



MATHS

BOOKS - RD SHARMA MATHS (ENGLISH)

DERIVATIVES



1. Differentiate the following with respect to x: (i)

 $x^3 e^x \sin x$ (ii) $x \sin x \log x$ (iii) $x^n (\log)_a x e^x$

2. Differentiate the following functions with respect to $x: \frac{x+e^x}{1+\log x}$

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3. If
$$f(x)=lpha x^n, ext{ prove that } lpha=rac{f^{\,\prime}(1)}{n}$$
 .

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4. Differentiate the following functions with respect to $x : (a x+b)^n(c x+d)^m$

5. If
$$f(x)andg(x)$$
 are two differentiable
functions, show that $f(x)g(x)$ is also
differentiable such that
 $\frac{d}{dx}[f(x)g(x)] = f(x)\frac{d}{dx}\{g(x)\} + g(x)\frac{d}{dx}\{f(x)\}$
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6. The differentiation of $(\log)_a x$ (a >0) with respect to x i.e. $\frac{d}{dx}((\log)_a x) = \frac{1}{x(\log)_e a}$

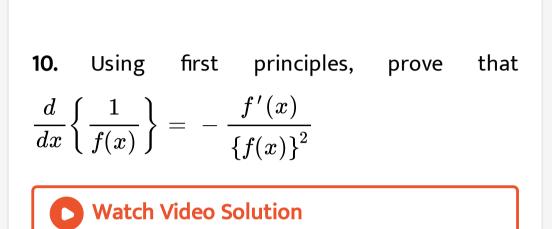
7. If
$$y = \sqrt{\frac{x}{a}} + \sqrt{\frac{a}{x}}$$
 , prove that $2xy\frac{dy}{dx} = \left(\frac{x}{a} - \frac{a}{x}\right)$

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8. If for
$$f(x) = \lambda x^2 + \mu x + 12$$
 and $f'(4) = 15$
and $f'(2) = 11$, then find λ and μ

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9. Differentiate $x^2 \cos x$ from first principles .



11. If
$$y = \sqrt{rac{1-\cos 2x}{1+\cos 2x}}, x \in \left(0,rac{\pi}{2}
ight) \cup \left(rac{\pi}{2},\pi
ight),$$
 then find $rac{dy}{dx}$.

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12. The integration of logx.

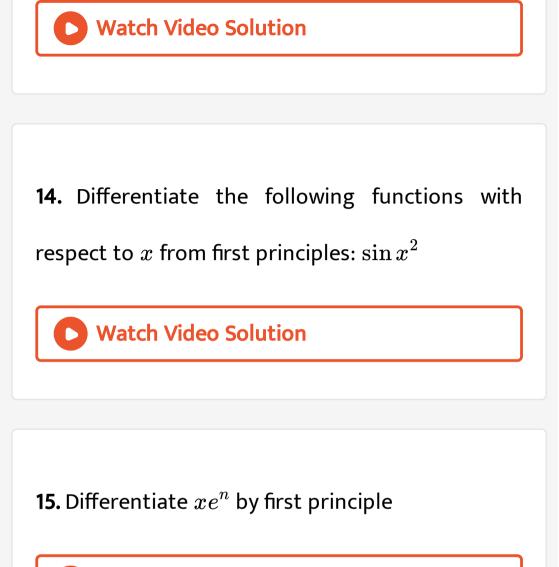


13. Differentiate the following functions with respect to x from first principles: $\sqrt{ax+b}$

A.
$$\displaystyle rac{a}{2\sqrt{ax+b}}$$

B. $\displaystyle rac{a}{\sqrt{ax+b}}$
C. $\displaystyle rac{1}{2\sqrt{ax+b}}$
D. $\displaystyle rac{a}{2\sqrt{ax-b}}$

Answer: A



16. Differentiate the following functions with respect to x from first principles: $\tan \sqrt{x}$ Watch Video Solution

17. The differentiation of
$$tanx$$
 with respect to $\xi s \sec^2 x$. i.e. $\frac{d}{dx}(\tan x) = \sec^2 x$
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18. The differentiation of $\cot x$ with respect to x is

$$-\cos ec^2 x$$
 i.e. $rac{d}{dx}(\cot x)=\ -\cos ec^2 x$



19. What is the differentiation of secx with respect

to x.



20. The differentiation of $\cos ecx$ with respect to

$$x$$
 i s $cosecx \cot x$ i.e. $rac{d}{dx}(\cos ecx) = -\cos ecx \cot x$

21. The differentiation of e^x with respect to $\xi s e^x$.

i.e.
$$\frac{d}{dx}(e^x) = e^x$$

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22. Differentiate the following functions with respect to $x: (\log)_{\times}$ (ii) $e^{3\log x}$ (iii) $5e^x$ (iv) $9(3^x)$

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23. Let f(x) be a differentiable and let c a be a constant. Then cf(x) is also differentiable such

that
$$\frac{d}{dx} \{cf(x)\} = c \frac{d}{dx} (f(x))$$
.
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24. Differentiate the following functions with
respect to $x: \left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2$
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25. Differentiate the following functions with respect to $x: \frac{3x}{x + \tan x}$

26. Differentiate the following functions with respect to $x : \frac{10^x}{\sin x}$

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27. Differentiate the following functions with

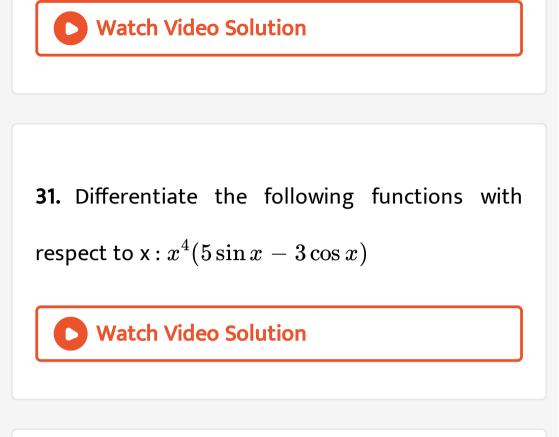
respect to $x : x^2e^x\log x$



28. Differentiate the following functions with respect to x (i) $\frac{2x+3}{x^2-5}$ (ii) $\frac{x+3}{x^2+1}$ **Vatch Video Solution**

29. If
$$y=1+rac{x}{1!}+rac{x^2}{2!}+rac{x^3}{3!}++rac{x^n}{n!},$$
 show that $rac{dy}{dx}-y+rac{x^n}{n!}=0.$

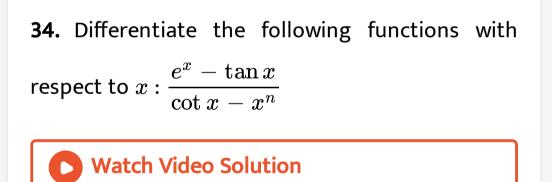
30. If
$$y=1+rac{x}{1!}+rac{x^2}{2!}+rac{x^3}{3!}+,$$
 show that $rac{dy}{dx}=y$.



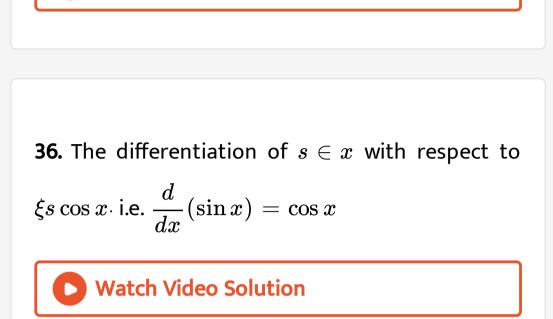
32. Differentiate the following functions with

respect to x : $(x \sin x + \cos x)(e^x + x^x + \log x)$

33. Differentiate the following functions with respect to $x: \frac{e^x + \sin x}{1 + \log x}$ **Vatch Video Solution**



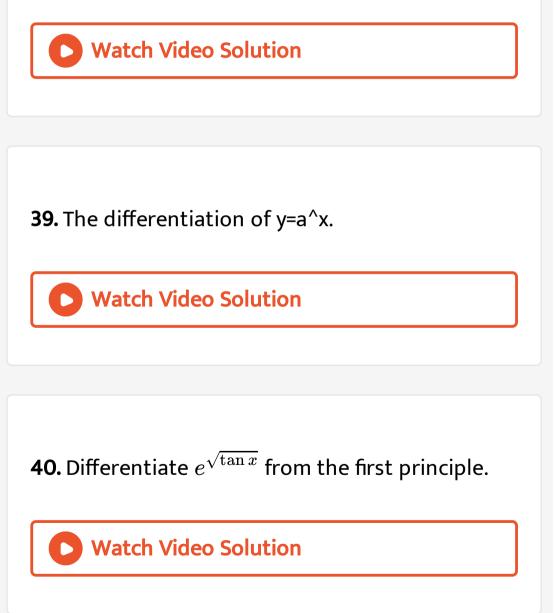
35. The differentiation of $\cos x$ with respect to $x\,'is - \sin x$. i.e. $\frac{d}{dx}(\cos x) = -\sin x$



37. Differentiate $\log \sin x$ from the first principles.



38. Find the derivative of $\sin x3$ from first principles.



41. If $f(x) = x^n where n \in R$, then

differentiation of x^n with respect to $x \sin x^{n-1}$.



42. Find the derivatives of $f(x) = \tan x$

at x = 0

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43. If is a real valued function defined by $f(x) = x^2 + 4x + 3$, then find $f^{\,\prime}(1) and f^{\,\prime}(3)$.



44. If
$$f(x)andg(x)$$
 a re differentiate functions,
then show that $f(x) \pm g(x)$ are also
differentiable such that
 $\frac{d}{dx} \{f(x) \pm g(x)\} = \frac{d}{dx} \{f(x)\} \pm \frac{d}{dx} \{g(x)\}$
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45. If f(x)andg(f) are two differentiable functions and $g(x) \neq 0$, then show trht $\frac{f(x)}{g(x)}$ is

also

differentiable

$$rac{d}{dx}iggl\{rac{f(x)}{g(x)}iggr\}=rac{g(x)rac{d}{x}\{f(x)\}-g(x)rac{d}{x}\{g(x)\}}{\left[g(x)
ight]^2}$$



46. If u, v and w are functions of x, then show that

 $rac{d}{dx}(u\dot{v}\dot{w}) = rac{du}{dx}v\dot{w} + urac{\dot{d}v}{dx}\dot{w} + u\dot{v}rac{dw}{dx}$ in two ways - first by repeated application of product rule, second by logarithmic differentiation.

47. Differentiation of a constant function is zero

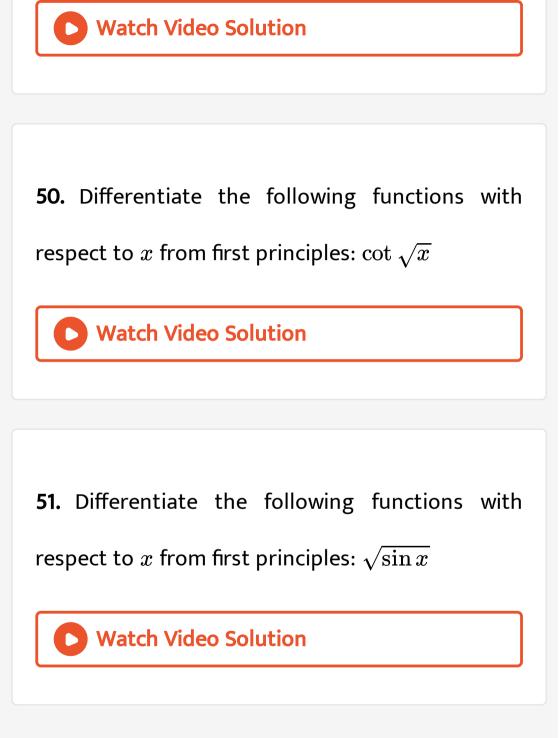
i.e.,
$$rac{d}{dx}(c)=0.$$

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48. If
$$f(x) = mx + candf(0) = f'(0) = 1.$$

What is $f(2)$?

49. Find
$$rac{dy}{dx}, wheny = 3 an x + 5(ext{log})_a x + \sqrt{x} - 3e^x + rac{1}{x}$$

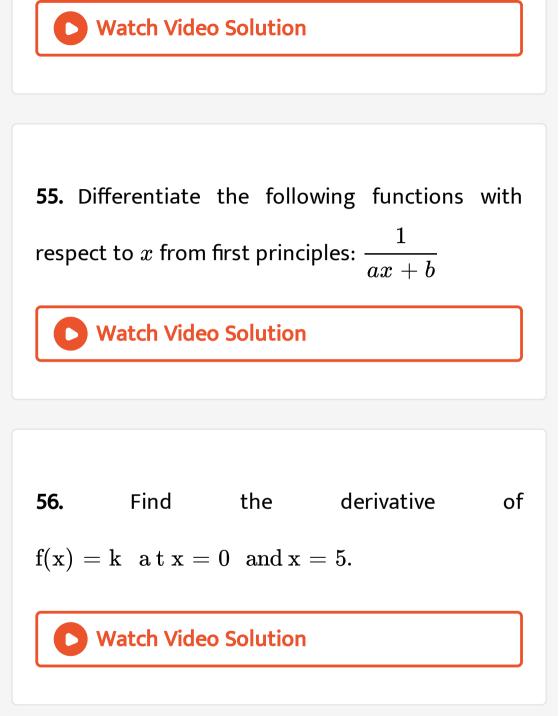


52. Differentiate the following functions with respect to x from first principles: $\sin(\sqrt{x})$ Watch Video Solution

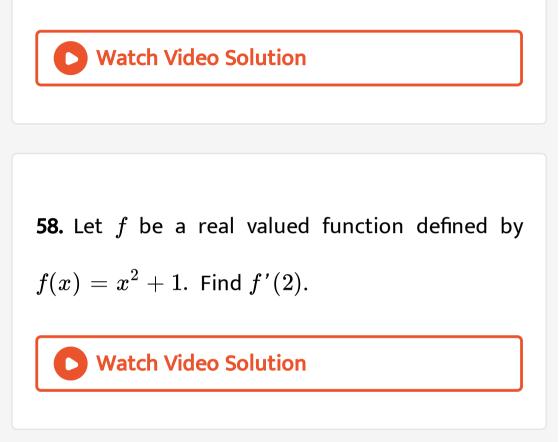
respect to x from first principles: $\sqrt{ax+b}$

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54. Differentiate the following functions with respect to x from first principles: $\frac{1}{x}$

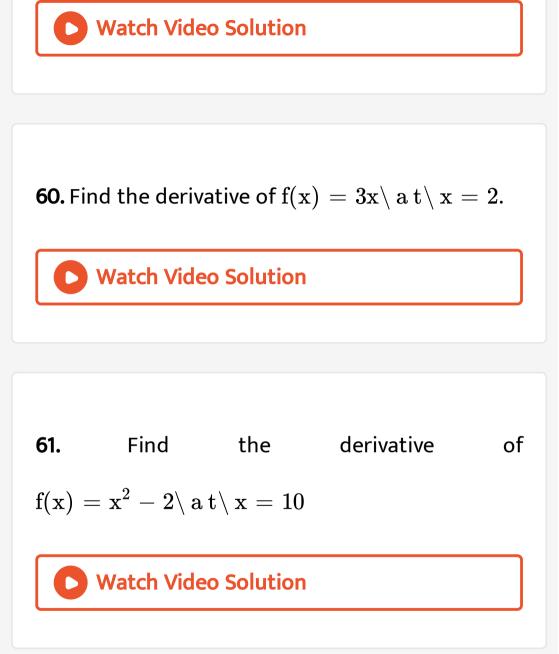


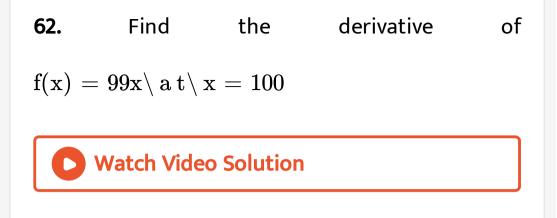
57. Find the derivative of $\sin x \ \ a t \ x = 0.$



59. Find the derivative of $f(x) = 2x^2 + 3x - 5$ at

x=-1. Also, prove that f'(0)+3f'(-1)=0.





63. Find the derivative of f(x) = cos(x)

at x= 0



64. Find the derivative of $f(x) = x \setminus at \setminus x = 1$

65. Find the derivative of the function at the indicated point: $\sin x \ at \ x = \frac{\pi}{2}$

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66. Find the derivative of the following function at

the indicated point: $x \setminus at \setminus x = 1$

67. Find the derivative of the following function at

the indicated point: $2\cos x \setminus at \setminus x =$

$$\setminus \frac{\pi}{2}$$

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68. Find the derivative of the following function at

the indicated point: $\sin 2x \setminus at \setminus x = rac{\pi}{2}$

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69. The distance f(t) in metres ived by a particle travelling in a straight line in t seconds is given by $f(t) = t^2 + 3t + 4$. Find the speed of the particle

at the end of 2 seconds.

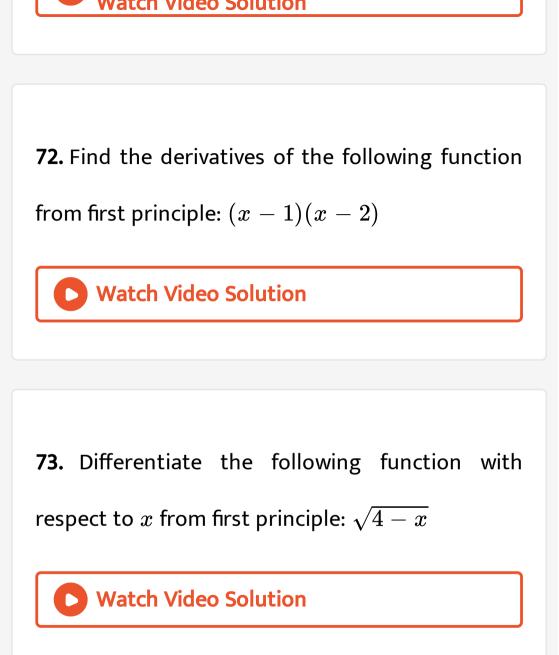
70. Find the slope of the tangent to the curve

$$y = x^2$$
 at $\left(-\frac{1}{2}, \frac{1}{4}\right)$.

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71. Find the derivatives of the following function

from first principle: x^3-27



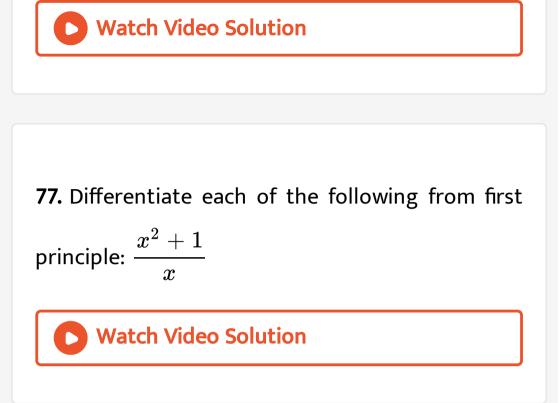
74. Differentiate the following function with respect to x from first principle: $\frac{2x+3}{3x+2}$

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75. Differentiate the following function with respect to x from first principle: $x^{-3/2}$

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76. Differentiate each of the following from first principle: $\frac{2}{x}$



78. Differentiate each of the following from first

principle:
$$rac{x+2}{3x+5}$$

79. Differentiate each of the following from first

principle: $x^2 + x + 3$

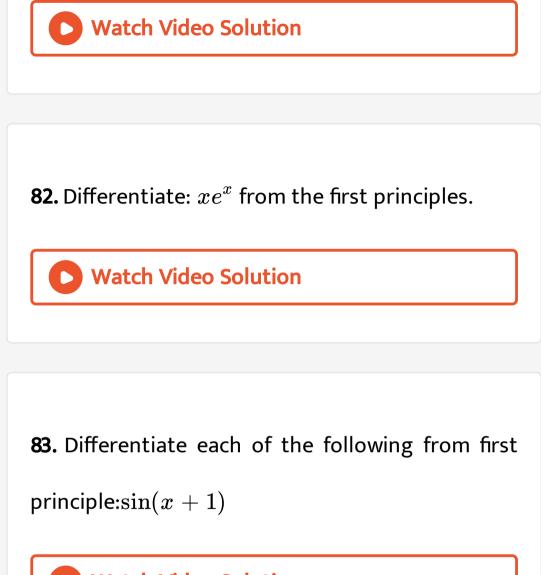
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80. Differentiate each of the following from first principle: $(x^2 + 1)(x - 5)$

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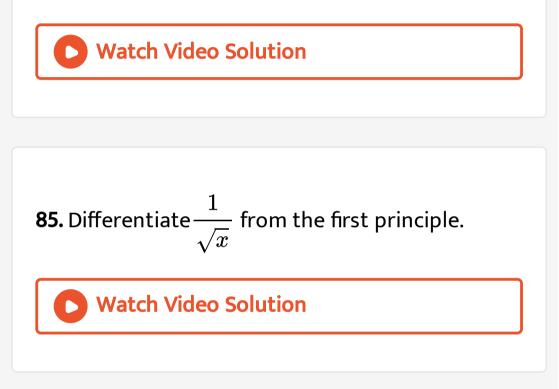
81. Differentiate each of the following from first

principle: e^{-x}



84. Differentiate each of the following from first

principle: $x \cos x$



86. Differentiate each of the following from first

principle:
$$rac{x^2-1}{x}$$



principle: kx^n

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88. Differentiate each of the following from first

principle: $(x + 2)^3$

principle: $\sqrt{2x^2+1}$

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90. Differentiate e^{3x} from the first principle.

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91. Differentiate each of the following from first

principle: -x

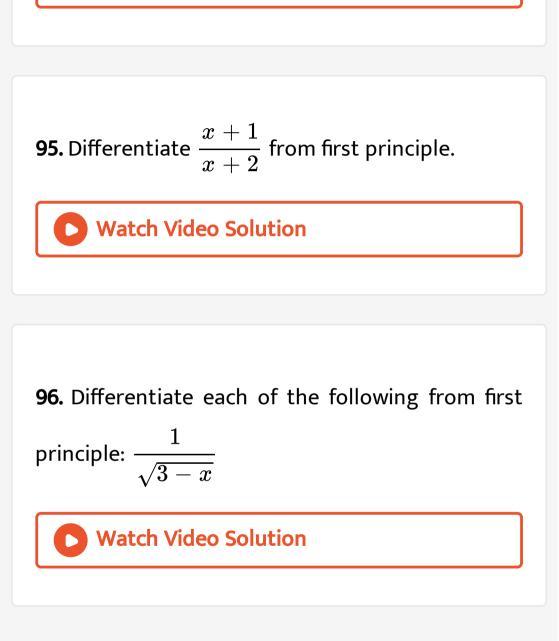
92. Differentiate each of the following from first principle: $\cos\left(x - \frac{\pi}{8}\right)$

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93. Differentiate each of the following from first

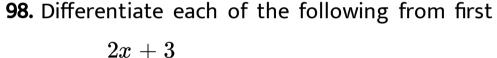
principle:sin(2x - 3)

94. Differentiate
$$\frac{1}{x^3}$$
 from the first principle.



principle: $x^3 + 4x^2 + 3x + 2$

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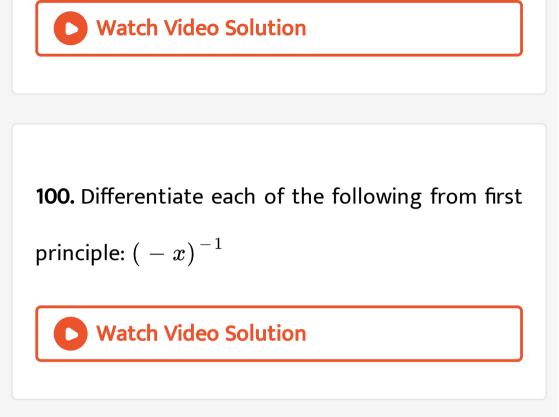


principle:
$$\frac{2x+3}{x-2}$$

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99. Differentiate each of the following from first

principle:
$$e^{ax+b}$$



principle: $x \sin x$



principle: $\sqrt{\sin 2x}$



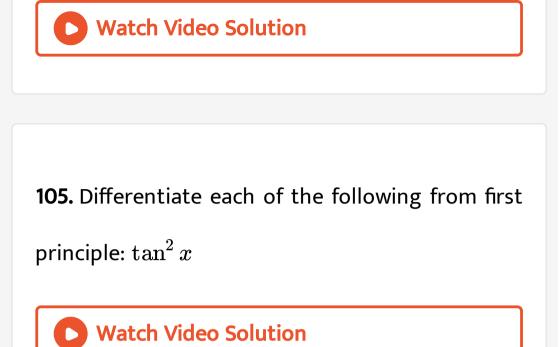
103. Differentiate each of the following from first

principle: $x^2 \sin x$

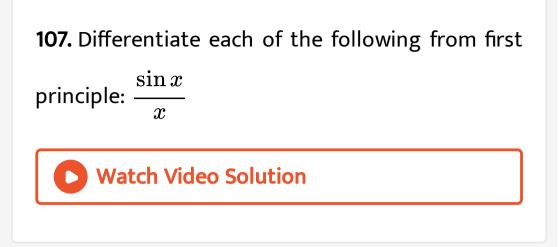
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104. Differentiate each of the following from first

principle: $e^{\sqrt{ax+b}}$



principle: $\sin\sqrt{2x}$

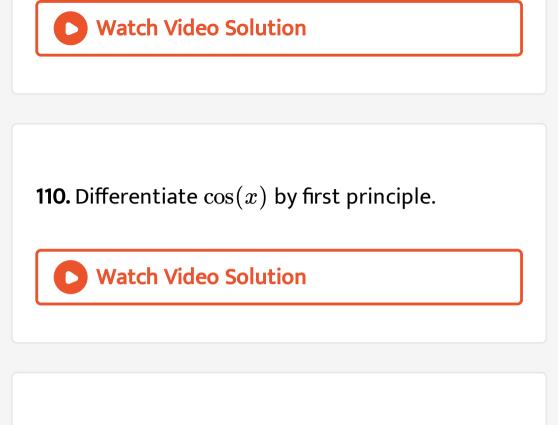


principle: $\sqrt{\sin(3x+1)}$

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109. Differentiate each of the following from first

principle: e^{x^2+1}



111. Differentiate the following from first principle:

 $\tan 2x$



principle: $tan \sqrt{x}$



113. Differentiate logsin(x) by first principle.



114. Differentiate each of the following from first

principle: $\sin x + \cos x$

principle: $e^{\sqrt{2x}}$

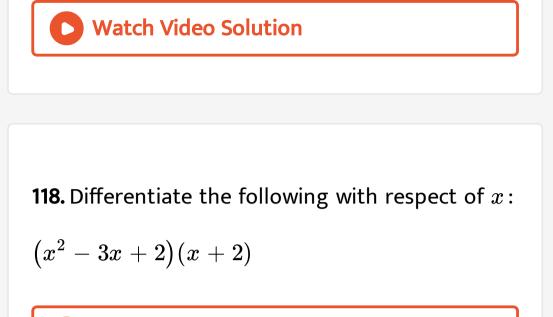
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116. Differentiate the following from first principle:

 $3x^2$.



117. Differentiate $\sqrt{\tan x}$ from first principle.



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119. Differentiate the following with respect of `x :

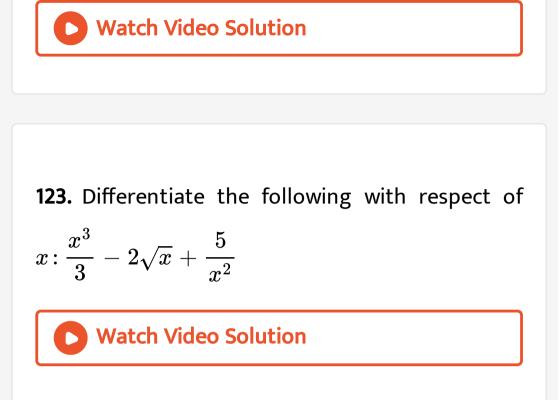
 $(x^2+1/(x^2))$

120. Differentiate the following with respect of $x: \frac{\sin(x+a)}{\cos x}$ **Vatch Video Solution**

121. Differentiate the following with respect of $x : x^4 - 2\sin x + 3\cos x$

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122. Differentiate the following with respect of $x: 3^x + x^3 + 3^3$



 $x : e^{x \log a} + e^{a \log x} + e^{a \log a}$

125. Differentiate the following with respect of $x: (2x^2 + 1)(3x + 2)$ Watch Video Solution

126. Differentiate the following with respect of $x: (\log)_3 x + 3(\log)_e x + 2\tan x$

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127. Differentiate \sqrt{x} +1/ (\sqrt{x})



128. Differentiate the following with respect of
$$x: \frac{(x^3+1)(x-2)}{x^2}$$
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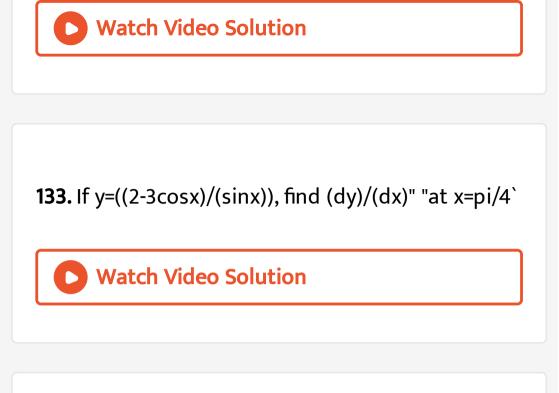
129. Differentiate the following with respect of $x: a_0x^n + a_1x^{n-1} + a_2x^{n-2} + a_{n-1}x + a_n$. Watch Video Solution

130. Differentiate the following with respect of
$$x: \frac{(x+5)(2x^2-1)}{x}$$

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131. Differentiate the following with respect of $x : \cos(x + a)$

132. If
$$y = \left(\sin\left(\frac{x}{2}\right) + \cos\left(\frac{x}{2}\right)\right)^2, \, \frac{dy}{dx}$$
 at $x = \frac{\pi}{6}$



134. Differentiate the following with respect of $x: \frac{2x^2 + 3x + 4}{x}$

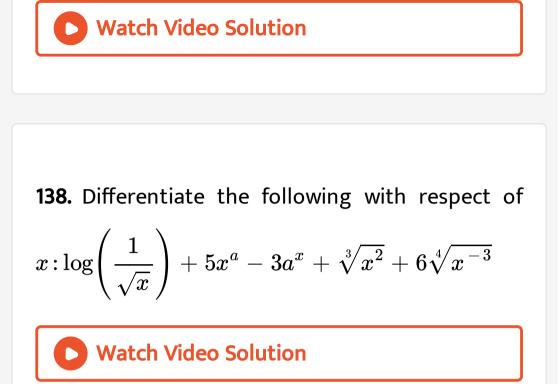
135. Differentiate the following with respect of $x: \frac{a\cos x + b\sin x + c}{\sin x}$ **Over the set of t**

136. Differentiate the following with respect of

 $x : 2 \sec x + 3 \cot x - 4 \tan x$

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137. Differentiate the following with respect of $x: \frac{1}{\sin x} + 2^{x+3} + \frac{4}{\log_x 3}$



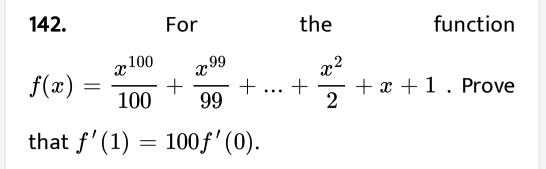
139. Differentiate the following with respect of $x: \frac{\cos(x-2)}{\sin x}$



140. Find the rate of at which the function $f(x) = x^4 - 2x^3 + 3x^2 + x + 5$ changes with respect to x.

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141. If
$$y=rac{2x^9}{3}-rac{5}{7}x^7+6x^3-x$$
, find $rac{dy}{dx}at\ x=1.$





 $x : x \sin x$



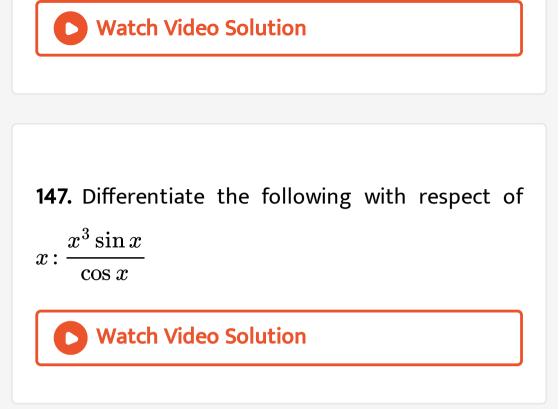
 $x : e^x \sin x + x^n \cos x$



145. Differentiate the following with respect of $x: (x + \sec x)(x - \tan x)$

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146. Differentiate the following with respect of $x : (x^2 + 1) \cos x$



 $x\!:\!e^x(x+\log x)$

 $x : (x + \cos x)(x - \tan x)$



150. Differentiate the following with respect of $x: (ax^2 + \sin x)(p + q\cos x)$

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151. Using mathematical induction prove that : $rac{d}{dx}(x^n)=nx^{n-1}$ for all $n\in\mathbb{N}.$



153. Differentiate the following function with

respect of $x : x^n \tan x$

154. Differentiate the following function with

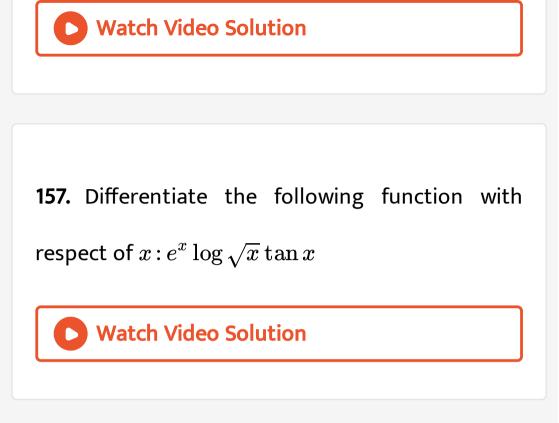
respect of x: $\sin x \cos x$

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155. Differentiate the following function with respect of $x : x^5 e^x + x^6 \log x$

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156. Differentiate the following function with respect of $x: (1 + x^2) \cos x$

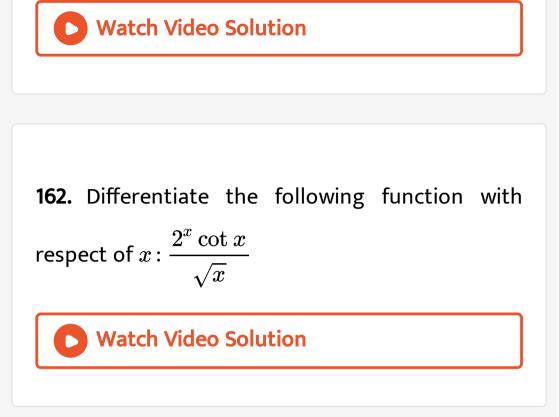


158. Differentiate the following function with respect of $x : x^5 (3 - 6x^{-9})$ **Vatch Video Solution** **159.** Differentiate the following function with respect of $x: f(x) = \frac{ax+b}{cx+d}$ Watch Video Solution

160. Differentiate the following function with respect of $x : x^3 e^x$

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161. Differentiate the following function with respect of $x : x^n \log_a x$



163. Differentiate the following function with

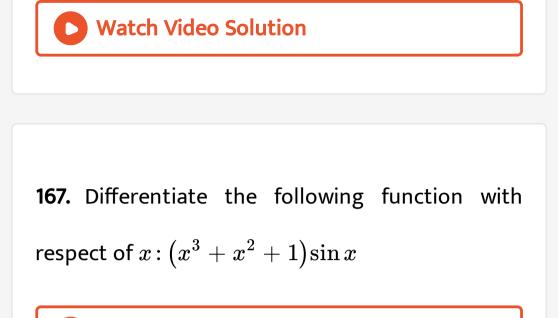
respect of x: $(x \sin x + \cos x)(x \cos x - \sin x)$

164. Differentiate the following function with respect of $x : \sin^2 x$ Watch Video Solution

165. Differentiate the following function with respect of x: $x^3 e^x \cos x$

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166. Differentiate the following function with respect of $x \setminus x^{-4}(3 - 4x^{-5})$



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168. Differentiate the function with respect of x:

 $x^2 \sin x \log x$

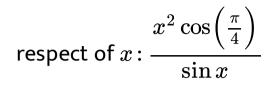
169. Differentiate the function with respect of

 $x\!:\!(1-2\tan x)(5+4\sin x)$

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170. Differentiate the following function with respect of $x : (\log)_{x^2} x$





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172. Differentiate the following function with respect of $x: (2x^2 - 3) \sin x$



173. Differentiate the following function with respect of $x : x^{-3}(5+3x)$ **Vatch Video Solution**

174. Differentiate in two ways, using product rule and otherwise, the function $(1 + 2\tan x)(5 + 4\cos x)$.Verify that the answer

are the same.

175. Differentiate the following functions by the product rule and the other method and verify that answer from both the methods is the same: $\left(3x^2+2\right)^2$



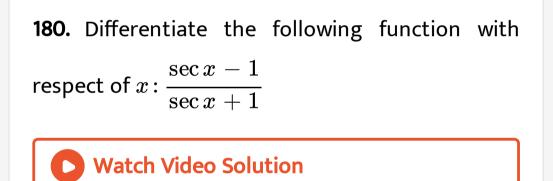
176. Differentiate the following function by the product rule and the other method and verify that answer from both the methods is the same : $(3 \sec x - 4 \cos ecx)(-2 \sin x + 5 \cos x)$



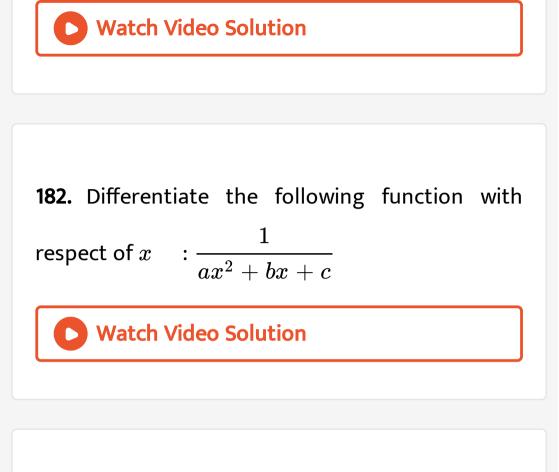
177. Differentiate the following function with respect of $x : \frac{e^x}{1 + \sin x}$ Watch Video Solution

178. Differentiate the following function with respect of $x: \frac{\sin x + \cos x}{\sin x - \cos x}$

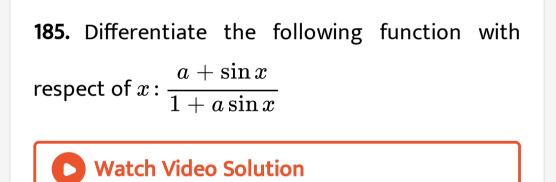
179. Differentiate the following function with respect of $x : \frac{x + \sin x}{x + \cos x}$ **Vatch Video Solution**



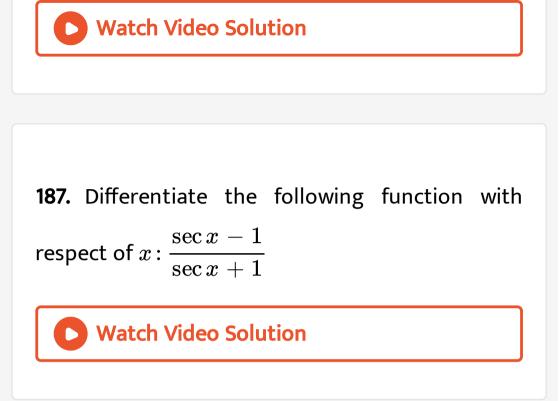
181. Differentiate the following function with respect of $x: \frac{x^2+1}{x+1}$

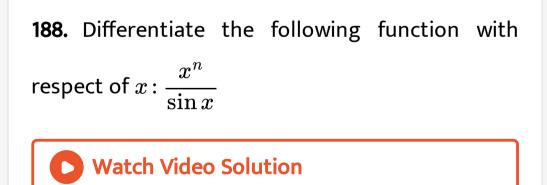


183. Differentiate the following function with respect of $x: \frac{x \tan x}{secx + tanx}$ **Vatch Video Solution** **184.** Differentiate the following function with respect of $x: \frac{\sin x - x \cos x}{x \sin x + \cos x}$ **Vatch Video Solution**

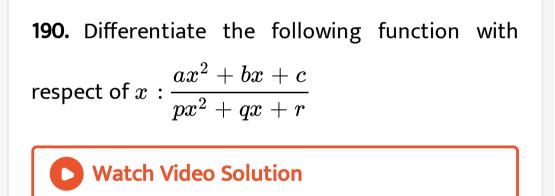


186. Differentiate the function with respect of $x: \frac{x}{1+\tan x}$

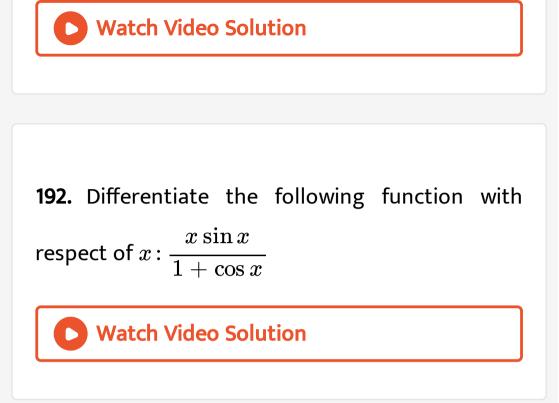




189. Differentiate the following function with respect of
$$x: \frac{2x-1}{x^2+1}$$
 Vatch Video Solution



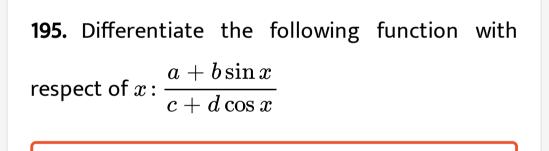
191. Differentiate the following function with respect of $x: \frac{e^x}{1+x^2}$



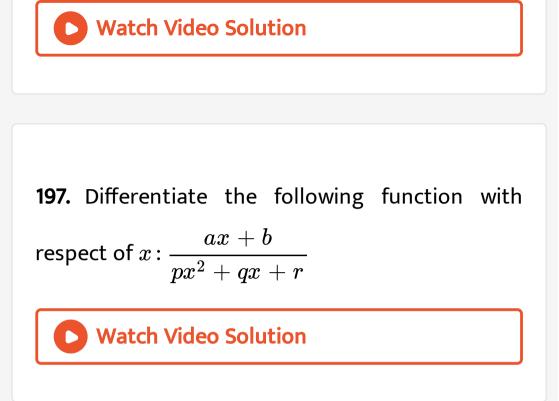
193. Differentiate the following function with respect of
$$x: \frac{x^2 - x + 1}{x^2 + x + 1}$$

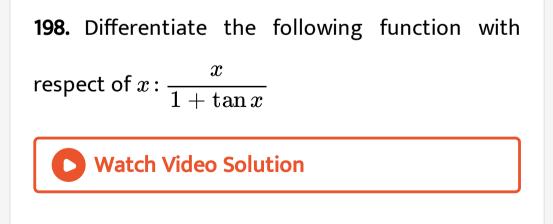
194. Differentiate the following function with respect of
$$x: \frac{1 + \log x}{1 - \log x}$$

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196. Differentiate the function with respect of $x: \frac{x^5 - \cos x}{\sin x}$





199. Differentiate the following function with

respect of x:

 $\frac{2^x \cot x}{\sqrt{x}}$

A.
$$\frac{2^x}{\sqrt{x}}\left(\log 2\cot x - \cos ec^2x - \frac{\cot x}{2x}\right)$$

Β.

$$rac{2^x(x+1)}{\sqrt{x}}igg(\log 2\cot x - \cos ec^2x - rac{\cot x}{2x}igg)$$
C. $rac{2^x}{\sqrt{x}}igg(\log 2\cot x - \cos ec^2x - rac{\cot x}{x^2}igg)$

D. None of these

Answer: A

200. Differentiate the following function with respect of $x: \frac{\sqrt{a} + \sqrt{x}}{\sqrt{a} - \sqrt{x}}$

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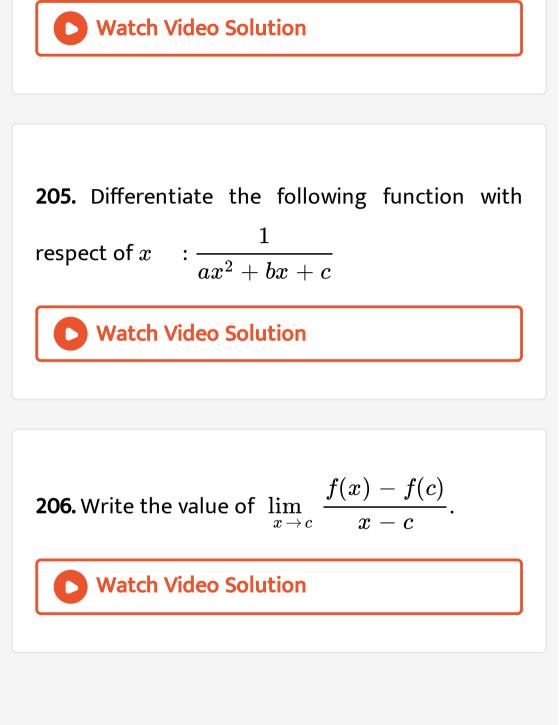
201. Differentiate the following function with respect of $x: \frac{1+3^x}{1-3^x}$

202. Differentiate the following function with respect of $x: \frac{4x + 5\sin x}{3x + 7\cos x}$ **Vatch Video Solution**

203. Differentiate the following function with respect of
$$x: \frac{px^2 + qx + r}{ax + b}$$

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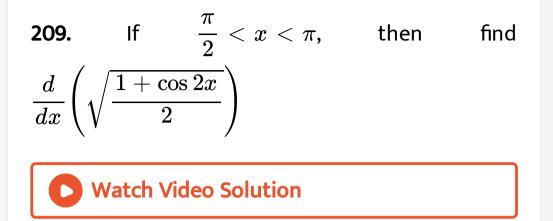
204. Differentiate the following function with respect of $x: \frac{x + \cos x}{\tan x}$



207. It is given that f (a) exists, then

$$\lim_{x \to a} \frac{xf(a) - af(x)}{x - a}$$
is equal to:
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208. If
$$x < 2$$
, then write the value of $\frac{d}{dx} \left(\sqrt{x^2 - 4x + 4} \right)$. Watch Video Solution



210. Write the value of
$$\frac{d}{dx}(x |x|)$$
.

211. Write the value of
$$\displaystyle rac{d}{dx} \{(x+|x|)|x|\}$$
 .

212. If f(x) = |x| + |x - 1| , write the value of $\displaystyle rac{d}{dx}(f(x)).$

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213. Write the value of the derivative of f(x) = |x-1| + |x-3| at x = 2.

214. If
$$f(x)=rac{x^2}{|x|}$$
 , write $rac{d}{dx}(f(x))$



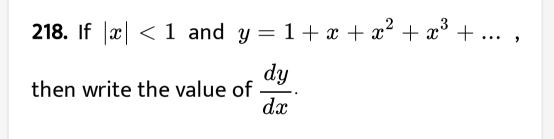
215. Write the value of
$$\frac{d}{dx}(\log |x|)$$
.

216. If
$$f(1)=1,$$
 $f'(1)=2,$ then write the value of $\lim_{x
ightarrow 1}rac{\sqrt{f(x)}-1}{\sqrt{x}-1}$

217. Write the derivative of f(x) = 3 |2 + x| at

x = -3.





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219. Let $f: \mathbb{R} \to \mathbb{R}$ be a function defined by $f(x) = \frac{x^2 - 8}{x^2 + 2}$ Then f is

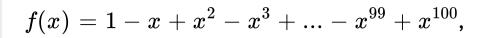


220. If
$$f(x)=rac{x-4}{2\sqrt{x}}$$
, then $f'(1)$ is a. $rac{5}{4}$ b. $rac{4}{5}$ c. 1

d. 0

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221. If
$$y=1+rac{x}{1!}+rac{x^2}{2!}+rac{x^3}{3!}+...$$
 , then $rac{dy}{dx}= ext{ a. }y+1 ext{ b. }y-1 ext{ c. }y ext{ d. }y^2$



then f'(1) equals a. 150 b. -50 c. -150 d. 50

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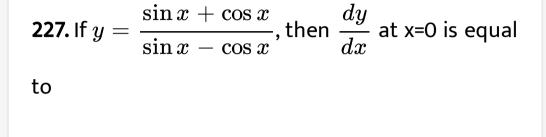
223. If
$$y = \frac{1 + \frac{1}{x^2}}{1 - \frac{1}{x^2}}$$
, then $\frac{dy}{dx}$ = a. $-\frac{4x}{(x^2 - 1)^2}$ b. $-\frac{4x}{x^2 - 1}$ c. $\frac{1 - x^2}{4x}$ d. $\frac{4x}{x^2 - 1}$

224. If
$$y=\sqrt{x}+rac{1}{\sqrt{x}}$$
, then $rac{dy}{dx}$ at $x=1$ is a. 1 b. $rac{1}{2}$ c. $rac{1}{\sqrt{2}}$ d. 0

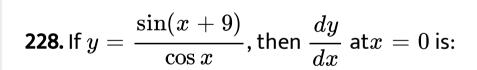
225. If
$$f(x) = x^{100} + x^{99} + ... + x + 1$$
, then

f'(1) is equal to a. 5050 b. 5049 c. 5051 d. 50051

226. If
$$f(x) = 1 + x + rac{x^2}{2} + ... + rac{x^{100}}{100},$$
 then $f'(1)$ is equal to a. $rac{1}{100}$ b. 100 c. 50 d. 0



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A. $\cos 9$

 $B.\sin 9$

C. 0

D. 1

Answer: A

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229. If
$$f(x)=rac{x^n-a^n}{x-a}$$
, then $f'(a)$ is a. 1 b. $rac{1}{2}$ c.

0 d. does not exist

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230. If $f(x) = x \sin x$, then $f'\left(\frac{\pi}{2}\right)$ is a. $\frac{1}{2}$ b. 1 c. 0 d. -1

