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MATHS

BOOKS - RD SHARMA MATHS (ENGLISH)

MEAN VALUE THEOREMS

Others

1. Using Lagranges mean value theorem, show that $\sin x < x$ for $x > 0$.

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2. Using mean value theorem, prove that $\tan x > x$ for all $x\left(0, \frac{\pi}{2}\right)$.

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3. Using Lagranges mean value theorem, find a point on the curve $y = \sqrt{x-2}$ defined on the interval [2,3], where the tangent is parallel to the chord joining the end points of the curve.

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4. Verify Lagranges mean value theorem for the following functions on the indicated intervals.

$f(x) = x - 2\sin x on[-\pi, \pi]$

$f(x) = 2\sin x + \sin 2x on[0, \pi]$

$f(x) = (\log)_e x on[1, 2]$

$f(x) = \{2 + x^3, \quad \text{if} \quad x \leq 13x, x > 0 on[-1, 2]$

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5. Verify lagranges mean value theorem for the function $f(x) = (x-3)(x-6)(x-9) on[3, 5]$

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6. Verify lagranges mean value theorem for the following functions on the indicated intervals. Also, find a point c in the indicated interval:

$f(x) = x(x-2) on [1, 3]$

$f(x) = x(x-1)(x-2) on \left[0, \frac{1}{2}\right].$

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7. Find the point on the curve $y = \cos x - 1, x \in \left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$ at which the tangent in parallel to the x-axis.

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8. It is given that the Rolles' theorem holds for the function $f(x) = x^3 + bx^2 + cx, x \in [1, 2]$ at the point $x = \frac{4}{3}$. Find the values of b and c

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9. Using Lagranges mean value theorem, prove that $\frac{b-a}{b} < \log\left(\frac{b}{a}\right) < \frac{b-a}{a}$,where $0 < a < b$

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10. Let $f and g$ be differentiable on [0,1] such that $f(0) = 2, g(0) = 0, f(1) = 6 and g(1) = 2.$

Show that there exists $c \in (0, 1)$ such that $f'(c) = 2g'(c).$

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11. If the value of c prescribed inRolles theorem for the function $f(x) = 2x(x - 3)^n$ on the interval $[0, 2\sqrt{3}] is \frac{3}{4}$, write the value of n (a positive integer).

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12. Using Lagranges mean value theorem, prove that

$(b-a)\sec^2 a < (\tan b - \tan a) < (b-a)\sec^2 b$

, where $0 < a < b < \frac{\pi}{2}$

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13. It is given that for the function $f(x) = x^3 - 6x^2 + ax + bon[1,3]$, Rolles theorem holds with $c = 2 + \frac{1}{\sqrt{3}}$. Find the values of $aandb$, if $f(1) = f(3) = 0.$

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14. Verify Rolles theorem for each of the following functions on the indicated intervals:

$f(x) = x(x+3)e^{-\frac{x}{2}} on[-3, 0]$

$f(x) = e^x(\sin x - \cos x) on\left[\frac{\pi}{4}, \frac{5\pi}{4}\right]$

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15. Find a point on the curve $y = x^2 + x,$ where the tangent is parallel to the chord joining (0,0) and (1,2).

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16. find the percentage error in calculating the volume of the cubical box if an error of 1% is made in measuring the length of the edges of the cube.

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17. Verify Rolles theorem for the function $f(x) = x^2 - 5x + 6$ on the interval $[2, 3]$.

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18. Discuss the applicability of Rolles theorem on the function

$$f(x) = \begin{cases} x^2 + 1 & \text{if} \quad 0 \leq x \leq 1 \\ 3 - x & \text{if} \quad 1 < x \leq 2 \end{cases}$$

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19. Verify Rolles theorem for the function $f(x) = (x - a)^m (x - b)^n$ on the interval $[a, b]$, where m, n are positive integers.

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20. Verify Rolls theorem for the function $f(x) = x^3 - 6x^2 + 11x - 6$ on the interval $[1, 3]$.

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21. Verify Rolle's theorem for each of the following functions on indicated intervals;

$f(x) = \sin^2 x$ on $0 \leq x \leq \pi$

$f(x) = \sin x + \cos x - 1$ on $\left[0, \frac{\pi}{2}\right]$

$f(x) = \sin x - \sin 2x$ on $[0, \pi]$

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22. Verify Rolle theorem for the function $f(x) = \log\left\{\frac{x^2 + ab}{x(a+b)}\right\} on [a, b]$, where `0

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23. Differentiate ysiny = x+y with respect to x

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24. Differentiate xy = siny with respect to x

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25. Differentiate y = xsiny with respect to x

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26. Differentiate ycosx = x with respect to x

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27. Verify Rolles theorem for the function $f(x) = x^2 - 5x + 6$ on the interval [2, 3].

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28. Verify Rolles theorem for the function $f(x) = x(x-3)^2,\ 0 \leq x \leq 3$.

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29. Verify Rolles theorem for the function $f(x) = x^3 - 6x^2 + 11x - 6$ on the interval [1, 3].

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30. Find the second order derivative of tanx= x+ y with respect to x

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31. Verify Rolles theorem for the function $f(x) = \sqrt{4 - x^2}$ on $[-2, 2]$.

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32. Find the second order differentiation of cotx with respect to x .

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33. Find the derivative of sinxcosx=x+y with respect to x

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34. Verify Rolles theorem for the function: $f(x) = \sin x + \cos x - 1$ on $[0,\ \pi/2]$.

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35. Verify Rolles theorem for the function:

$f(x) = \sin x - \sin 2x$ on $[0,\ \pi]$

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36. Find the differentiation for the function:

$f(x) = (x + 3)e^{-x}$.

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37. Find dy/dx for the function:

$f(x) = e^{x}(\sin x - \cos x)$.

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38. Find the derivative of the function $f(x) = x^3 - 6x^2 + ax + b$

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39. Find the differentiation for the function f given by $f(x) = x^3 + bx^2 + ax$

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40. Find the derivative of y=cosx-1 with respect to x

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41. Find the derivative for the function $f(x) = 3 + (x - 2)^{2/3}$ with respect to x

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42. Find the second order derivative of y= sinx +cosx

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43. Find f '(x) If $f(x) = \frac{\sin x}{x}$

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44. Find the derivative for the function $f(x) = 2x^2 - 5x + 3$ with respect to x

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45. Discuss the applicability of Rolles theorem for the function $f(x) = x^{2/3}$ on $[-1, 1]$

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46. Discuss the applicability of Rolle's theorem for the function $f(x) = \{-4x + 5, 0 \leq x \leq 1, 2x - 3, 1 \leq x \leq 2.$

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47. Verify Rolles theorem for function $f(x) = x^2 - 8x + 12$ on $[2,\ 6]$

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48. Verify Rolles theorem for function $f(x) = x^2 - 4x + 3$ on $[1,\ 3]$

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49. Verify Rolles theorem for function $f(x) = (x-1)(x-2)^2$ on $[1,\ 2]$

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50. Verify Rolles theorem for function $f(x) = x(x-1)^2$ on $[0,\ 1]$

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51. Verify Rolles theorem for function $f(x) = \left(x^2 - 1\right)(x-2)$ on $[-1,\ 2]$

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52. Verify Rolles theorem for function $f(x) = x(x-4)^2$ on $[0,\ 4]$

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53. Verify Rolles theorem for function $f(x) = x(x-2)^2$ on $[0,\ 2]$

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54. Verify Rolles theorem for function $f(x) = x^2 + 5x + 6$ on $[-3,\ -2]$

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55. Verify Rolles theorem for function $f(x) = \cos 2(x - \pi/4)$ on $[0,\ \pi/2]$.

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56. Find the second oder derivative for function $f(x) = \sin 2x$ with respect to x

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57. find the second order derivative for function $f(x) = \cos 2x$ with respect to x

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58. Find the derivative for function $f(x) = e^x \sin x$ with respect to x

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59. Find the derivative for function $f(x) = e^x \cos x$ with respect to x

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60. Find the second order derivative for function $f(x) = \cos 2x$ with respect to x

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61. Find the derivative for function $f(x) = \frac{\sin x}{e^x}$ with respect to x

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62. Find the second order derivative for function $f(x) = \sin 3x$ with respect to x

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63. Find the derivative for function $f(x) = e^1 - x^2$ with respect to x

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64. Find the derivative for function $f(x) = \log\left(x^2 + 2\right) - \log 3$ with respect to x

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65. Find the derivative for function $f(x) = \sin x + \cos x$ with respect to x

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66. Find the derivative for function $f(x) = 2\sin x + \sin 2x$ with respect to x

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67. Find the derivative for function f(x) = x/2 - sinxcosx with respect to x

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68. Find the second order derivative for function f(x) = 6x - 4 with respect to x

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69. Find the derivative for function $f(x) = 4^{\sin x}$ with respect to x

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70. Find the second order derivative for function $f(x) = x^2 - 5x + 4$ with respect to x

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71. Find the derivative for function xy = tan(x+y) with respect to x

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72. Verify Rolles theorem for the function: $f(x) = \sin x - \sin 2x$ on $[0,\ \pi]$

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73. find the second order derivative of $y = 16 - x^2$ with respect to x .

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74. At what points on the curve $y = x^2$ on $[-2,\ 2]$ is the tangent parallel to x-axis?

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75. At what points on the curve $y = e^1 - x^2$ on $[-1, 1]$ is the tangent parallel to x-axis?

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76. At what points on the curve $y = 12(x+1)(x-2)$ is the tangent parallel to x-axis on $[-1, 2]$.

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77. If $f:[-5, 5] \to R$ is differentiable and if $f'(x)$ doesnt vanish anywhere, then prove that $f(-5) \neq f(5)$.

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78. Examine if Rolle's theorem is applicable to any one of the following functions: $f(x) = [x]$ for $x \in [5, 9]$ (ii) $f(x) = [x]$ for $x \in [-2, 2]$ Can you say something about the converse of Rolle's Theorem from these functions?

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79. It is given that the Rolles theorem holds for the function $f(x) = x^3 + bx^2 + cx, \quad x \in [1, 2]$ at the point $x = \frac{4}{3}$. Find the values of b and c.

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80. Verify lagranges mean value theorem for the function $f(x) = (x-3)(x-6)(x-9)$ on the interval $[3, 5]$.

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81. Verify Lagranges mean value theorem for $f(x) = x(x-1)$ on $[1, 2]$ on the indicated intervals. Also, find a point c in the indicated interval:

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82. Verify Lagranges mean value theorem for $f(x) = x(x-1)(x-2)$ on $\left[0, \frac{1}{2}\right]$

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83. Find the derivative of $y = \sqrt{x - 2}$ with respect to x

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84. Verify Lagranges mean value theorem for $f(x) = x - 2\sin x$ on $[-\pi, \pi]$

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85. Verify Lagranges mean value theorem for $f(x) = 2\sin x + \sin 2x$ on $[0, \pi]$

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86. Find the second order derivative of $f(x) = \log x$ with respect to x

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87. Find the second order derivative of tanx with respect to x

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88. Find the derivative of $\cos(x + y) = y$ with respect to x .

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89. Find the derivative of $\sin(x + y) = 80$ with respect to x

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90. Find the derivative of $\cot(x + y) = xy$ with respect to x .

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91. Find the second order derivative of $y = \sin x + \cos x$ with respect to x .

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92. Find the derivative of $\tan xy = \sin x$ with respect to x .

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93. Find the second order derivative for function $f(x) = x^2 - 1$ with respect to x

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94. Find the derivative for function $f(x) = x^3 - 2x^2 - x + 3$ with respect to x

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95. Find the derivative for function $f(x) = x(x - 1)$ with respect to x

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96. Find the derivative for function $f(x) = x^2 - 3x + 2$ with respect to x

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97. Find the derivative for function $f(x) = 2x^2 - 3x + 1$ with respect to x

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98. Find the derivative for function $f(x) = x^2 - 2x + 4$ with respect to x

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99. Find the second order derivative for function $f(x) = 2x - x^2$ with respect to x

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100. Find the derivative for function $f(x) = (x-1)(x-2)(x-3)$ with respect to x

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101. Find the derivative for function $f(x) = \sqrt{25 - x^2}$ with respect to x

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102. Find the second order derivative for function $f(x) = \tan^{-1} x$ with respect to x

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103. Find the derivative for function $f(x) = x + \frac{1}{x}$ with respect to x

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104. Find the derivative for function $f(x) = x(x+4)^2$ with respect to x

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105. Find the derivative for function $f(x) = \sqrt{x^2 - 4}$ with respect to x

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106. Find the second order derivative for function

$f(x) = x^2 + x - 1$ with respect to x

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107. Find the second order derivative for function

$f(x) = \sin x - \sin 2x - x$ with respect to x

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108. Find the derivative for function $f(x) = x^3 - 5x^2 - 3x$ with respect to x

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109. Find the derivative of f(x) = xcosecx with respect to x .

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110. Find the second order derivative of the function $f(x) = \frac{1}{x}$ with respect to x .

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111. Find the dy/dx for the function f(x)=1/(4x-1) with respect to x .

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112. Find a point on the parabola $y = (x - 4)^2$, where the tangent is parallel to the chord joining (4, 0) and (5, 1).

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113. Find a point on the curve $y = x^2 + x$, where the tangent is parallel to the chord joining (0, 0) and (1, 2).

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114. Find a point on the parabola $y = (x - 3)^2$, where the tangent is parallel to the chord joining (3, 0) and (4, 1).

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115. Find the derivative of $y = x^3 - 3x$, with respect to x

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116. Find the derivative of $y = x^3 + 1$ with respect of x .

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117. Find dy/dx $x = a\cos^3\theta$, $y = a\sin^3\theta$

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118. Find dy/dx if $y = \sin x^{\cos x}$.

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119. If $f(x) = Ax^2 + Bx + C$ then find f '(x)

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120. Find dy/dx if $y = x^x$

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121. Find dy/dx if y= xy

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122. Find the derivative for the function $f(x) = 2x(x - 3)$

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123. Find the derivative for the function $f(x) = \sqrt{x^2 - 4}$ with respect to x .

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124. Find dy/dx if y = sin(x+y)

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125. Find the derivative of function $3ax^2 + 2bx + c = y$ with respect to x

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126. For the function $f(x) = x + \frac{1}{x}$ Find f ' (x)

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127. Find dy/dx if tan(x+ y) = xy

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128. $f(x) = a^{\sin x}$ find the derivative of the function with respect to x

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129. Find f ' (x) if $f(x) = 2x^3 - 5x^2 - 4x + 3$,

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130. Find $\frac{dy}{dx}$ if $y = x \log x$

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131. Find the derivative for the function $f(x) = \frac{x+1}{e^x}$ with respect to x

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132. Find the derivative for the function $f(x) = x(x-2)$ with respect to x

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133. Find the second order derivative for the function $f(x) = x^3 - 3x$ with respect to x

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134. If $f(x) = e^x \sin x$ then find $f'(x)$

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