MATHS

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DIFFERENTIAL EQUATIONS

Example

1. Consider $x\frac{dy}{dx} = y - x\tan\left(\frac{y}{x}\right)$, Express $\frac{dy}{dx}$ as a function of y/x.

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2. Consider $x\frac{dy}{dx} = y - x\tan\left(\frac{y}{x}\right)$, Solve the equation using the substitution y=vx.

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3. Obtain the equation of the family of straight lines parallel to the line y=2x.

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4. Solve the DE`dy/dx=2xy/(1+x^2)+x^2+2

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5. Solve the initial value problem:

$\frac{dy}{dx} = y\tan 2x, y(0) = 2$

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

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7. Find the integrating factor of the differential equation $\cos x(dy/dx) + y\sin x = 1.$

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8. Choose the correct answer. The number of arbitrary constains in the general solution of a differential equation of fourth order is

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9. 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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10. Solve $\frac{dy}{dx} = \frac{x.\, e^x \log x + e^x}{x \cos y}$.

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11. $\frac{dy}{dx} = \frac{1 - \cos x}{1 + \cos x}$

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12. $e^x \tan y dx + (1 - e^x)\left(\sec^2 y\right) dy = 0$

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

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14. Consider the differential equation $3e^x \tan y dx - (1 + e^x)\sec^2 y dy = 0$ Order of the differential equation is ....

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15. Consider the differential equation $3e^x \tan y dx - (1+e^x)\sec^2 y dy = 0$ Express the differential equation in variable separable form.

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16. Solve the differential equation $3e^x \tan y dx - (1+e^x)\left(\sec^2 y\right) dy = 0$

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17. Solve $\sqrt{a+x}\frac{dy}{dx} + x = 0$

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18. Solve $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$

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19. Given $ydx - xdy + (\log x)dx = 0$ Express the given equation in the form $\frac{dy}{dx} + Py = Q$.

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20. Given $ydx - xdy + (\log x)dx = 0$ Find the integrating factor.

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21. Given $ydx - xdy + (\log x)dx = 0$ Solve the given differential equation.

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22. Consider the differential equation $\frac{dy}{dx} + y\tan x = x^2\cos^2 x$. Find its integrating factor.

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

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24. Find the solution of $e^x \cos y dx - e^x \sin y dy = 0$.

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

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

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

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28. Find the equation of a 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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29. Find the differential equation of all the circles touching the x-axis at origin.

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30. Form a differential equation of the family

of circles having centre on y-axis and

radius 3 units.

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31. Write the order and degree of the differential equation $\left(\frac{d^2s}{dt^2}\right) + 3\left(\frac{ds}{dt}\right)^3 + 4 = 0.$

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32. Solve $\frac{dy}{dx} = 1 + x + y + xy.$

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33. Solve $\frac{dy}{dx} + \frac{y}{x} = \log x.$

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34. A spherical rain drop evaporates at a rate proportional to its surface area. If its radius is originally 3 mm and after 1 hour i t is reduced to 2 mm, find an expression for radius of rain drop at any time.

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35. Solve $y' + \frac{y}{x} = x^3.$

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36. Given $ydx - xdy + (\log x)dx = 0$ Express the given equation in the form $\frac{dy}{dx} + Py = Q$.

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37. Given $ydx - xdy + (\log x)dx = 0$ Find the integrating factor.

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38. Given $ydx - xdy + (\log x)dx = 0$ Solve the given differential equation.

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39. Write the equation of a circle having centre at (a,b) and radius 'r'.

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40. By eliminating 'a' and 'b' from the equation of circle with center (a,b) and radius r. form the differential equation corresponding to the family.

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41. Solve : $\left(1+x^2\right)\frac{dy}{dx}+2xy-4x^2=0.$

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42. Show that the general solution of the differential 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 parameter.

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

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44. Solve $\frac{dy}{dx} + 1 = e^{x+y}$.

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45. Solve $\frac{dy}{dx} + y \cot x = 2 \cos x.$

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46. Find the equation of a 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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47. Solve the initial value problem $y' = y \cot 2x, y\left(\frac{\pi}{4}\right) = 2$

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48. Consider the differential equation given

below.

$$\frac{d^4y}{dx^4} - \sin\left(\frac{d^3y}{dx^3}\right) = 0$$

write the order and degree of the DE(if

defined)

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49. Find the Differential equation satisfying

the family of curves $y^2 = a\left(b^2 - x^2\right)$,a and b

are arbitrary constants.

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50. Find the Differential equation satisfying the family of curves $y = ae^{3x} + be^{-2x}$,a and b are arbitrary constants.

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51. Choose the correct answer from the bracket.

The solution of the differential equation $xdy + ydx = 0$ represents

A. a rectangular hyperbola

B. a parabola whose centre is origin

C. a straight line whose centre is origin

D. a circle whose centre is origin

Answer:

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52. Form the DE of the family of circles

touching the x-axix at origin.

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53. Find a particular solution satisfying the

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

when $y=1$,$x=0$

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54. Consider the DE $xy\frac{dy}{dx} = (x+2)(y+2)$ Find the equation of the family of curves

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55. For the DE $xy\frac{dy}{dx} = (x+2)(y+2)$,find the solution curve passing through the point (1,-1).

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56. Consider the differential equation $xdy - ydx = \sqrt{x^2+y^2}dx$ Find $\frac{dy}{dx}$

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57. Consider the differential equation $xdy - ydx = \sqrt{x^2 + y^2}dx$ Solve the above differential equation.

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58. The general solution of the DE

dy/dx= e^x-y is

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

B. $e^y - e^x = c$

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

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

Answer:

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59. Solve the DE`dy/dx=2xy/(1+x^2)+x^2+2

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60. Choose the correct answer from the bracket determine the order and degree of the differential equation, $2x\frac{d^4y}{dx^4}+5x^2\left(\frac{dy}{dx}\right)^3-xy=0$ a)Fourth order, first degree b)Third order, first degree c)first order, fourth degree d)first order, third degree

A. Fourth order, first degree

B. Third order, first degree

C. first order, fourth degree

D. first order, third degree

Answer:

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61. The population of a country doubles in 50 years. How many years will it be five times as much? Assume that the rate of increase is proportional to the number inhabitants. (hint: log2=0.6931, log5=1.6094)

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62. The volume of spherical ballon being inflated 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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63. Solve the differential equation:

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

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64. Solve the differential equation:

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

.

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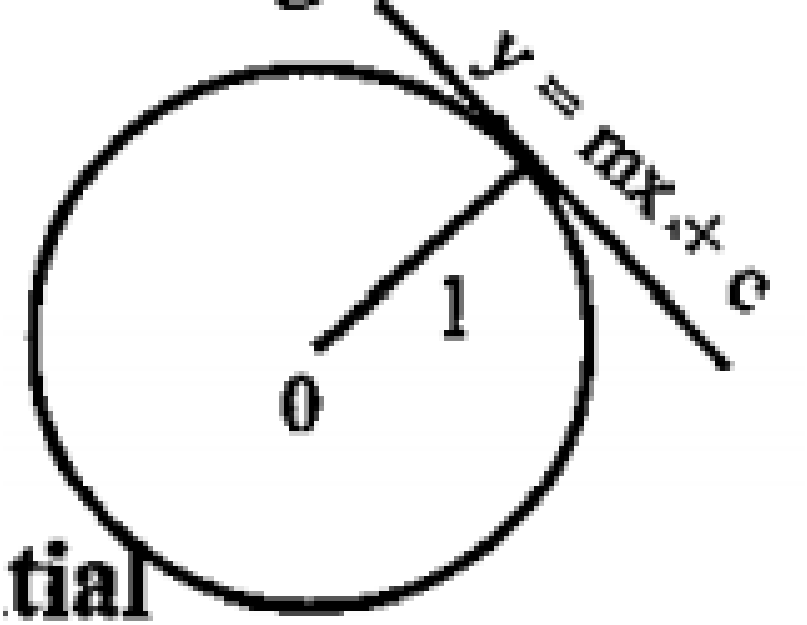
65. If y=mx+c is a tangent to the circle $x^2 + y^2 = 1$, show that

$c = \pm \sqrt{1 + m^2}$



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66. Find the differential equation of all straight lines touching the circle $x^2 + y^2 = 1$.

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67. Given $\left(1+e^{x/y}\right)dx+e^{x/y}\left(1-\frac{x}{y}\right)dy=0$ Express the differential equation as $\frac{dx}{dy}$= A function of $\left(\frac{x}{y}\right)$.

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68. Given $\left(1+e^{x/y}\right)dx+e^{x/y}\left(1-\frac{x}{y}\right)dy=0$ Solve the differential equation using x=vy.

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69. Consider $\left(1+y^2\right)dx=\left(\tan^{-1}y-x\right)dy$ Express the equation in the form $\frac{dx}{dy}+Px=Q$

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70. Consider $\left(1+y^2\right)dx=\left(\tan^{-1}y-x\right)dy$ Find the integrating factor.

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71. Consider $\left(1+y^2\right)dx=\left(\tan^{-1}y-x\right)dy$ Solve the given equation.

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72. Consider $\frac{dy}{dx}=-\frac{2xy}{x^2+1}$ Find the general solution of the differential equation.

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73. Consider $\frac{dy}{dx} = -\frac{2xy}{x^2+1}$ Find the equation of the curve that passes through (1,2) and satisfies the differential equation.

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74. Express the differential equation $(x^2+1)\frac{dy}{dx} + 2xy = \sqrt{x^2+4}$ in the form $\frac{dy}{dx} + P(x)y = q(x)$.

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75. $(x^2+1)\frac{dy}{dx} + 2xy = \sqrt{x^2+4}$ Find its integrating factor.

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76. $(x^2+1)\frac{dy}{dx}+2xy=\sqrt{x^2+4}$ Obtain the general solution.

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77. Consider the differential equation $x\frac{d^2y}{dx^2}+2\frac{dy}{dx}-xy+x^2-2=0$. Write the order and degree.

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

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79. Consider the differential equation $\left(x^2 - y^2\right)dx + 2xydy = 0$. Write the order and degree of differential equation.

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80. Consider the differential equation $\left(x^2 - y^2\right)dx + 2xydy = 0$. Show that the differential equation is homogeneous.

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81. solve the differential equation $\left(x^2 - y^2\right)dx + 2xydy = 0$

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82. Consider the differential equation $\left(x^2 - y^2\right)dx + 2xydy = 0$. Choose the correct solution from the following. For y=1 when x=1 a)$x^2 + y^2 = -2x$ b) $x^2 + y^2 = 2x$ c)$x^2 + y^2 - x = 0$ d)$x^2 + y^2 + x = 0$

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

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

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

D. $x^2 + y^2 + x = 0$

Answer:

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83. Consider $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x, x > 0$ Express the equation in the form $\frac{dy}{dx} + Py = Q$.

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84. Consider $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x, x > 0$ Find the integrating factor.

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85. Consider $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x, x > 0$ Solve the differential equation.

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86. The general solution of a differential equation contains 3 arbitrary constants. Then what is the order of the differential equation?A)2 B)3 C)0 D)1

A. 2

B. 3

C. 0

D. 1

Answer:

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87. Check whether $y = e^{-3x}$ is a solution of the differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0$

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88. Form the differential equation corresponding to the curve $y = mx$

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89. Consider the D.E $\frac{dy}{dx} + \frac{y}{x} = x^2$

Solve the D.E.

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90. The order of the differential equation formed by $y = A \sin x + B \cos x$, where A and B are arbitary constants is ... a)1 b)2 c)0 d)3

A. 1

B. 2

C. 0

D. 3

Answer:

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91. Solve the differential equation

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

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92. Consider the Differential equation

$\cos^2 x \frac{dy}{dx} + y = \tan x$. Find

its degree

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93. Consider the Differential equation $\cos^2 x \frac{dy}{dx} + y = \tan x$.

Find the integrating factor

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94. Consider the Differential equation $\cos^2 x \frac{dy}{dx} + y = \tan x$.

Find the general solution.

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95. Find the general solution of the differential equation

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

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96. The degree of the differential equation

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

A. 4

B. 3

C. 2

D. 1

Answer:

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97. Find the general solution of the differential equation

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

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98. The order of the differential equation $x^2 \frac{d^2y}{dx^2} = 1 + \left(\frac{dy}{dx}\right)^3$ is

A. 1

B. 3

C. 4

D. 2

Answer:

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99. Find the particular solution of the

differential equation

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

$x=1$.

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100. $y=a\cos x+b\sin x$ is the solution of the

differential equation

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

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

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

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

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

Answer:

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

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102. Consider the family of all circles having their centre at the point (1,2).Write the equation of the family.Write the corresponding differential equation.

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103. Write the integrating factor of the

differential equation

`cosxdy/dx+y=sinx

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

What is its integrating factor?

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

Obtain its general solution.

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106. The general solution of the differential equation $\frac{dy}{dx} = e^{x-y}$ is a)$e^y + e^x = C$ b)$e^{-y} + e^{-x} = C$ c) $e^y - e^x = C$ d)$e^{-y} - e^{-x} = C$

A. $e^y + e^x = C$

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

C. $e^y - e^x = C$

D. $e^{-y} - e^{-x} = C$

Answer:

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107. Solve the DE`dy/dx=2xy/(1+x^2)+x^2+2

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Exercise

1. Show that $y = Ce^{-x}$ is a solution of the differential equation $\frac{dy}{dx} + y = 0.$

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2. Form a differential equation representing the given family of curves $y = Ae^{2x} + Be^{-2x}$

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3. Consider the DE $xdy - ydx = \sqrt{x^2 + y^2}dx$

Express it in the form dy/dx=F(x,y)

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4. Consider the DE $xdy - ydx = \sqrt{x^2 + y^2}dx$

Find the general solution.

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

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