MATHS

BOOKS - MBD MATHS (ODIA ENGLISH)

LIMIT AND DIFFERENTIATION

Question Bank

1. $\lim_{x \to 3} (x + 4)$

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2. $\lim_{x \to 1} (4x - 1)$

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3. $\lim_{x \to 1} (\sqrt{x} + 3)$

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4. $\lim_{x \to 0} (x^2 + 3)$

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5. $\lim_{x \to 0} 7$

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6. $\lim_{x \to 1} \frac{(x-1)^3}{(x-1)^3}$

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7. $\lim_{x \to 3} \frac{x^3 - 9}{(x-3)}$

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8. $\lim_{x \to 1} \frac{3x + 2}{(2x + 3)}$

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9. $\lim_{x \to 0} |x|$

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10. $\lim_{x \to 2} (|x| + 3)$

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11. Using the $\varepsilon - \delta$ definition prove that

$$\lim_{x \to 0} (2x + 3) = 3$$

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12. Using the $\varepsilon - \delta$ definition prove that

$$\lim_{x \to 1} (2x - 1) = 1$$

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13. Using the $\varepsilon - \delta$ definition prove that

$$\lim_{x \to -2} (3x + 8) = 2$$

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14. Using the $\varepsilon - \delta$ definition prove that

$$\lim_{x \to 3} \left(x^2 + 2x - 8\right) = 7$$

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15. Using the $\varepsilon - \delta$ definition prove that

$$\lim_{x \to 9} \sqrt{x} = 3$$

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16. Using the $\varepsilon - \delta$ definition prove that

$$\lim_{x \to a} \sqrt{x} = \sqrt{a}, a > 0$$

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17. Using the $\varepsilon - \delta$ definition prove that

$$\lim_{x \to 1} |3x + 2| = 5$$

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18. Using the $\varepsilon - \delta$ definition prove that

$$\lim_{x \to 2} |5x - 7| = 3$$

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19. If $\lim_{x \to a} f(x) = l$

then prove that $\lim_{x \to a} |f(x)| = |l|$

Is the converse true? Justify your answer with reason.

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20. Prove that $\lim_{x \to a} x = a$

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21. Using $\lim_{x \to a} x = a$ and the laws of limits prove that $\lim_{x \to a} x^n = a^n$

where n is an integer

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22. Evaluate the following

$$\lim_{x \to 1} \left(1 + 2x - 3x^2 + 4x^3 - 5x^4\right)$$

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23. Evaluate the following

$$\lim_{x \to 0} \left(3x^2 + 4x - 1\right)$$

$$\left(x^4 + 2x^3 - 3x^2 + 5x + 2\right)$$

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24. Evaluate the following $\lim_{x \to 2} \frac{x^2 + 3x - 9}{x + 1}$

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25. Evaluate the following $\lim_{x \to 3} \frac{x^2 - 9}{x - 3}$

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26. Evaluate the following $\lim_{x \to 1} \frac{x^3 - 1}{x - 1}$

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27. Evaluate the following $\lim_{x \to 2} \frac{x - 2}{x^4 - 16}$

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28. Evaluate the following $\lim_{x \to 2} \frac{x^3 - 8}{x^5 - 32}$

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29. Evaluate the following

$$\lim_{x \to 3} \frac{x^2 + 2x - 15}{x^2 - x - 6}$$

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30. Evaluate the following

$$\lim_{x \to 0} \frac{(3 + x)^3 - 27}{x}$$

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31. Evaluate the following $\lim_{x \to 2} \dfrac{\frac{1}{x^2} - \frac{1}{4}}{x - 2}$

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32. Evaluate the following

$$\lim_{x \to 1} \frac{1}{x - 1}\left\{\frac{1}{x + 3} - \frac{2}{3x + 5}\right\}$$

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33. Evaluate the following

$$\lim_{h \to 0} \frac{(x + h)^3 - x^3}{h}$$

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34. Evaluate the following

$$\lim_{h \to 0} \frac{(x+h)^4 - x^4}{h}$$

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35. Evaluate the following $\lim_{x \to 1} \frac{x^m - 1}{x^n - 1}$, where m, n are integers.

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36. Evaluate the following $\lim_{x \to 1} \frac{x^2 - 2x + 1}{x^2 - x}$

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37. Evaluate the following

$\lim_{x \to 1} \frac{x^2 + x - 2}{x^3 - x^2 - x + 1}$

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38. Evaluate the following: $\lim_{x \to \infty} \frac{2x + 1}{3x - 2}$

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39. Evaluate the following:

$$\lim_{x \to \infty} \frac{3x^2 + x - 1}{2x^2 - 7x + 5}$$

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40. Evaluate the following:

$$\lim_{x \to \infty} \frac{x^3 + 2x^2 + 3}{x^4 - 3x^2 + 1}$$

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41. Evaluate the following:

$$\lim_{x \to \infty} \frac{x^4 - 5x + 2}{x^3 - 3x + 1}$$

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42. Evaluate the following:

$$\lim_{x \to \infty} \left(\frac{x^3}{2x^2 - 1} - \frac{x^2}{2x + 1} \right)$$

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43. Evaluate the following: $\lim_{n \to \infty} \frac{n}{n + 1}$

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44. Evaluate the following:

$$\lim_{n \to \infty} \left(\frac{n^2 + n + 1}{5n^2 + 2n + 1} \right)$$

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45. Evaluate the following: $\lim_{n \to \infty} \left(\frac{\sqrt{n} - 1}{\sqrt{n} + 1} \right)$

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46. Evaluate the following:

$$\lim_{n \to \infty} \left(\frac{6n^5 + 2n + 1}{n^5 + n^4 + 3n^3 + 2n^2 + n + 1} \right)$$

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47. Evaluate the following:

$$\lim_{n \to \infty} \frac{1 + 2 + 3 + \ldots + n}{n^2}$$

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48. Evaluate the following:

$$\lim_{n \to \infty} \frac{1^2 + 2^2 + 3^2 + \ldots + n^2}{n^3}$$

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49. Evaluate the following:

$$\lim_{n \to \infty} \frac{1^3 + 2^3 + 3^3 + \ldots + n^3}{n^4}$$

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50. Evaluate the following:

$$\lim_{n \to \infty} \frac{1 + \frac{1}{2} + \frac{1}{2^2} + \ldots + \frac{1}{2^n}}{1 + \frac{1}{3} + \frac{1}{3^2} + \ldots + \frac{1}{3^n}}$$

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51. Evaluate the following:

$$\lim_{n \to \infty} \frac{n!}{(n+1)! - n!}$$

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52. $\lim_{x \to \sqrt{3}} [x]$

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53. $\lim_{x \to 0} [x]$

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54. $\lim_{x \to -2} [x]$

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55. $\lim_{x \to 0} \frac{|x|}{x}$

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56. $\lim_{x \to 2} \frac{x-2}{|x-2|}$

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57. $\lim_{x \to \frac{1}{2}} \frac{|2x-1|}{2x-1}$

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58. lim_(xto1)[2x+3]

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59. $\lim_{x \to \infty} \frac{x}{[x]}$

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60. $\lim_{x \to \infty} \frac{x^2 - x}{[x^2 - x]}$

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61. $\lim_{x \to 1} \frac{|x^2 - 3x + 2|}{x^2 - 3x + 2}$

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62. `lim_(xtoinfty)(-1)^[x]

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63. $\lim_{x \to \infty}$ sinx

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64. $\lim_{x \to \infty}$ cosx

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65. $\lim_{x \to 0}$ cos(1/x)

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66. Evaluate the following: $\lim_{x \to \infty}$ sin(1/x)

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67. $\lim_{x \to 1} f(x)$ if $f(x) = \begin{cases} 2x - 1 & x \leq 1 \\ 2x + 1 & x > \end{cases}$

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68. $\lim_{x \to 0} f(x)$ and $\lim_{x \to 1} f(x)$

if $f(x) = \begin{cases} 0 \cdot x \leq 0 & x \leq 1 \\ 1 - 2x & 0 < x \leq 1 \\ 3 - 4x & x > 1 \end{cases}$

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69. Evaluate the following: $\lim_{x \to \infty} \frac{\sin x}{x}$

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70. Evaluate the following:

$$\lim_{x \to \infty} x\left(a^{\frac{1}{x}} - 1\right), a > 0$$

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71. Evaluate the following:

$$\lim_{x \to 0} \frac{x^{\frac{1}{2}} + 2x + 3x^{\frac{3}{2}}}{2x^{\frac{1}{2}} - 2x^{\frac{5}{2}} + 4x^{\frac{7}{2}}}$$

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72. Evaluate the following:

$$\lim_{x \to \infty} \sqrt{x}\left\{\sqrt{x+1} - \sqrt{x}\right\}$$

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73. Evaluate the following:

$$\lim_{x \to \infty} x^2\left\{\sqrt{x^4 + a^2} - \sqrt{x^4 - a^2}\right\}$$

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74. Evaluate the following: $\lim_{x \to 0}$ cos(sin x)

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75. Evaluate the following: $\lim_{x \to 0} \frac{\sqrt{1+x}-1}{\log_e(1-x)}$

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76. Evaluate the following: $\lim_{x \to 2} \log_2 \frac{x^2-4}{\sqrt{3x-2}-\sqrt{x+2}}$

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77. Evaluate the following: $\lim_{x \to \infty} \log_e \left(1 + \frac{a}{x}\right)^x$

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78. Evaluate the following: $\lim_{x \to 0} \log_e (1 + bx)^{\frac{1}{x}}$

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79. Evaluate the following:

$$\lim_{x \to \frac{\pi}{4}} \frac{\sin\left(\frac{1 - \tan x}{1 + \tan x}\right)}{\frac{\pi}{4} - x}$$

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80. Evaluate the following: $\lim_{x \to \frac{\pi}{2}} \log \frac{1 - \sin^3 x}{\cos^2 x}$

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81. Evaluate the following: $\lim_{x \to \infty} e^x \left(a^{\frac{1}{x}} - 1 \right)$

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82. Evaluate the following:

$$\lim_{x \to 0} \frac{x\left(e^{\frac{\sqrt{1+x^2+x^4-1}}{x}}-1\right)}{\sqrt{1+x^2+x^4-1}}$$

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83. Examine the existence of the following limits: $\lim_{x \to 0+} \log_a x$

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84. Examine the existence of the following limits: $\lim_{x \to \frac{\pi}{2}} \tan x$

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85. Examine the existence of the following limits: $\lim_{x \to 0} \operatorname{cosec} x$

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86. Examine the existence of the following limits: $\lim_{x \to 0-} e^{\frac{1}{x}}$

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87. Examine the existence of the following limits: $\lim_{x \to 0+} e^{\frac{1}{x}}$

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88. Examine the existence of the following limits: $\lim_{x \to 0} \frac{1}{e^{\frac{1}{x}} - 1}$

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89. Find the value of a if, $\lim_{x \to \alpha} \frac{\tan a(x - \alpha)}{x - \alpha} = \frac{1}{2}$

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90. Find the value of a if, $\lim_{x \to 0} \frac{\tan ax}{\sin 2x} = 1$

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91. Find the value of a if, $\lim_{x \to 0} \frac{e^{ax} - e^{x}}{x} = 2$

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92. Find the value of a if, $\lim_{x \to 1} \frac{5^{x} - 5}{(x - 1)\log_{e} a} = 5$

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93. Find the value of a if,

$$\lim_{x \to 2} \frac{\log_e(2x-3)}{a(x-2)} = 1$$

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94. Find the derivative of the following functions 'ab initio', that is, using the definition.

$2x^3$

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95. Find the derivative of the following functions 'ab initio', that is, using the definition.

x^4

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96. Find the derivative of the following functions 'ab initio', that is, using the definition.

$x^2 + 1$

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97. Find the derivative of the following functions 'ab initio', that is, using the definition.

1/x

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98. Find the derivative of the following functions 'ab initio', that is, using the

definition.

$$\frac{1}{3x+2}$$

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99. Find the derivative of the following functions 'ab initio', that is, using the definition.

$$\frac{1}{x^2}$$

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100. Find the derivative of the following functions 'ab initio', that is, using the definition.

$$\frac{x}{x+1}$$

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101. Find the derivative of the following functions 'ab initio', that is, using the definition.

t(t-1)

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102. Find the derivative of the following functions 'ab initio', that is, using the definition.

$s^2 - bs + 5$

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103. Find the derivative of the following functions 'ab initio', that is, using the

definition.

$\sqrt{z}$

104. Find the derivative of the following functions 'ab initio', that is, using the definition.

$\tan\theta$

105. Find the derivative of the following functions 'ab initio', that is, using the definition.

$\cos 2\theta$

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106. Find the derivative of the following functions 'ab initio', that is, using the definition.

x sin x

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107. Find the derivative of the following functions from definition at the indicated points.

x^4 at x=2

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108. Find the derivative of the following functions from definition at the indicated

points.

$2x^2 + x + 1$ at x=1

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109. Find the derivative of the following functions from definition at the indicated points.

$x^3 + 2x^2 - 1$ at x=0

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110. Find the derivative of the following functions from definition at the indicated points.

tan x at x=$\frac{\pi}{3}$

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111. Find the derivative of the following functions from definition at the indicated points.

$\sqrt{3x+2}$ at x=0

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112. Find the derivative of the following functions from definition at the indicated points.

ln x at x=2

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113. Find the derivative of the following functions from definition at the indicated

points.

e^x at x=1

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114. Find the derivative of the following functions from definition at the indicated points.

$\sin 2\theta$ at $\theta = \frac{\pi}{4}$

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115. $\frac{x+1}{x-1}$ at x=-1

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116. $\sqrt{x}$ at x=0

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117. $f(x) = \begin{cases} 1-x & x \leq \frac{1}{2} \\ x & x > \frac{1}{2} \end{cases} atx = \frac{1}{2}$

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118. $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$ $atx = 0$

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119. Find the derivative of the following functions from definition

$3x^2 - \frac{4}{x}$

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120. Find the derivative of the following functions from definition

$(4x - 1)^2$

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121. Find the derivative of the following functions from definition

$2 + x + \sqrt{x^3}$

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122. Find the derivative of the following functions from definition

$$x - \sqrt{x^2 - 1}$$

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123. Find the derivative of the following functions from definition

$$\frac{1}{x^{\frac{2}{5}}} + 1$$

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124. Differentiate cos(ax+b)

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125. Differentiate $x^2 \sin x$

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126. Differentiate $\sqrt{\tan x}$

Watch Video Solution

127. Differentiate $\cot x^2$

Watch Video Solution

128. Differentiate cosec 3x

Watch Video Solution

129. Differentiate $\sqrt{x}\sin x$

Watch Video Solution

130. Differentiate $\sqrt{x^2+1}\cos x$

Watch Video Solution

131. Differentiate $\tan x - x^2 - 2x$

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132. Differentiate $x^8 + x^7$

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133. Differentiate $x^{\frac{5}{3}} - x^{\frac{1}{2}}$

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134. Differentiate $x^3 - 5x$

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135. Differentiate $\sqrt{x} + \frac{1}{\sqrt{x}} - \sqrt[3]{x^2}$

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136. Differentiate $x^2 + 2x - \sin x + 5$

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137. Differentiate $\frac{1}{2}x^{\frac{1}{2}} + \frac{1}{3}x^{\frac{1}{3}}$

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138. Differentiate $ax^2 + b\tan x + \ln x^3$

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139. Differentiate $\sqrt{x}\left(\sqrt{x}+1\right)$

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140. Differentiate $(x-1)^2$

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141. Differentiate $\left(x^2-x+2\right)^2$

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142. Differentiate $x \sin x - \dfrac{e^x}{1+x^2}$

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143. Differentiate $\tan 2x + \sec 2x$

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144. Differentiate $\dfrac{x^2}{x+1} - \dfrac{x}{1-x}$

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145. Differentiate $\frac{\sqrt{x}-1}{\sqrt{x}+1}$

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146. Differentiate $\frac{\tan x - \cos x}{\sin x \cos x}$

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147. Differentiate $\left(\frac{x-1}{x+1}\right)^2$

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148. Differentiate $x^2(1+x)(2-x)$

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149. Differentiate $x^3(\sin x)e^{4\ln x}$

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150. Differentiate $\frac{1}{\sqrt{x}} + x\ln x^3$

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151. Differentiate $x^2 \log_2 x + \sec x$

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152. Differentiate $\dfrac{x^2 - 1}{x^3 + 1}$

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153. Differentiate $\left(x^3 + 1\right)\left(3x^2 + 2x - 7\right)$

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154. Differentiate $\cot x - \sec x - \log_{10} x$

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155. Differentiate $\dfrac{1 - \cos x}{1 + \cos x}$

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156. Differentiate $\dfrac{1 - \tan x}{1 + \tan x}$

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157. Differentiate $\frac{\left[x^{\frac{3}{5}} - 2e^2 \ln x + \ln^{\frac{2}{3}}\right]}{1+x}$

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158. Differentiate cosec x + cot x

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159. Differentiate $\tan^2 x + \sec^2 x$

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160. Differentiate $\tan^2 x + a^x$

View Text Solution

161. Differentiate $\cos^2 x + e^x \cos x$

View Text Solution

162. Differentiate $\frac{a^x - b^x}{x}$

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163. Differentiate $\frac{e^x + e^{-x}}{x^2 + 1}$

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164. Differentiate $\frac{\ln x}{x^2}$

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165. Show that $f(x) = \begin{cases} x \sin \frac{1}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$

is not differentiable x=0

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