: $(x+2)\frac{dy}{dx} = x^2 + 3x + 7$

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222. Solve the following differential equation: $\frac{dy}{dx} = \log x$

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223. Solve the following differential equation: $\frac{dy}{dx} = \cos^3 x \sin^2 x + x\sqrt{2x-1}$

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224. Solve the following differential equation: $\frac{dy}{dx} = x^5 \tan^{-1}\left(x^3\right)$

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225. Solve the following differential equation: $\sqrt{a+x}dy + x\,dx = 0$

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226. Solve the following differential equation: $\frac{dy}{dx} = x\,e^x - \frac{5}{2} + \cos^2 x$

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227. Solve the following initial value problem:

$C'(x) = 2 + 0.15x; C(0) = 100$

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228. Solve the following initial value problem: $x\frac{dy}{dx} + 1 = 0; y(-1) = 0$

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229. Solve: $\frac{dy}{dx} = \frac{1}{y^2 + \sin y}$

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230. Solve: $\frac{dy}{dx} = \sec y$

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231. Solve: $\frac{dy}{dx} + y = 1$

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232. Solve the initial vale problem $\frac{dy}{dx} + 2y^2 = 0,\ y(1) = 1$ and find the corresponding solution curve.

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233. Solve the following differential equation: $\frac{dy}{dx} + \frac{1+y^2}{y} = 0$

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234. Solve the following differential equation: $\frac{dy}{dx} = \frac{1+y^2}{y^3}$

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235. Solve the following differential equation: $\frac{dy}{dx} = \frac{1-\cos 2y}{1+\cos 2y}$

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236. Find the general solution of the differential equations $\sec^2 x \tan y dx + \sec^2 y \tan x dy = 0$

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237. Solve: $e^x\sqrt{1-y^2}dx+\frac{y}{x}dy=0$

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238. Find the particular solution of the differential equation $\left(1+e^{2x}\right)dy+\left(1+y^2\right)e^x dx=0,$ given that $y=1$ when $x=0.$

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239. Solve the differential equation: $\left(1+y^2\right)(1+\log x)dx+xdy=0$ given that when $x=1,\ y=1.$

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240. Solve the differential equation $x\left(1+y^2\right)dx-y\left(1+x^2\right)dy=0,$ given that $y=0,$ when $x=1$

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241. Solve: $\left(x^2 - yx^2\right)dy + \left(y^2 + x^2y^2\right)dx = 0$

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242. Solve : $3e^x \tan y dx + (1 - e^x)\sec^2 y\, dy = 0$

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243. Solve: $\sin^3 x \frac{dx}{dy} = \sin y$

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244. Solve the differential equation $\frac{dy}{dx} + \sqrt{\frac{1 - y^2}{1 - x^2}} = 0$

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245. The solution of the differential equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ is (A) $y = e^x + \frac{1}{2}x^2 + c$ (B) $e^{y-x} = \frac{1}{3}x^3 + c$ (C) $e^y = e^x + \frac{1}{3}x^3 + c$ (D) none of these

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246. Solve: $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$

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

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248. Solve the initial value problem: $(x+1)\frac{dy}{dx} = 2e^{-y} - 1, \; y(0) = 0$

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249. Solve the initial value problem: $y - x\frac{dy}{dx} = 2\left(1 + x^2\frac{dy}{dx}\right),\ y(1) = 1$

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250. Show that the general solution of the differentia equation $\frac{dy}{dx} + \frac{y^2 + y + 1}{x^2 + x + 1} = 0$ is given by $x + y + 1 = A(1 - x - y - 2xy)$ where A is a parameter.

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251. Find the particular solution of the differential equation $\log\left(\frac{dy}{dx}\right) = 3x + 4y$ given that $y = 0$ when $x = 0$.

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252. In a bank, principal increases continuously at the rate of 5% per year. In how many years Rs 1000 double itself?

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253. Find the equation of the curve passing through the point (0, -2) given that at any point (x, y) on the curve the product of the slope of its tangent and y coordinate of the point is equal to the x-coordinate of the point.

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254. At any point (x, y) of a curve, the slope of the tangent is twice the slope of the line segment joining the point of contact to the point $(-4, -3)$. Find the equation of the curve given that it passes through $(-2, \quad 1)$.

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255. Solve the following differential equation: $(x-1)\frac{dy}{dx} = 2xy$

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256. Solve the following differential equation: $\frac{dy}{dx} = (e^x + 1)y$

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257. Solve the following differential equation:

$xy(y+1)dy = \left(x^2+1\right)dx$

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258. Solve the following differential equation:

$x \cos y \, dy = (xe^x \log x + e^x)dx$

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259. Solve the following differential equation: $x\frac{dy}{dx} + y = y^2$

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260. Solve the following differential equation: $x\frac{dy}{dx} + \cot y = 0$

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261. Solve the following differential equation:

$(1 - x^2)dy + xy\,dx = xy^2dx$

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262. Solve the following differential equation:

$\cos x \cos y\frac{dy}{dx} = -\sin x \sin y$

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263. Solve the following differential equation:

$x\sqrt{1-y^2}dx + y\sqrt{1-x^2}\,dy = 0$

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264. Solve the following differential equation:

$(y+xy)dx + \left(x - xy^2\right)dy = 0$

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265. Solve the following differential equation:

$\left(y^2+1\right)dx - \left(x^2+1\right)dy = 0$

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266. Solve the following differential equation: $\frac{dy}{dx} = \left(1+x^2\right)\left(1+y^2\right)$

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267. Solve the following differential equation:

$$\left(xy^2 + 2x\right)dx + \left(x^2y + 2y\right)dy = 0$$

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268. Solve the following differential equation: $xy\frac{dy}{dx} = 1 + x + y + xy$

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269. Solve the following differential equation: $\left(1 + x^2\right)dy = xy\,dx$

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270. Solve the following differential equation: $(x - 1)\frac{dy}{dx} = 2x^3y$

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271. Solve the following differential equation: $5\frac{dy}{dx} = e^x y^4$

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272. Solve the following differential equation: $\frac{dy}{dx} = e^{x+y} + x^2 e^y$

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273. $(e^y + 1)\cos x dx + e^y \sin x dy = 0$

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274. Solve the following differential equation:$xydy = (y-1)(x+1)dx$

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275. Solve the following differential equation:

$$y\sqrt{1+x^2}+x\sqrt{1+y^2}\frac{dy}{dx}=0$$

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276. The solution of the equation $\frac{dy}{dx}=\frac{x(2\log x+1)}{\sin y+y\cos y}$ is

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277. Solve the following differential equation:

$$\tan y dx+\sec^2 y\tan x dy=0$$

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278. Solve the following differential equation:

$$\tan y\frac{dy}{dx}=\sin(x+y)+\sin(x-y)$$

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279. Solve the following differential equation: $\frac{dy}{dx} + \frac{\cos x \sin y}{\cos y} = 0$

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280. Solve the following differential equation:

$y(1 + e^x)dy = (y + 1)e^x dx$

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281. Solve the following differential equation: $\frac{dy}{dx} = 1 - x + y - xy$

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282. Solve the following differential equation:

$dy + (x + 1)(y + 1)dx = 0$

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283. Solve the following differential equation: $(x-1)\frac{dy}{dx} = 2x^3 y$

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284. Solve the following differential equation: $\frac{dy}{dx} = \left(\cos^2 x - \sin^2 x\right)\cos^2 y$

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285. Solve the following differential equation: $\cos ecx \log y \frac{dy}{dx} + x^2 y^2 = 0$

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286. Solve the following differential equation: $y\left(1-x^2\right)\frac{dy}{dx} = x\left(1+y^2\right)$

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287. Solve the differential equation $ye^{\frac{x}{y}}dx = \left(xe^{\frac{x}{y}} + y^2\right)dy(y \neq 0)$

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288. Solve the following differential equation:

$\left(1+y^2\right)\tan^{-1}dx + 2y\left(1+x^2\right)dy = 0$

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289. Solve the following initial value problem: $\frac{dy}{dx} = y\tan 2x,\ y(0) = 2$

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290. Solve the following initial value problem: $xy\frac{dy}{dx} = y + 2,\ y(2) = 0$

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291. Solve the following initial value problem: $\frac{dr}{dt} = -rt,\ r(0) = r_0$

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292. Solve the following initial value problem: $\frac{dy}{dx} = y\tan x,\ y(0) = 1$

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293. Solve the following initial value problem: $\frac{dy}{dx} = 2e^{2x}y^2,\ y(0) = -1$

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294. Solve the following initial value problem: $\frac{dy}{dx} = 2xy,\ y(0) = 1$

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295. Solve the following initial value problem:

$$\frac{dy}{dx} = 1 + x^2 + y^2 + x^2y^2,\ y(0) = 1$$

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296. Solve the following initial value problem:

$$xy\frac{dy}{dx} = x^2 + 2y^2\Big),\ y(1) = 0$$

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297. Solve the following initial value problem: $\frac{dy}{dx} = 1 + x + y^2 + xy^2$ when $y = 0, x = 0$.

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298. Solve the following initial value problem:

$$2(y+3) - xy\frac{dy}{dx} = 0,\ y(1) = -2$$

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299. Solve the following initial value problem: $2x\dfrac{dy}{dx} = 3y,\ y(1) = 2$

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300. Solve the following initial value problem: $\dfrac{dy}{dx} = 2e^x y^3,\ y(0) = \dfrac{1}{2}$

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301. Solve the following initial value problem: $\dfrac{dy}{dx} = y\sin 2x,\ y(0) = 1$

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302. Solve the following initial value problem: $\dfrac{dy}{dx} = y\sin 2x,\ y(0) = 1$

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303. Solve the following initial value problem: $2x\frac{dy}{dx} = 5y,\ y(1) = 1$

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304. Solve the following initial value problem: $\cos y\frac{dy}{dx} = e^x,\ y(0) = \frac{\pi}{2}$

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305. Solve the differential equation $x\frac{dy}{dx} + \cot y = 0,$ given that $y = \frac{\pi}{4}$, when $x = \sqrt{2}$

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306. Solve the differential equation $\left(1 + x^2\right)\frac{dy}{dx} + \left(1 + y^2\right) = 0$, given that $y = 1,$ when $x = 0.$

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307. Find the equation of a curve passing through the point (0, 0) and whose differential equation is $y' = ex \sin x$

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308. For the differential equation $xy\frac{dy}{dx} = (x+2)(y+2)$, find the solution curve passing through the point $(1, \quad 1)$.

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309. The volume of a spherical balloon being inflated changes at a constant rate. If initially its radius is 3 units and after 3 seconds it is 6 units. Find the radius of the balloon after t seconds.

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310. In a bank principal increases at the rate of r% per year. Find the value of r if Rs. 100 double itself in 10 years $\left((\log)_e 2 = 0.6931.\right)$

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311. In a bank, principal increases continuously at the rate of 5% per year. An amount of Rs 1000 is deposited with this bank, how much will it worth after 10 years $\left(e^{0.5} = 1.648\right)$

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312. In a culture the bacteria count is 100000. The number is increased by 10% in 2 hours. In how many hours will the count reach 200000, if the rate of growth of bacteria is proportional to the number present.

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313. If $y(x)$ is a solutioin of the differential equation $\left(\frac{2+\sin x}{1+y}\right)\frac{dy}{dx} = -\cos x \; and \; y(0) = 1,$ then find the value of $y\left(\frac{\pi}{2}\right).$

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314. Solve the following initial value problems:

$(x+y+1)^2 dy = dx, \; y(-1) = 0$

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315. Solve the following initial value problems:

$(x-y)(dx+dy) = dx - dy, \; y(0) = -1$

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316. Solve the following differential equation: $\frac{dy}{dx} = (x+y+1)^2$

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317. Solve the following differential equation: $\frac{dy}{dx}\cos(x-y)=1$

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318. Solve the following differential equation: $\frac{dy}{dx}=(x+y)^2$

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319. Solve the following differential equation: $\frac{dy}{dx}=\sec(x+y)$

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320. Solve the following differential equation: $\frac{dy}{dx}=\tan(x+y)$

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321. Solve the following differential equation: $\cos^2(x-2y)=1-2\frac{dy}{dx}$

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322. Solve the differential equation $x^2dy+y(x+y)dx=0,$ given that $y=1\,when\,x=1.$

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323. Solve the differential equation $\left(x^2-y^2\right)dx+2xy\,dy=0;$ given that $y=1\,when\,x=1.$

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324. Find the particular solution of the differential equation ; $\left(x^2+xy\right)dy=\left(x^2+y^2\right)dx$ given that $y=0\,when\,x=1.$

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325. Find the particular solution of the differentialion $(3xy + y^2)dx + (x^2 + xy)dy = 0; f \text{ or } x = 1, y = 1.$

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326. Solve $x\,dy - y\,dx = \sqrt{x^2 + y^2}dx$

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327. Solve $\left\{x\cos\left(\frac{y}{x}\right) + y\sin\left(\frac{y}{x}\right)\right\}ydx = \left\{y\sin\left(\frac{y}{x}\right) - x\cos\left(\frac{y}{x}\right)\right\}xdy$

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328. Solve $2ye^{x/y}dx + \left(y - 2xe^{x/y}\right)dy = 0$

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329. Solve each of the following initial value problem:

$$2x^2\frac{dy}{dx} - 2xy + y^2 = 0,\ y(e) = e$$

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330. Solve each of the following initial value problem:

$$2xy + y^2 - 2x^2\frac{dy}{dx} = 0,\ y(1) = 2$$

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331. Solve each of the following initial value problems:

$$\left(x^2 + y^2\right)dx + xy\,dy = 0,\ y(1) = 1$$

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332. Solve each of the following initial value problems:

$(x^2 - 2y^2)\,dx + 2xy\,dy = 0,\ y(1) = 1$

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333. Solve each of the following initial value problems:

$\left(xe^{y/x} + y\right)dx = x\,dy,\ y(1) = 1$

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334. Solve the differential equation $x^2dy + \left(xy + y^2\right)dx = 0$ given $y = 1,$ when $x = 1$

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335. Solve the following differential equation:

$(x^2 - y^2)\,dx - 2\,xy\,dy = 0$

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336. Solve the following differential equation: $2xy\frac{dy}{dx} = x^2 - y^2$

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337. Solve the following differential equation: $x^2\frac{dy}{dx} = x^2 + xy + y^2$

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338. Solve the following differential equation: $\frac{dy}{dx} = \frac{x}{2y + x}$

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339. Solve the following differential equation: $\frac{dy}{dx} = \frac{y}{x} + \sin\left(\frac{y}{x}\right)$

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340. Solve the following differential equation:

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

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341. Solve the following differential equation:

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

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342. Solve the following differential equation:

$$\left(x^2-2xy\right)dy+\left(x^2-3xy+2y^2\right)dx=0$$

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343. Solve the following differential equation: $x\frac{dy}{dx}=y-x\cos^2\left(\frac{y}{x}\right)$

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344. Solve the following differential equation: $x\frac{dy}{dx} - y = 2\sqrt{y^2 - x^2}$

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345. Solve the following differential equation:

$x\cos\left(\frac{y}{x}\right)(ydx + xdy) = y\sin\left(\frac{y}{x}\right)(x\,dy - y\,dx)$

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346. Solve the following differential equation: $(x - y)\frac{dy}{dx} = x + 2y$

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347. Solve the following differential equation $\frac{dy}{dx} = \frac{x + y - 1}{x - y}$

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348. Solve the following differential equation: $x^2\frac{dy}{dx} = x^2 - 2y^2 + xy$

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349. Solve the following differential equation: $(y^2 - 2xy)dx = (x^2 - 2xy)dy$

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350. Solve the following differential equation: $3x^2dy = (3xy + y^2)dx$

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351. Solve the differential equation - $(x - 2y)dx + (2x + y)dy = 0$

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352. Solve $x\left(\frac{dy}{dx}\right) = y(\log y - \log x + 1)$

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353. Solve the following differential equation:

$y^2dx + \left(x^2 - xy + y^2\right)dy = 0$

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354. Solve the following differential equation: $x\frac{dy}{dx} = y - x\cos^2\left(\frac{y}{x}\right)$

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355. Solve the following differential equation: $x\frac{dy}{dx} - y + x\sin\left(\frac{y}{x}\right) = 0$

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356. Solve each of the following initial value problem:

$$\left(x^2+y^2\right)dx = 2xy\,dy,\ y(1)=0$$

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357. Solve each of the following initial value problem:

$$xe^{y/x} - y + x\frac{dy}{dx} = 0,\ y(e)=0$$

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358. Solve each of the following initial value problem:

$$\frac{dy}{dx} - \frac{y}{x} + \cos ec\frac{y}{x} = 0,\ y(1)=0$$

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359. Solve each of the following initial value problem:

$$\left(xy-y^2\right)dx + x^2dy = 0,\ y(1)=1$$

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360. Solve: $\frac{dy}{dx} = \frac{y(x+2y)}{x(2x+y)}$,y(1) = 2

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361. Solve each of the following initial value problem:

$(y^4 - 2x^3y)dx + (x^4 - 2xy^3)dy = 0,\ y(1) = 1$

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362. Solve each of the following initial value problem:

$x(x^2 + 3y^2)dx + y(y^2 + 3x^2)dy = 0,\ y(1) = 1$

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363. Solve the following initial value problem:

$$\left\{x \sin^2\left(\frac{y}{x}\right) - y\right\}dx + xdy = 0,\ y(1) = \frac{\pi}{4}$$

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364. Solve the initial value problem:

$$x\frac{dy}{dx} - y + x\sin\left(\frac{y}{x}\right) = 0,\ y(2) = x$$

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365. Find the particular solution of the differential equation $x\cos\left(\frac{y}{x}\right)\frac{dy}{dx} = y\cos\left(\frac{y}{x}\right) + x$ given that when $x = 1,\ y = \frac{\pi}{4}$.

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366. Find the particular solution of the differential equation $(x - y)\frac{dy}{dx} = x + 2y,$ given that when $x = 1,\ y = 0.$

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367. Find the particular solution of the differential equation $\frac{dy}{dx} = \frac{xy}{x^2 + y^2}$ given that $y = 1 \, when \, x = 0$.

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368. Solve the differential equation : $\frac{dy}{dx} - \frac{y}{x} = 2x^2$

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369. Find the general solution of the differential equations: $x \log x \frac{dx}{dy} + y = \frac{2}{x} \log x$

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370. Solve the following differential equation:

$$\frac{(x^2-1)dy}{dx}+2xy=\frac{1}{x^2-1};\ |x|\neq 1$$

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371. Solve: $\frac{dy}{dx}+y\sec x=\tan x$

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372. Solve the following differential equation: $\cos^2 x\frac{dy}{dx}+y=\tan x$

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373. Find the general solution of the differential equations:

$$x\frac{dx}{dy}+y-x+xy\cot x=0(x\neq 0)$$

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374. Find the general solution of the differential equations: $(1+x^2)dy+2xydx=\cot xdx(x\neq 0)$

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

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376. Solve: $y\,dx-\left(x+2y^2\right)dy=0$

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377. Solve: $ydx+\left(x-y^3\right)dy=0$

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378. Solve $\left[\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}}\right]\frac{dx}{dy} = 1(x \neq 0)$

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379. Solve each of the following initial value problem:

$(x - \sin y)dy + (\tan y)dx = 0,\ y(0) = 0$

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380. Solve each of the following initial value problem:

$\left(1 + y^2\right)dx = \left(\tan^{-1} y - x\right)dy, y(0) = 0$

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381. Solve the following differential equation: $\frac{dy}{dx} + 2y = e^{3x}$

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382. Solve the following differential equation : $\frac{dy}{dx} + 2y = 6e^x$

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383. Solve the following differential equation: $x\frac{dy}{dx} + y = x\log x$

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384. Solve the following differential equation: $\frac{dy}{dx} + \frac{y}{x} = x^3$

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385. Solve the following differential equation: $\frac{dy}{dx} + y = \cos x$

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386. Solve the following differential equations: $\frac{dy}{dx} = y\tan x - 2\sin x$

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387. Solve the following differential equation: $x\,dy = \left(2y + 2x^4 + x^2\right)dx$

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388. Solve the following differential equation: $y^2\frac{dx}{dy} + x - \frac{1}{y} = 0$

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389. Solve the following differential equations: $\frac{dy}{dx} = y\tan x - 2\sin x$

Watch Video Solution

390. Solve the differential equation $\sin x\frac{dy}{dx} + y\cos x = 2\sin^2 x\cos x$

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391. Solve the following differential equation: $x\frac{dy}{dx} + 2y = x\cos x$

Watch Video Solution

392. Solve the following differential equation: $4\frac{dy}{dx} + 8y = 5\,e^{-3x}$

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393. Solve the differential equation: $\frac{dy}{dx} + y = e^{-2x}$

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394. Solve the following differential equation: $\frac{dy}{dx} + 2y = 4x$

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395. Solve the following differential equations: $x\frac{dy}{dx} - y = (x-1)e^x$

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396. Solve the following differential equation: $\frac{dy}{dx} + y = \sin x$

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397. Solve the differential equation: $\left(1+x^2\right)\frac{dy}{dx} + y = \tan^{-1} x$

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398. The solution of differential equation

$\left(1+x^2\right)\frac{dy}{dx} + y = e^{\tan^{-1} x}$

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399. Solve the differential equation: (i) $\left(1+y^2\right)+\left(x-e^{\tan^{-1}y}\right)\frac{dy}{dx}=0$ (ii) $x\frac{dy}{dx}+\cos^2 y=\tan y\frac{dy}{dx}$

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400. Solve the following differential equation: $dx+xdy=e^{-y}\sec^2 y\,dy$

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401. Solve differential equation: $\left(x^2-1\right)\frac{dy}{dx}+2(x+2)y=2\,(x+1)$

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402. Solve differential equation $\left(x+2y^2\right)\frac{dy}{dx}=y,$ given that when $x=2,\ y=1$

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403. Find one parameter families of solution curves of the following differential equations: (or solve the following differential equations): (a) $(x \log x)\frac{dy}{dx} + y = \log x$ (b) $\frac{dy}{dx} + y\cos x = e^{\sin x}\cos x$

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404. Find one parameter families of solution curves of the following differential equations: (or solve the following differential equations): (a) $\frac{dy}{dx}\cos^2 x = \tan x - y$ (b) $x \log x \frac{dy}{dx} + y = 2\log x$

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405. Find one parameter families of solution curves of the following differential equations: (or solve the following differential equations): (a) $\frac{dy}{dx} - y = \cos 2x$ (b) $x\frac{dy}{dx} + y = x^4$

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406. Find one parameter families of solution curves of the differential equation: (or solve the differential equation): $\frac{dy}{dx} - \frac{2xy}{1+x^2} = x^2 + 2$

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407. Find one parameter families of solution curves of the following differential equations: (or solve the following differential equations): (a) $(x+y)\frac{dy}{dx} = 1$ (b) $e^{-y}\sec^2 y\, dy = d + = x\, dy$ (c) $x\frac{dy}{dx} + 2y = x^2 \log x$

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408. Solve each of the following initial value problem: $y' + y = e^x,\ y(0) = \frac{1}{2}$

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409. Solve each of the following initial value problem:

$$x\frac{dy}{dx} - y = \log x,\ y(1) = 0$$

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410. Solve the following initial value problem:

$$\frac{dy}{dx} + 2y = e^{-2x}\sin x,\ y(0) = 0$$

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411. Solve the following initial value problem:

$$\left(1 + y^2\right)dx + \left(x - e^{-\tan^{-1}y}\right)dy = 0,\ y(0) = 0$$

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412. Solve each of the following initial value problem:

$$\frac{dy}{dx} + y\,tanx = 2x + x^2 tanx,\ y(0) = 1$$

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413. Solve the following initial value problem:

$$\frac{dy}{dx} + y\cot x = 2\cos x,\ y\left(\frac{\pi}{2}\right) = 0$$

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414. Solve the initial value problem:

$$x\frac{dy}{dx} + y = x\cos x + \sin x,\ y\left(\frac{\pi}{2}\right) = 1$$

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415. Solve the following initial value problem:

$$\frac{dy}{dx} + y\cot x = 4x\ \cos ecx,\ y\left(\frac{\pi}{2}\right) = 0$$

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416. Solve the following initial value problem:

$$\frac{dy}{dx} + 2\tan x \cdot y = \sin x; y = 0 \, when \, x = \frac{\pi}{3}.$$

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417. Solve the initial value problem:

$$\frac{dy}{dx} - 3y\cot x = \sin 2x; y = 2 \, when \, x = \frac{\pi}{2}.$$

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418. Solve the following initial value problem:

$$\frac{dy}{dx} + y\cot x = 2\cos x, \; y\left(\frac{\pi}{2}\right) = 0$$

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419. Solve the initial value problem: $dy = \cos x \, (2 - y\cos ecx)dx$

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420. Find the general solution of the differential equation $x\frac{dy}{dx} + 2y = x^2(x \neq 0)$.

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421. Find the general solution of the differential equation $\frac{dy}{dx} - y = \cos x$

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422. Solve the differential equation $\left(y + 3x^2\right)\frac{dx}{dy} = x$.

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423. Find the particular solution of the differential equation $\frac{dx}{dy} + x\cot y = 2y + y^2\cot y,\ y \neq 0$ given that $x = 0\ when\ y = \frac{\pi}{2}$.

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424. The temperature T of a cooling object drops at a rate proportional to the difference $T - S$ where S is constant temperature of surrounding medium. If initially $T = 150^\circ C$; find the temperature of the cooling object at any time t.

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425. The slope of the tangent to the curve at any point is reciprocal of twice the ordinate of that point. The curve passes through the point $(4, 3)$. Determine its equation.

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426. The equation of electromotive forces for an electric circuit containing resistance and self inductance is $E = R\,i + L\frac{di}{dt}$, where E is the electromotive force given to the circuit, R, the resistance and L, the

coefficient of induction. Find the current i at time t when (i) $E = 0$ (ii) $E = a$,non-zero constant.

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427. The surface are of a balloon being inflated changes at a constant rate. If initially, its radius is3 units sand after 2 seconds, it s 5 units, find the radius after t seconds.

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428. A population grows at the rate of 5% per year. Then the population will be doubled in :

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429. The rate of growth of a population is proportional to the number present. if the population of a city doubled in the past 25 years, and the

present population is 100000, when will the city have a population of 500000? [Given, $\log_e 5 = 1.609$, $\log_e 2 = 0.6931$.]

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430. If the interest is compounded continuously at 6% per annum, how much worth Rs. 1000 will be after 10 years? How long will it take to double Rs. 1000? [Given $e^{0.6} = 1.822$]

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431. The rate of increase in the number of bacteria in a certain bacteria culture is proportional to the number present. Given the number triples in 5 hrs., find how many bacteria will be present after 10 hours. Also find the time necessary for the number of bacteria to be 10 times the number of initial present. [Given $\log_e 3 = 1.0986$, $e^{2.1972} = 9$]

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432. The population of a village increases continuously at the rate proportional to the number of its inhabitants present at any time. If the population of the village was 20, 000 in 1999 and 25000 in the year 2004, what will be the population of the village in 2009?

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433. Solve the following initial value problem: $C'(x) = 2 + 0.15x; C(0) = 100$

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434. The decay rate of radium at any time t is proportional to its mass at that time. Find the time when the mass will be halved of its initial mass.

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435. A curve passes through the point (3, -4) and the slope of . the is the tangent to the curve at any point (x, y) is $\left(-\frac{x}{y}\right)$ .find the equation of the curve.

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436. Find the curve for which the intercept cut off by a tangent on x-axis is equal to four times the ordinate of the point of contact.

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437. Show that the equation of the curve whose slope at any point is equal to $y+2x$ and which passes through the origin is $y+2(x+1)=2e^{2x}$.

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438. The tangent at any point (x, y) of a curve makes an angle $\tan^{-1}(2x + 3y)$ with x-axis. Find the equation of the curve if it passes through (1,2).

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439. Find the equation of the curve such that the portion of the x-axis cut off between the origin and the tangent art a point is twice the abscissa and which passes through the point (1,2).

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440. Find the equation of the cure which passes through the point $(3, -4)$ and has the slope $\frac{2y}{x}$ at any point (x, y) on it.

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441. Find the equation of the cure which passes through the origin and has the slope $x + 3y - 1$ at the point (x, y) on it.

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442. Find the equation of a curve passing through the point (0, 1). If the slope of the tangent to the curve at any point (x, y) is equal to the sum of the x coordinate (abscissa) and the product of the x coordinate and y coordinate (ordinate) of that point.

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443. Find the equation of the curve such that the portion of the x-axis cut off between the origin and the tangent art a point is twice the abscissa and which passes through the point (1,2).

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444. The rate of increase of the bacteria in a culture is proportional to the number of bacteria present and it is found that the number doubles in 6 hours. Prove that the bacteria becomes 8 times at the end of 18 hours.

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445. Show that the line $y = 2x - 4$ is a tangent to the hyperbola $\frac{x^2}{16} - \frac{y^2}{48} = 1$. Find its point of contact.

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446. Find the equation of a curve passing through the origin given that the slope of the tangent to the curve at any point (x, y) is equal to the sum of the coordinates of the point.

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447. Find the equation of a curve passing through the point (0, 1). If the slope of the tangent to the curve at any point (x, y) is equal to the sum of the x coordinate (abscissa) and the product of the x coordinate and y coordinate (ordinate) of that point.

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448. The slope of a curve at each of its points is equal to the square of the abscissa of the point. Find the particular curve through the point (-1,1).

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449. What is differential equation and order and degree of a differential equation

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450. What is differential equation and order and degree of a differential equation

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451. What is differential equation and order and degree of a differential equation

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452. What is differential equation and order and degree of a differential equation

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453. Write the differential equation representing the family of straight lines $y = Cx + 5,\ where\ C$ is an arbitrary constant.

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454. Write the differential equation obtained by eliminating the arbitrary constant C in the equation $x^2 - y^2 = C^2$.

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455. Write the differential equation obtained eliminating the arbitrary constant C in the equation $xy = C^2$.

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456. Write the degree of the differential equation $a^2 \frac{d^2y}{dx^2} = \left\{1 + \left(\frac{dy}{dx}\right)^2\right\}^{1/4}$.

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457. Write the order of the differential equation $1+\left(\frac{dy}{dx}\right)^2=7\left(\frac{d^2y}{dx^2}\right)^3$.

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458. Writhe the order and degree of the differential equation $y=x\frac{dy}{dx}+a\sqrt{1+\left(\frac{dy}{dx}\right)^2}$.

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459. Write the degree of the differential equation $\frac{d^2y}{dx^2}+x\left(\frac{dy}{dx}\right)^2=2x^2\log\left(\frac{d^2y}{dx^2}\right)$.

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460. Form the differential equation of the family of circles touching the y-axis at origin.

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461. Write the order of the differential equation of all non horizontal lines in a plane.

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462. If $\sin x$ is an integrating factor of the differential equation $\frac{dy}{dx} + Py = Q$, then write the value of P.

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463. Write the order of the differential equation of the family of circles of radius r.

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464. Write the order of the differential equation whose solution is $y = a\cos x + bs \in x + ce^{-x}$.

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465. Write 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.

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466. What is the degree of the following differential equation?

$$5x\left(\frac{dy}{dx}\right)^2 - \frac{d^2y}{dx^2} - 6y = \log x$$

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467. Write the degree of the differential equation $\left(\frac{dy}{dx}\right)^4 + 3x\frac{d^2y}{dx^2} = 0.$

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468. Form the differential equation representing the family of curves $y = mx$, where, m is arbitrary constant.

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469. Write the degree of the differential equation $x^3\left(\frac{d^2y}{dx^2}\right)^2 + x\left(\frac{dy}{dx}\right)^4 = 0.$

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470. Write degree of the differential equation $\left(1 + \frac{dy}{dx}\right)^3 = \left(\frac{d^2y}{dx^2}\right)^2.$

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471. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

$$\frac{d^2y}{dx^2} + 3\left(\frac{dy}{dx}\right)^2 = x^2 \log\left(\frac{d^2y}{dx^2}\right)$$

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472. Determine the order and degree of each of the following differential equation. State also whether they are linear or non-linear:

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

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473. The degree of the differential equation $\frac{d^2y}{dx^2} + e^{dy/dx} = 0.$

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474. The number of arbitrary constants in the particular solution of a differential equation of third order are: (A) 3 (B) 2 (C) 1 (D) 0

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475. Write the order of the differential equation representing the family of curves $y = ax + a^3$.

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476. Find the sum of the order and degree of the differential equation $y = x\left(\frac{dy}{dx}\right)^3 + \frac{d^2y}{dx^2}$.

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477. Find the solution of the differential equation $x\sqrt{1+y^2}dx + y\sqrt{1+x^2}dy = 0.$

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478. find the solution of the following differential equation $x\log x\frac{dy}{dx} + y = 2\log x$

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479. The general solution of the differential equation $\frac{dy}{dx} = \frac{y}{x}$ is

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480. Integrating factor of differential equation $\cos x\frac{dy}{dx} + y\sin x = 1$ is

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

a. $\frac{1}{2}$ b. 2 c. 3 d. 4

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482. The degree of the differential equation $\left\{5 + \left(\frac{dy}{dx}\right)^2\right\}^{5/3} = x^5\left(\frac{d^2y}{dx^2}\right)$, is a. 4 b. 3 c. 5 d. 10

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483. The general solution of the differentia equation $\frac{dy}{dx} + y\cot x = \cos ecx$, is (a). $x + y\sin x = C$ (b). $x + y\cos x = C$ (c). $y + x(\sin x + \cos x) = C$ (d). $y\sin x = x + C$

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484. The differentia equation obtained on eliminating A and B from $y = A\cos\omega t + b\sin\omega t,$ is $y^{+}y' = 0$ b. $y^{-\omega}\hat{}\, 2y = 0$ c. $y^{=}\omega^2 y$ d. $y^{+}y = 0$

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485. The equation of the curve whose slope is given by $\frac{dy}{dx} = \frac{2y}{x}; x > 0,\ y > 0$ and which passes through the point (1,1) is a. $x^2 = y$ b. $y^2 = x$ c. $x^2 = 2y$ d. $y^2 = 2x$

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486. The order of the differential equation whose general solution is given by $y = c_1\cos(2x + c_2) - (c_3 + c_4)a^{x+c_5} + c_6\sin(x - c_7)$ *is* a. 3 b. 4 c. 5 d. 2

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487. The solution of the differential equation $\frac{dy}{dx} = \frac{ax+g}{by+f}$ represents a circle when a. $a = b$ b. $a = -b$ c. $a = -2b$ d. $a = 2b$

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488. Solution of the differential equation $\frac{dy}{dx} + \frac{2y}{x} = 0$, where $y(1) = 1$, is

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489. The solution of the differential equation $\frac{dy}{dx} - \frac{y(x+1)}{x} = 0$ is given by a. $y = xe^{x+C}$ b. $x = ye^{x}$ c. $y = x + C$ d. $xy = e^{x} + C$

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490. The order of the differential equation satisfying $\sqrt{1-x^4} + \sqrt{1-y^4} = a\left(x^2 - y^2\right)$ is 1 b. 2 c. 3 d. 4

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491. The solution of the differential equation $y_1 y_3 = y_2^2$ is a. $x = C_1 e^{C_2\ y} + C_3$ b. $y = C_1 e^{C_2\ x} + C_3$ c. $2x = C_1 e^{C_2\ y} + C_3$ d. none of these

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492. The general solution of the differential equation $\frac{dy}{dx} + y\, g'(x) = g(x) g'(x)$, where $g(x)$ is a given function of x , is a. $g(x) + \log\{1 + y + g(x)\} = C$ b. $g(x) + \log\{1 + y - g(x)\} = C$ c. $g(x) - \log\{1 + y - g(x)\} = C$ d. None of these

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493. The solution of the differential equation $\frac{dy}{dx} = 1 + x + y^2 + xy^2,\ y(0) = 0$ is a. $y^2 = exp\left(x + \frac{x^2}{2}\right) - 1$ b.

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

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494. The differential equation of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = C$ is a. $\frac{y''}{y'} + \frac{y'}{y} - \frac{1}{x} = 0$ b. $\frac{y''}{y'} + \frac{y'}{y} + \frac{1}{x} = 0$ c. $\frac{y''}{y'} - \frac{y'}{y} - \frac{1}{x} = 0$ d. none of these

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495. Solution of the differential equation $\frac{dy}{dx} + \frac{y}{x} = \sin x$ is a. $x(y + \cos x) = \sin x + C$ b. $x(y - \cos x) = \sin x + C$ c. $x(y + \cos x) = \cos x + C$ d. None of these

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496. The solution of the differential equation $2x\frac{dy}{dx} - y = 3$ represents

$circles$ b. $straight\ l \in es$ c. $ellipses$ d. $parabolas$

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497. The solution of the differential equation $x\frac{dy}{dx} = y + x\frac{\tan y}{x}$, is

$xyy_2 + y12 + yy_1 = 0$ b. $xyy_2 + xy12 - yy_1 = 0$ c.

$xyy_2 - xy12 + yy_1 = 0$ d. none of these

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498. The differential equation which represents the family of curves

$y = e^{Cx}$ is $y_1 = C^2 y$ b. $xy_1 - In\ y = 0$ c. $x\ In\ y = yy_1$ d. $y\ In\ y = xy_1$

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499. Which of the following transformations reduce the differential equation $\frac{dz}{dx}+\frac{z}{x}\log z=\frac{z}{x^2}(\log z)^2$ into the form $\frac{dv}{dx}+P(x)v=Q(x)$

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500. The solution of the differential equation $\frac{dy}{dx}=\frac{y}{x}+\frac{\varphi\left(\frac{y}{x}\right)}{\varphi'\left(\frac{y}{x}\right)}$ is a. $\varphi\left(\frac{y}{x}\right)=kx$ b. $x\,\varphi\left(\frac{y}{x}\right)=k$ c. $\varphi\left(\frac{y}{x}\right)=ky$ d. $y\,\varphi\left(\frac{y}{x}\right)=k$

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501. If $m\ and\ n$ are the order the degree of the differential equation $(y_2)^5+\frac{4(y_2)^3}{y_3}+y_3=x^2-1,$ then a. $m=3,\ n=3$ b. $m=3,\ n=2$ c. $m=3,\ n=5$ d. $m=3,\ n=1$

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502. 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. $e^{-(x-y)} = x + c$ d. $(x-C)e^{x+y} + 1 = 0$

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503. The solution of $x^2 + y^2\frac{dy}{dx} = 4$ is a. $x^2 + y^2 = 12x + C$ b. $x^2 + y^2 = 3x + C$ c. $x^3 + y^3 = 3x + C$ d. $x^3 + y^3 = 12x + C$

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504. The family of curves in which the sub tangent at any point of a curve is double the abscissa, is given by a. $x = Cy^2$ b. $y = Cx^2$ c. $x^2 = Cy^2$ d. $y = Cx$

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505. The solution of the differential equation $x\,dx + y\,dy = x^2 y\,dy - y^2 x\,dx,$ is a. $x^2 - 1 = C(1 + y^2)$ b. $x^2 + 1 = C(1 - y^2)$ c. $x^3 - 1 = C(1 + y^3)$ d. $x^3 + 1 = C(1 - y^3)$

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506. The solution of the differential equation $(x^2 + 1)\dfrac{dy}{dx} + (y^2 + 1) = 0$ is a. $y = 2 + x^2$ b. $y = \dfrac{1 + x}{1 - x}$ c. $y = x(x - 1)$ d. $y = \dfrac{1 - x}{1 + x}$

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507. The differential equation $x\dfrac{dy}{dx} - y = x^2,$ has the general solution a. $y - x^3 = 2cx$ b. $2y - x^3 = cx$ c. $2y + x^2 = 2cx$ d. $y + x^2 = 2cx$

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508. The solution of the differential equation $\frac{dy}{dx} - ky = 0, y(0) = 1,$ approaches zero when $x \to \infty$, if

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509. The solution of the differential equation $\left(1 + x^2\right)\frac{dy}{dx} + 1 + y^2 = 0,$ is a. $\tan^{-1} x - \tan^{-1} y = \tan^{-1} C$ b. $\tan^{-1} y - \tan^{-1} x = \tan^{-1} C$ c. $\tan^{-1} y \pm \tan^{-1} x = \tan\ C$ d. $\tan^{-1} y + \tan^{-1} x = \tan^{-1} C$

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510. The solution of the differential equation $\frac{dy}{dx} = \frac{x^2 + xy + y^2}{x^2},$ is a. $\tan^{-1}\left(\frac{x}{y}\right) = \log y + C$ b. $\tan^{-1}\left(\frac{y}{x}\right) = \log x + C$ c. $\tan^{-1}\left(\frac{x}{y}\right) = \log x + C$ d. $\tan^{-1}\left(\frac{y}{x}\right) = \log y + C$

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511. The differential equation $\frac{dy}{dx} + Py = Qy^n,\ n > 2$ can be reduced to linear form by substituting a. $z = y^{n-1}$ b. $z = y^n$ c. $z = y^{n+1}$ d. $z = y^{1-n}$

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512. If p and q are the order and degree of the differential equation $y\frac{dy}{dx} + x^3\frac{d^2y}{dx^2} + xy = \cos x$, then a. $p < q$ b. $p = q$ c. $p > q$ d. none of these

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513. find the solution of the following differential equation $x \log x \frac{dy}{dx} + y = 2 \log x$

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514. Solve: $\frac{dy}{dx} + y \sec x = \tan x$

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515. Integrating factor of differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$ is

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516. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$ (A) 3 (B) 2 (C) 1 (D) not defined

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517. The order of the differential equation $2x^2 \frac{d^2y}{dx^2} - 3\frac{dy}{dx} + y = 0$ is (A) 2 (B) 1 (C) 0 (D) not defined

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518. The number of arbitrary constants in the particular solution of a differential equation of third order are: (A) 3 (B) 2 (C) 1 (D) 0

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519. Which of the following differential equations has $y = c_1 e^x + c_2 e^{-x}$ as the general solution? (A) $\frac{d^2y}{dx^2} + y = 0$ (B) $\frac{d^2y}{dx^2} - y = 0$ (C) $\frac{d^2y}{dx^2} + 1 = 0$ (D) $\frac{d^2y}{dx^2} - 1 = 0$

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520. Which of the following differential equations has y = x as one of its particular solution? (A) $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} + xy = x$ (B) $\frac{d^2y}{dx^2} + x\frac{dy}{dx} + xy = x$ (C) $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} + xy = 0$ (D) `(d^2y)/(dx^2)+x(dy)/(dx)+x y=0

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521. The general solution of the differential equation $\frac{dy}{dx} = e^{x+y}$ is (A) $e^x + e^{-y} = C$ (B) $e^x + e^y = C$ (C) $e^{-x} + e^y = C$ (D) $e^{-x} + e^{-y} = C$

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522. A homogeneous differential equation of the from $\frac{dx}{dy} = h\left(\frac{x}{y}\right)$ can be solved by making the substitution. (A) $y = vx$ (B) $v = yx$ (C) $x = vy$ (D) $x = v$

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523. Which of the following is a homogeneous differential equation? (A) $(4x + 6y + 5)\,dy \quad (3y + 2x + 4)\,dx = 0$ (B) $(xy)dx - \left(x^3 + y^3\right)dy = 0$ (C) $\left(x^3 + 2y^2\right)dx + 2xydy = 0$ (D) $y^2dx + \left(x^2 - xy - y^2\right)dy = 0$

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524. The Integrating Factor of the differential equation $x\frac{dy}{dx} - y = 2x^2$ is (A) e^{-x} (B) e^{-y} (C) $\frac{1}{x}$ (D) x

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525. The Integrating Factor of the differential equation $\left(1 - y^2\right)\frac{dx}{dy} + yx = ay(-1 < y < 1)$ is (A) $\frac{1}{y^2 - 1}$ (B) $\frac{1}{\sqrt{y^2 - 1}}$ (C) $\frac{1}{1 - y^2}$ (D) $\frac{1}{\sqrt{1 - y^2}}$

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526. The general solution of the differential equation $\frac{ydx - xdy}{y} = 0$ is (A) $xy = C$ (B) $x = Cy^2$ (C) $y = Cx$ (D) $y = Cx^2$

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527. The general solution of a differential equation of the type $\frac{dx}{dy} + P_1 x = Q_1$ is (A) $ye^{\int P_1 dy} = \int \left(Q_1 e^{\int P_1 dy}\right) dy + C$ (B) $y\dot{e}^{\int P_1 dx} = \int \left(Q_1 e^{\int P_1 dx}\right) dx + C$ (C) $xe^{\int P_1 dy} = \int \left(Q_1 e^{\int P_1 dy}\right) dy + C$ (D) $xe^{\int p_1 dx} = \int Q_1 e^{\int p_1 dx} dx + C$

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528. The general solution of the differential equation $e^x \; dy + (y \; e^x + 2x) \; dx = 0$ is (A) $xe^y + x^2 = C$ (B) $xe^y + y^2 = C$ (C) $ye^x + x^2 = C$ (D) $ye^y + x^2 = C$

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529. Determine order and degree (if defined) of differential equations given $\left(\frac{ds}{dt}\right)^4 + 3s\frac{d^2 s}{dt^2} = 0$

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530. Determine order and degree (if defined) of differential equations given $(y''')^2 + (y'')^3 + (y')^4 + y^5 = 0$

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531. Determine order and degree (if defined) of differential equations given $(y''')^2 + (y'')^3 + (y')^4 + y^5 = 0$

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532. Verify that the function $y = e^{-3x}$ is a solution of the differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0$

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533. Verify that the given functions (explicit or implicit) is a solution of the corresponding differential equation: $y = e^x + 1 : y'' - y' = 0$

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534. Verify that the given functions (explicit or implicit) is a solution of the corresponding differential equation: (2)$y = x^2 + 2x + C$: $y' - 2x - 2 = 0$

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535. Verify that the given functions (explicit or implicit) is a solution of the corresponding differential equation: $y = \cos x + C : y' + \sin x = 0$

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536. Verify that the given functions (explicit or implicit) is a solution of the corresponding differential equation: $y = \sqrt{1 + x^2} : y' = \frac{xy}{1 + x^2}$

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537. Verify that the given function (explicit or implicit) is a solution of the corresponding differential equation: $y = x \sin x : xy' = y + x\sqrt{x^2 - y^2}$

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538. Verify that the given functions (explicit or implicit) is a solution of the corresponding differential equation: $y = \sqrt{a^2 - x^2} x \in (-x, a)$: $x + y\frac{dy}{dx} = 0 (y \neq 0)$

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539. Form the differential equation representing the family of curves $y = mx$, where, m is arbitrary constant.

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540. Form the differential equation representing the family of curves $y = a \ s \in (x + b)$, where a, b are arbitrary constants.

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541. Form the differential equation representing the family of parabolas having vertex at origin and axis along positive direction of x-axis.

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542. Form the differential equation of the family of circles having centre on y-axis and radius 3 units.

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543. Form the differential equation of the family of parabolas having vertex at origin and axis along positive y-axis.

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544. Form the differential equation representing the family of ellipses foci on x-axis and centre at the origin.

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545. Form the differential equation representing the family of ellipses having foci on x-axis and centre at the origin.

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546. Show that $xy = ae^{x} + be^{-x} + x^{2}$ is a solution of the differential equation $x\frac{d^{2}y}{dx^{2}} + 2\frac{dy}{dx} - xy + x^{2} - 2 = 0.$

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547. Verify that $y = cx + 2c^2$ is a solution of the differential equation $2\left(\frac{dy}{dx}\right)^2 + x\frac{dy}{dx} - y = 0.$

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548. Show that $y^2 - x^2 - xy = a$ is a solution of the differential equation $(x - 2y)\frac{dy}{dx} + 2x + y = 0$

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549. Verify that $y = A\cos x + \sin x$ satisfies the differential equation $\cos x \frac{dy}{dx} + (\sin x)\, y = 1.$

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550. Find the differential equation corresponding to $y = ae^{2x} + be^{-3x} + ce^{x}$ where $a,\ b,\ c$ are arbitrary constants.

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551. The differential equation of all parabolas whose axis are parallel to the y-axis is

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552. From $x^2 + y^2 + 2ax + 2by + c = 0$, derive a differential equation not containing $a, b, and\ c$

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553. Solve: $\frac{dy}{dx} = \sin^3 x \cos^4 x + x\sqrt{x+1}$

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554. Solve the differential equation: $\frac{dy}{dx} = y^2 + 2y + 2$

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555. Solve the following differential equation: $\frac{dy}{dx} = x^2 e^x$

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556. Solve the differential equation: $\tan y dx + \tan x dy = 0$

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557. Solve the differential equation: $x \cos^2 y dx = y \cos^2 x dy$

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558. $\left(\frac{\ln(\sec x + \tan x)}{\cos x} dx = \left(\frac{\ln(\sec y + \tan y)}{\cos y} dy \right. \right.$

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559. Solve the following differential equation:

$$\cos ec\, x \log y \frac{dy}{dx} + x^2 y^2 = 0$$

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560. Solve the differential equation: $\frac{dy}{dx} = \frac{1}{x^2 + 4x + 5}$

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561. Solve the differential equation: $\frac{dy}{dx} + 4x = e^x$

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562. Solve the following differential equation: $\frac{dy}{dx} - x \sin^2 x = \frac{1}{x \log x}$

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563. Solve the following differential equations: $(x+2)\frac{dy}{dx} - x^2 + 4x - 9, x \neq -2$ and $y(0) = 0$, then $y(-4)$ is equal to

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564. Solve the differential equation: $\frac{dy}{dx} = \sin^3 x \cos^2 x + xe^x$

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565. Solve the following differential equation: $(1+x)ydx + (1+y)x\,dy = 0$

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566. Solve the following differential equation: $\left(1-x^2\right)dy + xy\,dx = xy^2dx$

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567. Solve the differential equation: $\frac{dy}{dx} + 1 = e^{x+y}$

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568. Solve the following differential equation: $\frac{dy}{dx} = \sec(x+y)$

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569. Solve the differential equation: $\frac{dy}{dx} = \frac{y(x-y)}{x(x+y)}$

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570. Solve the differential equation: $\frac{dy}{dx} - y\cot x = \cos ec\, x$

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571. Solve the following differential equation: $\frac{dy}{dx} - y\tan x = e^x \sec x$

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572. Solve the differential equation: $\left(1 + y + x^2 y\right)dx + \left(x + x^3\right)dy = 0$

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573. Solve the differential equation: $y\sec^2 x + (y+7)\tan x \frac{dy}{dx} = 0$

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574. Solve the following differential equation: $\left(x^3 - 2y^3\right)dx + 3x^2 y\, dy = 0$

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575. Solve the following differential equation: $y - x\frac{dy}{dx} = b\left(1 + x^2\frac{dy}{dx}\right)$

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576. Solve the following differential equation: $\frac{dy}{dx} + y = 4x$

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577. Solve the following differential equation: $x\frac{dy}{dx} = y - x\cos^2\left(\frac{y}{x}\right)$

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578. solution of differential equation $x\cos x\frac{dy}{dx} + y(x\sin x + \cos x) = 1$ is

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579. Solve the differential equation: $y^2 + \left(x - \frac{1}{y}\right)\frac{dy}{dx} = 0$

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580. Solve the differential equation: $2\cos x \frac{dy}{dx} + 4y \sin x = \sin 2x$, given that $y = 0 \, when \, x = \frac{\pi}{3}$.

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581. Solve the differential equation: $\left(1 + y^2\right)dx = \left(\tan^{-1} y - x\right)dy$

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582. Solve the following differential equation: $x\left(e^{2y} - 1\right)dy + \left(x^2 - 1\right)e^y dx = 0$

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583. Solve the differential equation $\frac{dy}{dx} + \frac{y}{x} = \frac{y^2}{x^2}$

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584. Solve the following differential equation:

$(x + y - 1)dy = (x + y)dx$

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585. Solve the following differential equations: $\frac{dy}{dx} = y \tan x - 2 \sin x$

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586. Solve the following differential equation: $\frac{dy}{dx} - y \tan x = e^x \sec x$

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587. Solve the following differential equation:

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

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588. Solve the differential equation: $\left(2ax+x^2\right)\frac{dy}{dx}=a^2+2ax$

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589. Solve the following differential equation:

$x^2dy+\left(x^2-xy+y^2\right)dx=0$

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590. Solve the differential equation: $\frac{dy}{dx}+2y=\sin 3x$

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591. Solve the differential equation: $\frac{dy}{dx} + 5y = \cos 4x$

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592. Solve the differential equation: $\cos^2 x \frac{dy}{dx} + y = \tan x$

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593. Solve the differential equation: (i) $\left(1 + y^2\right) + \left(x - e^{\tan^{-1} y}\right) \frac{dy}{dx} = 0$ (ii) $x \frac{dy}{dx} + \cos^2 y = \tan y \frac{dy}{dx}$

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594. Solve the differential equation: $\frac{dy}{dx} + y \tan x = x^n \cos x,\ n \neq -1$

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595. Find the general solution of the differential equation $\frac{dy}{dx} = \frac{x+1}{2-y}, (y \neq 2)$

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596. Find the particular solution of the differential equation $\frac{dy}{dx} = -4xy^2$ given that $y = 1$, when $x = 0$.

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597. Find the general solution of the differential equations $\frac{dy}{dx} = \frac{1-\cos x}{1+\cos x}$

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598. Find the general solution of the differential equations $\frac{dy}{dx} = (1+x^2)(1+y^2)$

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599. Find the general solution of the differential equations $\frac{dy}{dx} = \sin^{-1} x$

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600. Find the general solution of the differential equations $\frac{dy}{dx} = \sqrt{(4 - y^2)}$ (-2

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601. Find the general solution of the differential equations $y \log y dx - x dy = 0$

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602. Find the general solution of the differential equations $\frac{dy}{dx} + y = 1 (y \neq 1)$

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603. The differential equations, find a particular solution satisfying the given condition: $x\left(x^2 - 1\right)\frac{dy}{dx} = 1; y = 0$ when $x = 2$

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604. The differential equations, find a particular solution satisfying the given condition: $\cos\left(\frac{dy}{dx}\right) = a (a \in R); y = 1$

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605. The differential equations, find a particular solution satisfying the given condition: $\frac{dy}{dx} = y \tan x; y = 1$ when x = 0

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606. Solve the following differential equation: $(x-y)\frac{dy}{dx}=x+2y$

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607. Show that the given differential equation is homogeneous and solve each of them. $ydx+x\log\left(\frac{y}{x}\right)dy-2xdy=0$

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608. Solve the differential equation: $x\frac{dy}{dx}+2y=x^2,\ x\neq 0$

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609. Solve the differential equation: $\frac{dy}{dx}+y=e^{-2x}$

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610. Solve: $\frac{dy}{dx} + y \sec x = \tan x$

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611. Find the general solution of the differential equations: $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$

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612. Solve the differential equation: $(x + y) \frac{dy}{dx} = 1$

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613. Solve the differential equation: $\left(x + 3y^2\right) \frac{dy}{dx} = y$

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614. Show that the differential equation $x\cos\left(\frac{y}{x}\right)\frac{dy}{dx} = y\cos\left(\frac{y}{x}\right) + x$ is homogeneous and solve it.

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615. Solve the differential equation: $\frac{dy}{dx} - y = \cos x$

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616. Solve the differential equation: $\frac{dy}{dx} + 2y = \sin x$

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617. Solve the differential equation: $\frac{dy}{dx} + \frac{y}{x} = x^2$

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618. Solve $x\frac{dy}{dx} + 2y = x^2 \log x$

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619. Find the general solution of the differential equations: $\left(1 + x^2\right)dy + 2xydx = \cot x dx (x \neq 0)$

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620. Solve the differential equation: $y\,dx + \left(x - y^2\right)dy = 0$

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621. The differential equations, find a particular solution satisfying the given condition: $\left(1 + x^2\right)\frac{dy}{dx} + 2xy = \frac{1}{1 + x^2}; y = 0$ when $x = 1$

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622. Find a particular solution of the differential equation: $(x+y)dy+(x-y)dx=0; y=1\ when\ x=1$

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623. Solve the differential equation $x^2dy+y(x+y)dx=0,$ given that $y=1\ when\ x=1.$

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

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625. Find the equation of a curve passing through the point $(2,\quad 3)$, given that the slope of the tangent to the curve at any point (x, y) is $\frac{2x}{y^2}$.

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626. Find the equation of a curve passing through the point (0, 0) and whose differential equation is $y' = e^x \sin x$

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627. At any point (x, y) of a curve, the slope of the tangent is twice the slope of the line segment joining the point of contact to the point $(\quad 4, \quad 3)$. Find the equation of the curve given that it passes through $(2, \quad 1)$.

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628. Show that the family of curves for which the slope of the tangent at any point (x, y) on it is $\frac{x^2 + y^2}{2xy}$, is given by x^2 -$y^2 = \quad cx$.

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629. Find the equation of a curve passing through the point (0, 1). If the slope of the tangent to the curve at any point (x, y) is equal to the sum of the x coordinate (abscissa) and the product of the x coordinate and y coordinate (ordinate) of that point.

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630. Find the equation of a curve passing through the origin given that the slope of the tangent to the curve at any point (x, y) is equal to the sum of the coordinates of the point.

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631. Find the equation of a curve passing through the point (0, 2) given that the sum of the coordinates of any point on the curve exceeds the magnitude of the slope of the tangent to the curve at that point by 5.

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632. The slope of the tangent to the curve at any point is reciprocal of twice the ordinate of that point. The curve passes through the point $(4, 3)$. Determine its equation.

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633. The decay rate of radium at any time t is proportional to its mass at that time. Find the time when the mass will be halved of its initial mass.

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634. Experiments show that radius disintegrates at a rate proportional to the amount of radium present at the moment. Its half life is 1590 years. What percentage will disappear in one year? [Use $e^{-\frac{\log 2}{1590}} = 0.9996$]

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Others

1. Solve: (i) $\sin^{-1}\left(\frac{dy}{dx}\right) = x + y$ (ii) $\frac{dy}{dx} = \cos(x + y)$

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2. The normal lines to a given curve at each point pass through $(2, 0)$. The curve pass through $(2, 3)$. Formulate the differntioal equation and hence find out the equation of the curve.

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3. In a college hostel accommodating 1000 students, one of them came in carrying a flu virus, then the hostel as isolates. If rate at which the virus spreads is assumed to be proportional tot the product of the number B of infected students and the number of non-infected students, and if the number of infected students is 50 after 4 years then show that more than 95% of the students will be infected after 10 days.

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4. Solve the following differential equations:

$$\left(x^2+y^2\right)\frac{dy}{dx}=8x^2=3xy+2y^2$$

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5. Solve the following differential equations:

$$\left(2x^2y+y^3\ \hat{}\ \right)dx+\left(xy^2-3x^3\right)dy=0$$

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6. Write the order and degree of the differential equation

$$\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^{1/4}+x^{1/5}=0.$$

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7. 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

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