MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

HIGHER ORDER DERIVATIVES

Solved Examples And Exercises

1. Find $\frac{d^2y}{dx^2}$ where $y = \log\left(\frac{x^2}{e^2}\right)$.

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2. If $x = \cos\theta, y\sin^3\theta$, prove that $y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 3\sin^2\theta(5\cos^2\theta - 1)$.

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3. If $y = e^x(\sin x + \cos x)$ prove that $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0.$

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4. If $x = a(1 - \cos^3\theta), y = a\sin^3\theta,$ prove that $\frac{d^2y}{dx^2} = \frac{32}{27a}$ at $\theta = \frac{\pi}{6}.$

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5. If $x = a(\theta + \sin\theta), y = a(1 + \cos\theta), y = a(1 + \cos\theta),$ Prove that $\frac{d^2y}{dx^2} = -\frac{a}{y^2}$

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6. If $x = 2\cos t - \cos 2t, y = 2\sin t - \sin 2t,$ find $\frac{d^2y}{dx^2}$ at $t = \frac{\pi}{2}.$

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7. If $y = \log(1 + \cos x)$,prove that $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2}\frac{dy}{dx} = 0.$

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8. If $y = \sin(\sin x)$, p r o v et h a t $\frac{d^2y}{dx^2} + \tan x \frac{dy}{dx}\cos^2 x = 0.$

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9. If $x = \sin t$ and $y = \sin pt$, prove that $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y = 0.$

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10. If $x = a(\cos t + t\sin t)$ and $y = a(\sin t - t\cos t)$, then find the value of $\frac{d^2y}{dx^2}$

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11. If $y = \left(\cot^{-1} x\right)^2$, $provethaty_2\left(x^2+1\right)^2 + 2x\left(x^2+1\right)y_1 = 2.$

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12. If $y = e^x \cos x$, $provethat\frac{d^2y}{dx^2} = 2e^x \cos\left(x + \frac{\pi}{2}\right).$

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13. If $x = \cos t + \frac{\log \tan t}{2}$, $y = \sin t$, then find the value of $\frac{d^2y}{dt^2}$ and $\frac{d^2y}{dx^2} a = \frac{\pi}{4}.$

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14. Find A and B so that $y = A\sin 3x + b\cos 3x$ satisfies the equation $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = 10\cos 3x.$

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15. If $x = a\sin t - b\cos t, y = a\cos t + b\sin t$, prove that $\frac{d^2y}{dx^2} = -\frac{x^2+y^2}{y^3}$

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16. If $y = e^{2x}(ax+b)$, show that $y_2 - 4y_1 + 4y = 0$

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17. If $x = a\sec\theta, y = b\tan\theta$, prove that $\frac{d^2y}{dx^2} = -\frac{b^4}{a^2y^3}$

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18. If $y = e^{\tan\hat{}((-1)x)}$, prove that $\left(1+x^2\right)y_2 + (2x-1)y_1 = 0.$

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19. If $y = \left(\sin^{-1} x\right)^2$,prove that $\left(1 - x^2\right) y_2 - x y_1 - 2 = 0.$

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20. If $y = \log\left(x + \sqrt{x^2 + 1}\right)$, show that $\left(1 + x^2\right) \frac{d^2 y}{dx^2} + x \frac{dy}{dx} = 0.$

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21. If $x = \sin\left(\frac{1}{a} \log y\right)$, s h o wt h a t $\left(1 - x^2\right) y_2 - x y_1 - a^2 y = 0.$

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22. If $y = x + \tan x$, show that $\cos^2 x \frac{d^2 y}{dx^2} - 2y + 2x = 0$

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23. If $y = e^{-x}\cos x$, show that $\frac{d^2y}{dx^2} = 2e^{-1}\sin x$

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24. If $y = \log(\sin x)$, prove that $\frac{d^3y}{dx^3} = 2\cos x \cos ec^3 x$.

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25. If $y = x^3 \log x$, prove that $\frac{d^4y}{dx^4} = \frac{6}{x}$.

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26. If $y = \frac{\log x}{x}$, $showthat\frac{d^2y}{dx^2} = \frac{2\log x - 3}{x^3}$

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27. If $y = 2\sin x + 3\cos x$, show that $\frac{d^2y}{dx^2} + y = 0$

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28. Find . $\frac{d^2y}{dx^2}$, if $x = at^2, y = 2at$.

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29. If $x = \sin\theta, y = \cos p\theta, provethat$

$(1 - x^2)y_2 - xy_1 + p^2y = 0, wherey_2 = \frac{d^2y}{dx^2} and y_1 = \frac{dy}{dx}$

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30. If $y = \tan^{-1} x$ find $\frac{d^2y}{dx^2}$ in terms of y alone.

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31. If $x^m y^n = (x+y)^{m+n}$, prove that $\frac{d^2y}{dx^2} = 0$

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32. If $y^3 - y = 2x$, $provethat \frac{d^2y}{dx^2} = \frac{-24y}{(3y^2-1)^3}$

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33. If $y = x^x$, $f \in d\frac{d^2y}{dx^2}$

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34. If $y = \sin^{-1} x$, $showthat \frac{d^2y}{dx^2} = \frac{x}{(1-x^2)^{\frac{3}{2}}}$

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35. If $y = A\cos nx + B\sin nx$, $showthat \frac{d^2y}{dx^2} + n^2 y = 0$

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36. If $y = \tan x + \sec x, provethat \frac{d^2y}{dx^2} = \frac{\cos x}{(1 - \sin x)^2}$

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37. If $y = \frac{ax + b}{x^2 + c}, then(2xy_1 + y)y_3 =$

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38. If $y = (\log)_e \left(\frac{x}{a}\right)^x$,then $x^3 y_2 =$

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39. If $\sin^{-1}(1-x) - 2\sin^{-1} x = \frac{\pi}{2}$,then x is equal to

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40. If $y = \frac{2}{\sqrt{a^2 - b^2}} \left\{ \tan^{-1} \left(\frac{a-b}{a+b} \right) \frac{\tan x}{2} \right\}$, then show that $\frac{d^2y}{dx^2} = \frac{b \sin x}{(a + b \cos x)^2}$

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41. If $y = x^{n-1} \ln x$ then $x^2 y_2 + (3 - 2n) x y_1$ is equal to $-(n-1)^2 y$ (b) $(n-1)^2 y - n^2 y$ (d) $n^2 y$

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42. If $xy - (\log)_e y = 1$ satisfies the equation $x(yy_2 + y12) - y_2 + \lambda y y_1 = 0, then \lambda =$ -3 (b) 1 (c) 3 (d) none of these

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43. If x=

$f(t)\cos t - f'(t)\sin t and y = f(t)\sin t + f'(t)\cos t$, $then\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2$

(a) $f(t) - f''(t)$ (b) $\{f(t) - f''(t)\}^2$ (c) $\{f(t) + f''(t)\}^2$ (d) none of these

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44. If $x = f(t)$ and $y = g(t)$, then $\frac{d^2y}{dx^2}$ is equal to

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45. Let $f(x)$ be a polynomial.Then, the second order derivative of $f(e^x)$ is

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46. If $y = \tan^{-1}\left(\frac{\log\left(\frac{e}{x^2}\right)}{\log(ex^2)}\right) + \tan^{-1}\left(\frac{3+2\log x}{1-6\log x}\right)$, then $\frac{d^2y}{dx^2}$ is (a) 2 (b) 1 (c) 0 (d) -1

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47. If $f(x) = \frac{\sin^{-1} x}{\sqrt{1-x^2}}, then\left(1-x^2\right)fx - xy(x) =$ 1 (b) -1 (c) 0 (d) none of these

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48. If $f(x) = (\cos x + i\sin x)(\cos 2x + i\sin 2x)(\cos 3x + i\sin 3x).....(\cos nx +$ and $f(1) = 1$,then f^{11} is equal to (a) $\frac{n(n+1)}{2}$ (b) $\left\{\frac{n(n+1)}{2}\right\}^2$ (C) $-\left\{\frac{n(n+1)}{2}\right\}^2$ (d) none of these

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49. $\frac{d^{20}}{dx^{20}}(2\cos x\cos 3x)$ is equal to (a) $2^{20}\left(\cos 2x-2^{20}\cos 3x\right)$ (b) $2^{20}\left(\cos 2x+2^{20}\cos 4x\right)$ (c) $2^{20}\left(\sin 2x+2^{20}\sin 4x\right)$ (d) $2^{20}\left(\sin 2x-2^{20}\sin 4x\right)$

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50. If $x=a\cos nt-b\sin nt$, then $\frac{d^2x}{dt^2}$ is n^2x (b) $-n^2x$ (c) $-nx$ (d) nx

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51. In $\frac{dy}{dx}$, x is a independent variable and y is the dependent variable. If independent and dependent variables are interchanged $\frac{dy}{dx}$ becomes $\frac{dx}{dy}$ and these two are connected by the relation $\frac{dy}{dx}\frac{dx}{dy}=1$. Find a relation between $\frac{d^2y}{dx^2}$ and $\frac{d^2x}{dy^2}$.

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52. If $y^2 = a^2 \cos^2 x + b^2 \sin^2 x$ then prove that $\frac{d^2y}{dx^2} + y = \frac{a^2b^2}{y^3}$

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53. If $y = \sin^{-1} x$, show that $\frac{d^2y}{dx^2} = \frac{x}{(1-x^2)^{3/2}}$

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54. If $y = A\cos nx + B\sin nx$, show that $\frac{d^2y}{dx^2} + n^2 y = 0$.

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55. If $y = Ae^{mx} + Be^{nx}$, show that $\frac{d^2y}{dx^2} - (m+n)\frac{dy}{dx} + mny = 0$.

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56. If $y = A\cos(\log x) + B\sin(\log x)$, prove that $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$.

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57. If $y = \tan x + \sec x$, prove that $\frac{d^2y}{dx^2} = \frac{\cos x}{(1-\sin x)^2}$

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58. If $y = \tan x$, prove that $y_2 = 2yy_1$.

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59. If $y = \tan^{-1} x$, find $\frac{d^2y}{dx^2}$ in terms of y alone.

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60. If $x^m y^n = (x+y)^{m+n}$, prove that $\frac{d^2y}{dx^2} = 0$.

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61. If $y^3 - y = 2x$, prove that $\frac{d^2y}{dx^2} = -\frac{24y}{(3y^2-1)^3}$.

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62. If $e^y(x+1) = 1$. Show that $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^2$

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63. If $y = x^x$, find $\frac{d^2y}{dx^2}$.

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64. If $y = x\log\left[\frac{x}{(a+bx)}\right]$, then show that $x^3\frac{d^2y}{dx^2} = \left(x\frac{dy}{dx} - y\right)^2$.

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65. If $y = \log\left\{x + \sqrt{x^2 + a^2}\right\}$, prove that: $\left(x^2 + a^2\right)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0$.

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66. If $y = \sin^{-1} x$, then show that $\left(1 - x^2\right)\frac{d^2y}{dx^2} - x\frac{dy}{dx} = 0$.

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67. If $y = e^{m \sin^{-1} x}$, prove that $\left(1 - x^2\right)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - m^2y = 0$.

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68. If $y = \left\{x + \sqrt{x^2 + 1}\right\}^m$, show that $\left(x^2 + 1\right)y_2 + xy_1 - m^2\, y = 0$

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69. If $y = \frac{\sin^{-1} x}{\sqrt{1-x^2}}$, show that $(1-x^2)\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} - y = 0$.

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70. If $x = \tan\left(\frac{1}{a}\log y\right)$, show that $(1+x^2)\frac{d^2y}{dx^2} + (2x-a)\frac{dy}{dx} = 0$.

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71. If $y = x^x$, prove that $\frac{d^2y}{dx^2} - \frac{1}{y}\left(\frac{dy}{dx}\right)^2 - \frac{y}{x} = 0$

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72. Find $\frac{d^2y}{dx^2}$, if $x = at^2,\ \ y = 2at$.

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73. If $x = a\cos^3\theta$ and $y = a\sin^3\theta$, then find the value of $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{6}$.

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74. If $y = a\sin t$ and $x = a\left(\cos t + \frac{\log\tan t}{2}\right)$, find $\frac{d^2y}{dx^2}$.

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75. If $x = a\cos\theta + b\sin\theta$, $y = a\sin\theta - b\cos\theta$ then show that $y^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 0$

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76. If $x = \sin t, y = \sin pt$, prove that $\left(1 - x^2\right)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y = 0.$

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77. If $x = \sin\theta$, $y = \cos p\theta$, prove that $\left(1 - x^2\right)y_2 - xy_1 + p^2 y = 0$, where $y_2 = \dfrac{d^2y}{dx^2}$ and $y_1 = \dfrac{dy}{dx}$.

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78. If $(x-a)^2 + (y-b)^2 = c^2$, for some $c > 0$, $prove that \dfrac{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\frac{d^2y}{dx^2}} is a constant \in dependen \to f$ a and b.

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79. If $y^2 = a^2\cos^2 x + b^2\sin^2 x$ then prove that $\dfrac{d^2y}{dx^2} + y = \dfrac{a^2b^2}{y^3}$

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80. If $f(x) = |x|^3$, show that $f(x)$ exists for all real x and find it.

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81. In $\frac{dy}{dx}$, x is independent variable and y is the dependent variable. If independent and dependent variables are interchanged $\frac{dy}{dx}$ becomes $\frac{dx}{dy}$ and these two are connected by the relation $\frac{dy}{dx} \cdot \frac{dx}{dy} = 1$. Find a relation between $\frac{d^2y}{dx^2}$ and $\frac{d^2x}{dy^2}$

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82. In $\frac{dy}{dx}$, x is a independent variable and y is the dependent variable. If independent and dependent variables are interchanged $\frac{dy}{dx}$ becomes $\frac{dx}{dy}$ and these two are connected by the relation $\frac{dy}{dx}\frac{dx}{dy} = 1$. Find a relation between $\frac{d^2y}{dx^2}$ and $\frac{d^2x}{dy^2}$.

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83. Find second order derivative of $x^3 + \tan x$

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84. Find second order derivative of $\sin(\log x)$

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85. Find second order derivative of $\log(\sin x)$

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86. Find second order derivative of $e^x \sin 5x$

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87. Find second order derivative of $e^{6x} \cos 3x$

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88. Find second order derivative of $x^3 \log x$

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89. Find second order derivative of $\tan^{-1} x$

Watch Video Solution

90. Find second order derivative of $x \cos x$

Watch Video Solution

91. Find second order derivative of $\log(\log x)$

Watch Video Solution

92. If $y = e^{-x} \cos x$, show that $\frac{d^2y}{dx^2} = 2e^{-x} \sin x$.

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93. If $y = x + \tan x$, show that $\cos^2 x \dfrac{d^2y}{dx^2} - 2y + 2x = 0$.

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94. If $y = x^3 \log x$, prove that $\dfrac{d^4y}{dx^4} = \dfrac{6}{x}$.

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95. If $y = \log(\sin x)$, prove that $\dfrac{d^3y}{dx^3} = 2\cos x \cos ec^3 x$.

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96. If $y = 2\sin x + 3\cos x$, show that $\dfrac{d^2y}{dx^2} + y = 0$.

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97. If $y = \frac{\log x}{x}$, show that $\frac{d^2y}{dx^2} = \frac{2\log x - 3}{x^3}$.

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98. If $x = a\sec\theta, y = b\tan\theta$, prove that $\frac{d^2y}{dx^2} = -\frac{b^4}{a^2\, y^3}$.

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99. If $x = a(\cos\theta + \theta\sin\theta)$, $y = a(\sin\theta - \theta\cos\theta)$, prove that $\frac{d^2x}{d\theta^2} = a(\cos\theta - \theta\sin\theta),\ \frac{d^2y}{d\theta^2} = a(\sin\theta + \theta\cos\theta)$ and $\frac{d^2y}{dx^2} = \frac{sec^3\theta}{a\,\theta}$.

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100. If $y = e^x\cos x$, prove that $\frac{d^2y}{dx^2} = 2\,e^x\cos\left(x + \frac{\pi}{2}\right)$.

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101. If $x = a\cos\theta, y = b\sin\theta$, show that $\frac{d^2y}{dx^2} = -\frac{b^4}{a^2y^3}$.

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102. If $x = a(1-\cos^3\theta)$, $y = a\, s\in^3\theta$, prove that $\frac{d^2y}{dx^2} = \frac{32}{27\,a}$ at $\theta = \frac{\pi}{6}$.

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103. If $x = a(\theta+\sin\theta), y = a(1+\cos\theta)$, prove that $\frac{d^2y}{dx^2} = -\frac{a}{y^2}$.

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104. If $x = a(\theta-\sin\theta), y = a(1+\cos\theta)$ find $\frac{d^2y}{dx^2}$

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105. If $x = a(1 - \cos\theta)$, $y = a(\theta + \sin\theta)$, prove that $\frac{d^2y}{dx^2} = -\frac{1}{a}$ at $\theta = \frac{\pi}{2}$.

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106. If $x = a(1 + \cos\theta)$, $y = a(\theta + \sin\theta)$, prove that $\frac{d^2y}{dx^2} = \frac{-1}{a}$ at $\theta = \frac{\pi}{2}$.

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107. If $x = \cos\theta$, $y = \sin^3\theta$, prove that $y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 3\sin^2\theta(5\cos^2\theta - 1)$.

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108. If $y = \sin(\sin x)$, prove that $\frac{d^2y}{dx^2} + \tan x\frac{dy}{dx} + y\cos^2 x = 0$.

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109. If $x = \sin t, y = \sin pt$, prove that $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y = 0.$

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110. If $y = \left(\sin^{-1} x\right)^2$, prove that $(1-x^2)y_2 - xy_1 - 2 = 0$.

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111. If $y = e^{\tan \hat{} ((-1)x)}$, prove that $(1+x^2)y_2 + (2x-1)y_1 = 0$.

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112. If $y = 3\cos(\log x) + 4\sin(\log x)$, prove that $x^2y_2 + x\,y_1 + y = 0$.

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113. If $y = e^{2x}(ax + b)$, show that $y_2 - 4\,y_1 + 4\,y = 0$.

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114. If $x = \sin\left(\frac{1}{a}\log y\right)$, show that $\left(1 - x^2\right)y_2 - x\,y_1 - a^2\,y = 0$.

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115. If $\log y = \tan^{-1} x$, show that $\left(1 + x^2\right)y_2 + (2x - 1)y_1 = 0$.

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116. If $y = \tan^{-1} x$, show that $\left(1 + x^2\right)\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} = 0$.

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117. If $y = \left\{\log\left(x + \sqrt{x^2+1}\right)\right\}^2$, show that $\left(1+x^2\right)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0$

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118. If $y = \left(\tan^{-1} x\right)^2$, then prove that $\left(1+x^2\right)^2 y_2 + 2x\left(1+x^2\right)y_1 = 2$.

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119. If $y = \cot x$ show that $\frac{d^2y}{dx^2} + 2y\frac{dy}{dx} = 0$.

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120. Find $\frac{d^2y}{dx^2}$, where $y = \log\left(\frac{x^2}{e^2}\right)$.

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121. If $y = ae^{2x} + be^{-x}$, show that, $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 0$.

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122. If $y = e^x(\sin x + \cos x)$ prove that $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$.

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123. If $y = \cos^{-1} x$, find $\frac{d^2y}{dx^2}$ in terms of y alone.

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124. If $y = e^a \cos^{(-1)x}$, $-1 \leq x \leq 1$, show that $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - a^2y = 0$.

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125. If $y = 500\,e^{7x} + 600\,e^{-7x}$, show that $\dfrac{d^2y}{dx^2} = 49\,y$.

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126. If $x = 2\cos t - \cos 2t, \quad y = 2\sin t - \sin 2t$, find $\dfrac{d^2y}{dx^2}$ at $t = \dfrac{\pi}{2}$.

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127. If $x = 4z^2 + 5, \quad y = 6z^2 + 7z + 3,$ find $\dfrac{d^2y}{dx^2}$.

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128. If $y = \log(1 + \cos x)$, prove that $\dfrac{d^3y}{dx^3} + \dfrac{d^2y}{dx^2}\dfrac{dy}{dx} = 0$.

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129. If $y = \sin(\log x)$, prove that $x^2\dfrac{d^2y}{dx^2} + x\dfrac{dy}{dx} + y = 0$.

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130. If $y = 3\,e^{2x} + 2\,e^{3x}$, prove that $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$.

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131. If $y = \left(\cot^{-1} x\right)^2$, prove that $y_2\left(x^2+1\right)^2 + 2x\left(x^2+1\right)y_1 = 2$.

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132. If $y = \operatorname{cosec}^{-1} x,\ x > 1$, then show that $x\left(x^2-1\right)\frac{d^2y}{dx^2} + \left(2x^2-1\right)\frac{dy}{dx} = 0$.

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133. If $x = \cos t + \log\tan\left(\frac{t}{2}\right),\ y = \sin t$, then find the value of $\frac{d^2y}{dt^2}$ and $\frac{d^2y}{dx^2}$ at $t = \frac{\pi}{4}$.

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134. If $x = a\sin t$ and $y = a\left(\cos t + \frac{\log\tan t}{2}\right)$, find $\frac{d^2y}{dx^2}$.

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135. If $x = a(\cos t + t\sin t)$ and $y = a(\sin t - t\cos t)$, then find the value of $\frac{d^2y}{dx^2}$.

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136. If $x = a\left(\cos t + \log\tan\left(\frac{t}{2}\right)\right)$, $y = a\sin t$, evaluate $\frac{d^2y}{dx^2}$ at $t = \frac{\pi}{3}$.

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137. If $x = a(\cos 2t + 2t \sin 2t)$ and $y = a(\sin 2t - 2t \cos 2t)$, then find $\frac{d^2y}{dx^2}$.

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138. If $x = a \sin t - b \cos t,\ y = a \cos t + b \sin t$, prove that $\frac{d^2y}{dx^2} = -\frac{x^2 + y^2}{y^3}$.

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139. Find A *and* B so that $y = A \sin 3x + B \cos 3x$ satisfies the equation $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = 10 \cos 3x$.

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140. If $y = Ae^{-kt} \cos(pt + c),$ then prove that $\frac{d^2y}{dt^2} + 2k\frac{dy}{dx} + n^2y = 0$, where $n^2 = p^2 + k^2$

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141. If $y = x^n\{a\cos(\log x) + b\sin(\log x)\}$, prove that $x^2\frac{d^2y}{dx^2} + (1-2n)\frac{dy}{dx} + \left(1+n^2\right)y = 0$.

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142. If $y = a\left[x + \left(x^2-1\right)^{\frac{1}{2}}\right]^n + b\left[x - \left(x^2-1\right)^{\frac{1}{2}}\right]^n$ the value of the expression $\left(x^2-1\right)\frac{d^2y}{dx^2} + x\frac{dy}{dx} - n^2y$ is _____.

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143. If $y = a\,x^{n+1} + bx^{-n}$ and $x^2\frac{d^2y}{dx^2} = \lambda y$, then write the value of λ .

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144. If $x = a\cos nt - b\sin nt$ and $\frac{d^2x}{dt^2} = \lambda x$, then find the value of λ .

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145. If $x = t^2$ and $y = t^3$, find $\frac{d^2y}{dx^2}$.

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146. If $x = 2at$, $y = at^2$, where a is a constant, then find $\frac{d^2y}{dx^2}$ at $x = \frac{1}{2}$

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147. If $x = f(t)$ and $y = g(t)$, then write the value of $\frac{d^2y}{dx^2}$.

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148. If $y = 1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \frac{x^4}{4!} \ldots\ldots \infty$, then write $\frac{d^2y}{dx^2}$ in terms of y.

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149. If $y = x + e^x$, find $\frac{d^2x}{dy^2}$.

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150. If $y = \left|x - x^2\right|$, then find $\frac{d^2y}{dx^2}$.

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151. If $y = \left|(\log)_e x\right|$, find $\frac{d^2y}{dx^2}$.

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152. If $x = a\cos nt - b\sin nt$, then $\frac{d^2x}{dt^2}$ is $(a)n^2x$ (b) $-n^2x$ (c) nx (d) nx

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153. If $x = at^2,\ y = 2\,at$, then $\frac{d^2y}{dx^2} = -\frac{1}{t^2}$ (b) $\frac{1}{2\,at^3}$ (c) $-\frac{1}{t^3}$ (d) $-\frac{1}{2\,at^3}$

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154. If $y = ax^{n+1} + bx^{-n}$, then $x^2\frac{d^2y}{dx^2} = (a)n(n-1)y$ (b) $n(n+1)y$ (c) ny (d) n^2y

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155. $\frac{d^{20}}{dx^{20}}(2\cos x\cos 3x) = 2^{20}\left(\cos 2x - 2^{20}\cos 4x\right)$ (b) $2^{20}\left(\cos 2x + 2^{20}\cos 4x\right)$ (c) $2^{20}\left(\sin 2x + 2^{20}\sin 4x\right)$ (d) $2^{20}\left(\sin 2x - 2^{20}\sin 4x\right)$

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156. If $x = t^2,\ \ y = t^3$, then $\frac{d^2y}{dx^2} =$ $(a) 3/2$ (b) $3/4t$ (c) $3/2t$ (d) $3t/2$

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157. If $y = a + bx^2,\ a,\ b$ arbitrary constants, then $\frac{d^2y}{dx^2} = 2xy$ (b) $x\frac{d^2y}{dx^2} = \frac{dy}{dx}$ (c) $x\frac{d^2y}{dx^2} - \frac{dy}{dx} + y = 0$ (d) $x\frac{d^2y}{dx^2} = 2xy$

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158. If

$f(x) = (\cos x + i\sin x)(\cos 2x + i\sin 2x)(\cos 3x + i\sin 3x)\cos nx + i\sin$

and $f(1) = 1$, then $f(1)$ is equal to $\frac{n(n+1)}{2}$ (b) $\left\{\frac{n(n+1)}{2}\right\}^2$ (c) $-\left\{\frac{n(n+1)}{2}\right\}^2$ (d) none of these

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159. If $y = a\sin mx + b\cos mx$, then $\frac{d^2y}{dx^2}$ is equal to $(a) -m^2y$ (b) m^2y (c) my (d) my

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160. If $f(x) = \frac{\sin^{-1}x}{\sqrt{1-x^2}}, then\left(1-x^2\right)f^x - xf(x) =$ 1 (b) -1 (c) 0 (d) none of these

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161. If $y = \tan^{-1}\left\{\frac{(\log)_e\left(e/x^2\right)}{(\log)_e(ex^2)}\right\} + \tan^{-1}\left(\frac{3+2\,(\log)_e x}{1-6\,(\log)_e x}\right)$, then $\frac{d^2y}{dx^2} =$ (a) 2 (b) 1 (c) 0 (d) -1

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162. Let $f(x)$ be a polynomial. Then, the second order derivative of $f(e^x)$ is $f(e^x)e^{2x} + f'(e^x)e^x$ (b) $f(e^x)e^x + f'(e^x)$ (c) $f(\hat{}x)e\hat{}(2x)+f(e^x)e^x$

(d) $f(e^x)$

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163. If $y = a\cos\left((\log)_e x\right) + b\sin\left((\log)_e x\right)$, then $x^2 y_2 + xy_1 =$ (a) 0 (b) y (c) y (d) none of these

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164. If $x = 2at$ at $y = at^2$, where a is a constant, then $\frac{d^2y}{dx^2}$ at $x = \frac{1}{2}$ is $(a) 1/2a$ (b) 1 (c) $2a$ (d) none of these

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165. If $x = f(t)$ and $y = g(t)$, then $\frac{d^2y}{dx^2}$ is equal to $\frac{f'g\text{-g'}\backslash \text{f}}{(f')^3}$ (b) $\frac{f'g\text{-g'}\backslash \text{f}}{(f')^2}$ (c) $(g)/(\text{f})$ (d) $\frac{f^{g\,\prime} - g\,f'}{(g')^3}$

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166. If $y = \sin\left(m \sin^{-1} x\right)$, then $\left(1 - x^2\right) y_2 - x y_1$ is equal to $m^2 y$ (b) $m y$ (c) $-m^2 y$ (d) none of these

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167. If $y = \left(\sin^{-1} x\right)^2$, then $\left(1 - x^2\right) y_2$ is equal to $x y_1 + 2$ (b) $x y_1 - 2$ (c) $x y_1 + 2$ (d) none of these

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168. If $y = e^{\tan x}$, then $\left(\cos^2 x\right) y_2 = (1 - \sin 2x) y_1$ (b) $-(1 + \sin 2x) y_1$ (c) $(1 + \sin 2x) y_1$ (d) none of these

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169. If $y = \frac{2}{\sqrt{a^2 - b^2}} \left\{ \tan^{-1} \left(\frac{a-b}{a+b} \right) \frac{\tan x}{2} \right\}$, then show that $\frac{d^2y}{dx^2} = \frac{b \sin x}{(a + b \cos x)^2}$

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170. If $y = \frac{ax + b}{x^2 + c}$, prove that $(2xy_1 + y)y_3 = 3(xy_2 + y_1)y_2$.

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171. If $y = \log_e \left(\frac{x}{a + bx} \right)^x$, then $x^3 y_2$ is (a) $(xy_1 - y)^2$ (b) $(1 + y)^2$ (c) $\left(\frac{y - xy_1}{y_1} \right)^2$ (d) none of these

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172. If $x = f(t)\cos t - f'(t)\sin t$ and $y = f(t)\sin t + f'(t)\cos t$, then $\left(\frac{dx}{dt} \right)^2 + \left(\frac{dy}{dt} \right)^2 =$ (a) $f(t) - f''(t)$ (b) $\{f(t) - f''(t)\}^2$ (c)

$\{f(t)+f''(t)\}^2$ (d) none of these

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173. If $y^{\frac{1}{m}}+y^{-\frac{1}{m}}=2x$ then $\left(x^2-1\right)y_2+xy_1$ is equal to

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174. If $y=x^{n-1}\log x$ then $x^2y_2+(3-2n)xy_1$ is equal to $-(n-1)^2y$ (b) $(n-1)^2y-n^2y$ (d) n^2y

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175. If $xy-(\log)_e y=1$ satisfies the equation $x(yy_2+y12)-y_2+\lambda yy_1=0, then\lambda=$ -3 (b) 1 (c) 3 (d) none of these

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176. If $y^2 = ax^2 + bx + c$, then $y^3 \frac{d^2y}{dx^2}$ is (a) a constant (b) a function of x only (c) a function of y only (d) a function of x and y

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Others

1. If $\frac{d}{dx}\{x^n - a_1x^{n-1} + a_2x^{n-2} + + (-1)^n a_n\}e^x = x^n e^x$, then the value of

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2. If $\frac{d}{dx}\left\{x^n - a_1x^{n-1} + a_2x^{n-2} + \dot{+}(-1)^n a_n\right\}e^x = x^n e^x$, then the value of $a_r = \begin{pmatrix} n \\ n-r \end{pmatrix}$, is equal to

A. (a) $\frac{n!}{r!}$

B. (b) $\frac{(n-r)!}{r!}$

C. (c) $\frac{n!}{(n-r)!}$

D. (d) none of these

Answer:

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