Derivative (1st order)

1) If $y = \sin x°$ then find $\dfrac{dy}{dx}$

2) Find the value of $\dfrac{d}{dx}(x^x)$

3) Find the value of $\dfrac{d}{dx}5^{f(x)}$

4) If $f(x)$ is an even function and $f'(0)$ exists, then find the value of $f'(0)$

5) If $y = \sqrt{2x} - \sqrt{\dfrac{2}{x}} + \dfrac{x+4}{4-x}$, then find $\left(\dfrac{dy}{dx}\right)_{x=2}$

6) If $y = \sqrt{\sin \sqrt{x}}$ then find $\dfrac{dy}{dx}$

7) Find the value of $\dfrac{d}{dx}\{\cos(\log x)\}$

8) If $u = e^{ax}\sin bx$ and $v = e^{ax}\cos bx$, then show that $\left(\dfrac{du}{dx}\right)^2 + \left(\dfrac{dv}{dx}\right)^2 = (a^2 + b^2)e^{2ax}$

9) If $x = \sqrt{t} + \dfrac{1}{\sqrt{t}}$, then find the value of $2t\dfrac{dx}{dt} + x$

10) If $\sqrt{x} + \sqrt{y} = 4$ then find the value of $\dfrac{dy}{dx}$ at $x = 1$

11) If $x^{\frac{3}{2}} + y^{\frac{3}{2}} = a^{\frac{3}{2}}$, then show that $\dfrac{dy}{dx} + \sqrt{\dfrac{x}{y}} = 0$

12) If $y = e^{\sin^{-1}x}$ and $z = e^{-\cos^{-1}x}$ then find the value of $\dfrac{dy}{dz}$

13) If $x = \sqrt{a^{\sin^{-1}t}}$, $y = \sqrt{a^{\cos^{-1}t}}$ then show that $\dfrac{dy}{dx} = -\dfrac{y}{x}$

14) If $f(x) = (x+1)^x + x^{x+1}$, then find the value of $f'(1)$

15) If $y = (\log x)^x + x^{\log x}$, then find $\dfrac{dy}{dx}$

16) If $f(x) = (\sin x)^x + x^x$ then find $f'(x)$

17) If $y = \dfrac{3x-2}{2x+1}$ where $\left(x \neq \dfrac{1}{2} \right)$, then justify the statement $\dfrac{dy}{dx} = 1 \div \left(\dfrac{dx}{dy} \right)$

18) If $f(x) = |1 - 2x|$ then find the value of $f'(2)$

19) If $f(x) = x|x|$, then show that $f'(x) = 2|x|$

20) If $f(x) = |x|^3$, then find $f'(0)$

21) If $y = x^{e^x}$ then find $\dfrac{dy}{dx}$

22) If $x^y = e^{x-y}$, then show that $\dfrac{dy}{dx} = \dfrac{\log x}{(\log ex)^2}$

23) If $y^x = e^{y-x}$ then show that $\dfrac{dy}{dx} = \dfrac{(\log ey)^2}{\log y}$

24) If $y = \log_{10} x$, then find the value of $\dfrac{dy}{dx}$

25) Find the value of $\dfrac{d}{dx}\{\log_7(\log_7 x)\}$

26) If $f(x) = \log_e x$, then find the derivative of $f(\log_e x)$ with respect to x

27) If $y = 10^{10^x}$ then find the value of $\dfrac{dy}{dx}$

28) If $y = \log|x|$ then find the value of $\dfrac{dy}{dx}$

29) If $f(x) = \log \sin\left(\sqrt{x^2 + 1} \right)$, then find $f'(x)$.

30) If $f(x) = \log\left(\tan \dfrac{x}{2} \right)$ then find $f'(x)$

31) If $f(x) = \log\left(\cot \dfrac{x}{2} \right)$ then find $f'(x)$

32) If $f(x) = \log_e \tan\left(\dfrac{\pi}{4} + \dfrac{x}{2} \right)$, then show that $f'(x) = \sec x$

33) If $f(x) = \log_e\left(\dfrac{1-x}{1+x}\right)$, then find the value of $f'(0)$

34) If $y = \log_5 \sqrt{\dfrac{1-\cos 2x}{1+\cos 2x}}$, then find the value of $\dfrac{dy}{dx}$

35) If $y = \log\sqrt{\tan x}$ then find the value of $\dfrac{dy}{dx}$ at $x = \dfrac{\pi}{4}$

36) If $\log\dfrac{x^2-y^2}{x^2+y^2} = a$ (where a constant) then find the value of $\dfrac{dy}{dx}$

37) If $y\sqrt{x^2+1} = \log\left(\sqrt{x^2+1}-x\right)$, then show that $\left(x^2+1\right)\dfrac{dy}{dx} + xy + 1 = 0$

38) If $y = \dfrac{1+x^2+x^4}{1+x+x^2}$ and $\dfrac{dy}{dx} = ax+b$, then find the value of a, b

39) If $y = \dfrac{1}{1+x^{q-p}+x^{r-p}} + \dfrac{1}{1+x^{p-q}+x^{r-q}} + \dfrac{1}{1+x^{p-r}+x^{q-r}}$ then show that $\dfrac{dy}{dx} = 0$

40) If $y = \left(x+\sqrt{x^2+a^2}\right)^n$, then show that $\dfrac{dy}{dx} = \dfrac{ny}{\sqrt{x^2+a^2}}$

41) If $10^x + 10^y = 10^{x+y}$, then find the value of $10^x\dfrac{dy}{dx} + 10^y$

42) If $x^2 y^3 = (x+y)^5$ then find the value of $\dfrac{dy}{dx}$

43) If $x^m y^n = (x+y)^{m+n}$, then prove that $\dfrac{dy}{dx} = \dfrac{y}{x}$

44) If $x^2 + y^2 = t - \dfrac{1}{t}$ and $x^4 + y^4 = t^2 + \dfrac{1}{t^2}$, then show that $x^3 y\dfrac{dy}{dx} = 1$

45) If $x^2 + y^2 = t + \dfrac{1}{t}$ and $x^4 + y^4 = t^2 + \dfrac{1}{t^2}$, then show that $\dfrac{dy}{dx} = -\dfrac{y}{x} = -\dfrac{1}{x^3 y}$

46) If $x^y = y^x$ then find the value of $\dfrac{dy}{dx}$

47) If $x^y \cdot y^x = 1$ then find the value of $\dfrac{dy}{dx}$

48) If $x^y \cdot y^x = e^{xy} - 3x$, then find the value of $\dfrac{dy}{dx}$

49) If $x^y + y^x = 2$, then show that $\dfrac{dy}{dx} = -\left[\dfrac{yx^{y-1} + y^x \log y}{x^y \log x + xy^{x-1}} \right]$

50) If $y = 5^x \cdot x^5$, then show that $x \dfrac{dy}{dx} = (5 + x \log_e 5)y$

51) If $y \cdot e^y = x$ then show that $\dfrac{dy}{dx} = \dfrac{y}{x(1+y)}$

52) If $y = e^{\frac{y}{x}}$, then show that $\dfrac{dy}{dx} = \dfrac{y^2}{x(y-x)}$

53) If $f(x) = \sin(\log x)$ and $y = f\left(\dfrac{2x+3}{3-2x} \right)$, then find $\dfrac{dy}{dx}$.

54) Find the derivative of $\dfrac{5x}{\sqrt[3]{1-x^2}} + sin^2(2x+3)$ w.r.t. x

55) Find the derivative w.r.t. x of following, $y = \log_{\sin x} \sec x + 10^{x^2}$

56) If $y = \log_{\sin x} \sec x + 10^{x^2}$, then find $\dfrac{dy}{dx}$

57) If $\sin y + e^{-x \cos y} = e$ then the value of $\dfrac{dy}{dx}$ at $(1, \pi)$

58) If $y = x^{n-1} \log x$, then find the value of $x \dfrac{dy}{dx} + (1-n)y$

59) If $y = \dfrac{x}{\sqrt{1+x^2}}$, then prove that $x^3 \dfrac{dy}{dx} = y^3$

60) If $y = \sqrt{1 + \sqrt{1 + x^4}}$, then prove that $y(y^2 - 1)\dfrac{dy}{dx} = x^3$

61) If $x = t \log t$ and $y = \dfrac{\log t}{t}$ then find the value of $\left(\dfrac{dy}{dx} \right)_{t=1}$

62) If $x = t \cos t$ and $y = \dfrac{\log t}{t}$ then find the value of $\left(\dfrac{dy}{dx} \right)_{t=1}$

63) If $x = a \cos^3 \theta$, $y = a \sin^3 \theta$ then find $\dfrac{dy}{dx}$

64) If $x = a\sec^2\theta$ and $y = a\tan^3\theta$ then find the value of $\dfrac{dy}{dx}$ at $\theta = \dfrac{\pi}{4}$

65) If $x = a(\theta + \sin\theta)$, $y = a(1 + \cos\theta)$ then show that $\left(\dfrac{dy}{dx}\right)_{\theta=\frac{\pi}{2}} = -1$

66) If $y = 2\cos 2t(1 - \cos 2t)$ and $x = 3\sin 2t(1 + \cos 2t)$, then find the value of $\dfrac{dy}{dx}$

67) If $\tan y = \dfrac{2t}{1 - t^2}$, $\sin x = \dfrac{2t}{1 + t^2}$ then find the value of $\dfrac{dy}{dx}$

68) If $xy = a\left(y + \sqrt{y^2 - x^2}\right)$ then show that $x^3\dfrac{dy}{dx} = y^2\left(y + \sqrt{y^2 - x^2}\right)$

69) If $\tan y = \dfrac{\tan x + \sec x - 1}{\tan x - \sec x + 1}$ then show that $\dfrac{dy}{dx} = -1$

70) If $y = \dfrac{1 + \sin x - \cos x}{1 + \sin x + \cos x}$ then show that $\dfrac{dy}{dx} = \dfrac{1}{1 + \cos x}$

71) If $y = \dfrac{x\sin x + \cos x}{x\cos x - \sin x}$, then show that $\dfrac{dy}{dx} = \dfrac{x^2}{(x\cos x - \sin x)^2}$

72) If $f(x) = \dfrac{\cos^2 x}{1 + \sin^2 x}$, then prove that $f\left(\dfrac{\pi}{4}\right) - 3f'\left(\dfrac{\pi}{4}\right) = 3$

73) If $f(x) = \left(\dfrac{1 + x}{2 + x}\right)^{3 + 2x}$ then find $f'(0)$

74) If $f(x) = \left(\dfrac{a + x}{b + x}\right)^{a + b + 2x}$ then prove that $f'(0) = \left[2\log\left(\dfrac{a}{b}\right) + \dfrac{b^2 - a^2}{ab}\right]\left(\dfrac{a}{b}\right)^{a + b}$

75) If $x = y\log(xy)$ then prove that $\dfrac{dy}{dx} = \dfrac{y(x - y)}{x(x + y)}$

76) If $y = \sqrt{x + \sqrt{x + \sqrt{x + \cdots \infty}}}$, then find the value of $\dfrac{dy}{dx}$

77) If $y = x + \dfrac{1}{x + \dfrac{1}{x + \dfrac{1}{x + \cdots \ \infty}}}$, prove that $\dfrac{dy}{dx} = \dfrac{y}{2y - x}$

78) If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \cdots \infty}}}$ then show that $\dfrac{dy}{dx} = \dfrac{\cos x}{2y - 1}$

79) If $x = e^{y + e^{y + e^{y + \cdots}} \; \infty}$ where $x > 0$ then find $\dfrac{dy}{dx}$

80) If $|x| < 1$ and $y = 1 + x + x^2 + \cdots \infty$ then prove that $y^2 \left(\dfrac{dy}{dx} - y \right) = x$

81) If $x\sqrt{1 + y} + y\sqrt{1 + x} = 0$ then prove that $\dfrac{dy}{dx} = -\dfrac{1}{(1 + x)^2}$

82) If $\sqrt{1 - x^2} + \sqrt{1 - y^2} = a(x - y)$, then show that $\dfrac{dy}{dx} = \dfrac{\sqrt{1 - y^2}}{\sqrt{1 - x^2}}$

83) If $\sqrt{1 + x^2} + \sqrt{1 + y^2} = k(x - y)$ where k constant, then show that $\dfrac{dy}{dx} = \sqrt{\dfrac{1 + y^2}{1 + x^2}}$

84) If $y\sqrt{1 - x^2} + x\sqrt{1 - y^2} = 1$, then show that $\dfrac{dy}{dx} = -\sqrt{\dfrac{1 - y^2}{1 - x^2}}$

85) If $\sqrt{1 - x^4} + \sqrt{1 - y^4} = k\left(x^2 - y^2\right)$ where k constant, then show that $\dfrac{dy}{dx} = \dfrac{x\sqrt{1 - y^4}}{y\sqrt{1 - x^4}}$

86) If $\sqrt{1 - x^6} + \sqrt{1 - y^6} = a^3\left(x^3 - y^3\right)$ where a is constant, then show that

$\dfrac{dy}{dx} = \dfrac{x^2}{y^2}\sqrt{\dfrac{1 - y^6}{1 - x^6}}$

87) If $xy = \sin(x + y)$ then show that $\dfrac{dy}{dx} = \dfrac{\sqrt{1 - x^2 y^2} - y}{x - \sqrt{1 - x^2 y^2}}$

88) If $xy = \tan(x + y)$ then find $\dfrac{dy}{dx}$

89) If $xy = \cot(x + y)$ then show that $\dfrac{dy}{dx} = \dfrac{1 + y + x^2 y^2}{1 + x + x^2 y^2}$

90) If $\cos y = x\cos(a + y)$, then prove that $\dfrac{dy}{dx} = \dfrac{\cos^2(a + y)}{\sin a}$ where $a \neq 0$ is a constant

91) If $\sin y = x\sin(a + y)$, then show that $\dfrac{dy}{dx} = \dfrac{\sin^2(a + y)}{\sin a} = \dfrac{\sin a}{1 - 2x\cos a + x^2}$ where $a \neq n\pi$, n is an integer.

92) If $f(x) = \left(\dfrac{a+x}{b+x}\right)^x + (\sin x)^{\tan x}$ then find the value of $f'(0)$

93) If $y = (\tan x)^{\sin x}$ then find the value of $\dfrac{dy}{dx}$ at $x = \dfrac{\pi}{4}$

94) If $y = x^{\cos x} + (\cos x)^{\sin x}$ then find the value of $\dfrac{dy}{dx}$

95) If $y = (\sin x)^{\cos x} + (\cos x)^{\sin x}$ then find the value of $\dfrac{dy}{dx}$

96) If $y = (\tan x)^{\cot x} + (\cot x)^{\tan x}$ then find the value of $\dfrac{dy}{dx}$

97) If $y = \left\{(\tan x)^{\tan x}\right\}^{\tan x}$, then find the value of $\dfrac{dy}{dx}$ at $x = \dfrac{\pi}{4}$

98) If $(\sin x)^y = x + y$ then prove that $\dfrac{dy}{dx} = \dfrac{1 - (x+y)y \cot x}{(x+y)\ln(\sin x) - 1}$

99) If $x = \sec\theta - \cos\theta$ and $y = \sec^n\theta - \cos^n\theta$, then show that $\left(x^2 + 4\right)\left(\dfrac{dy}{dx}\right)^2 = n^2\left(y^2 + 4\right)$

100) If $x = \csc\theta - \sin\theta$, $y = \csc^n\theta - \sin^n\theta$, then show that $\left(x^2 + 4\right)\left(\dfrac{dy}{dx}\right)^2 = n^2\left(y^2 + 4\right)$

101) If $y = 1 + \dfrac{a}{x-a} + \dfrac{bx}{(x-a)(x-b)} + \dfrac{cx^2}{(x-a)(x-b)(x-c)}$ then show that
$\dfrac{dy}{dx} = \dfrac{y}{x}\left[\dfrac{a}{a-x} + \dfrac{b}{b-x} + \dfrac{c}{c-x}\right]$ where $x \neq a, b, c$

102) If $f(x) = (1+x)\left(1+x^2\right)\left(1+x^4\right)\left(1+x^8\right)$ then find the value of $f'(1)$

103) If $y = (1+x)\left(1+x^2\right)\left(1+x^4\right)\cdots\left(1+x^{2n}\right)$, then find the value of $\dfrac{dy}{dx}$ at $x = 0$

104) If $\log\left(x^2 + y^2\right) = 2\tan^{-1}\left(\dfrac{y}{x}\right)$, then show that $\dfrac{dy}{dx} = \dfrac{x+y}{x-y}$

105) If $y = \sin^{-1}\left(\dfrac{5x + 12\sqrt{1-x^2}}{13}\right)$, then find $\dfrac{dy}{dx}$

106) Find $\dfrac{dy}{dx}$ where $y = \cos^{-1}\left(\dfrac{x - \frac{1}{x}}{x + \frac{1}{x}}\right)$

107) Find $\dfrac{dy}{dx}$ where $y = \cos^{-1}\left(\dfrac{2\cos x - 3\sin x}{\sqrt{13}}\right)$

108) If $y = 2\sin^{-1}\dfrac{x - 2}{\sqrt{6}} - \sqrt{2 + 4x - x^2}$, then show that the value of $\dfrac{dy}{dx}$ at $x = 2$ is $\dfrac{2}{\sqrt{6}}$

109) Find $\dfrac{dy}{dx}$ where $y = \cos^{-1} 2x + 2\cos^{-1}\sqrt{1 - 4x^2}$

110) If $y = \tan^{-1}\left(\dfrac{\cos x}{1 + \sin x}\right)$, then find $\dfrac{dy}{dx}$

111) If $y = \tan^{-1}\dfrac{\cos x + \sin x}{\cos x - \sin x}$ then find the value of $\dfrac{dy}{dx}$

112) If $y = \tan^{-1}\dfrac{a\cos x - b\sin x}{b\cos x + a\sin x}$ where $-\dfrac{\pi}{2} < x < \dfrac{\pi}{2}$ and $\dfrac{a}{b}\tan x > -1$, then show that $\dfrac{dy}{dx} = -1$

113) If $y = \cot^{-1}\sqrt{\dfrac{1 - \sin x}{1 + \sin x}}$ where $\left(0 < x < \dfrac{\pi}{2}\right)$, then find $\dfrac{dy}{dx}$

114) If $\sin^{-1}\left(\dfrac{x^2 - y^2}{x^2 + y^2}\right) = k$ (where k is constant), then show that $\dfrac{dy}{dx} = \dfrac{y}{x}$

115) If $y = \sin^{-1}\dfrac{a + b\cos x}{b + a\cos x}$, then prove that $\dfrac{dy}{dx} = -\dfrac{\sqrt{b^2 - a^2}}{b + a\cos x}$

116) If $y = \cos^{-1}\left(8x^4 - 8x^2 + 1\right)$ then show that $\dfrac{dy}{dx} + \dfrac{4}{\sqrt{1 - x^2}} = 0$

117) If $x = \cos^{-1}\left(8t^4 - 8t^2 + 1\right)$ and $y = \sin^{-1}\left(3t - 4t^3\right)$ where $\left(0 < t < \dfrac{1}{2}\right)$ then find $\dfrac{dy}{dx}$

118) Find $\dfrac{dy}{dx}$ where $y = \tan^{-1}\left(\sqrt{1 + x^2} + x\right)$

119) If $y = 2\tan^{-1}\sqrt{\dfrac{x-a}{b-x}}$ where $a < x < b$, then show that
$\left(\dfrac{dy}{dx}\right)^2 + \dfrac{1}{(x-a)(x-b)} = 0$

120) If $y = \tan^{-1}\dfrac{5-x}{1+5x}$, then find the value of $\dfrac{dy}{dx}$

121) If $y = \tan^{-1}\dfrac{1}{1+x+x^2} + \tan^{-1}\dfrac{1}{3+3x+x^2} + \cot^{-1}\left(7+5x+x^2\right)$ then show that
$\left(\dfrac{dy}{dx}\right)_{x=0} = -\dfrac{9}{16}$

122) If $y = \tan^{-1}\dfrac{1}{1+x+x^2} + \tan^{-1}\dfrac{1}{x^2+3x+3} + \tan^{-1}\dfrac{1}{x^2+5x+7} + \cdots$ upto n
terms, then find the value of $\dfrac{dy}{dx}$

123) If $y = \tan^{-1}\dfrac{3x}{1+4x^2} + \tan^{-1}\dfrac{2+5x}{5-2x}$, then show that $\dfrac{dy}{dx} = \dfrac{4}{1+16x^2}$

124) If $y = \tan^{-1}\dfrac{4x}{1+5x^2} + \tan^{-1}\dfrac{2+3x}{3-2x}$ then show that $\dfrac{dy}{dx} = \dfrac{5}{1+25x^2}$

125) If $y = \sin\left(\cos^{-1}x\right) + \dfrac{1}{2}\sin^{-1}\dfrac{2x}{1+x^2}$, then show that $\dfrac{dy}{dx} + \dfrac{1}{\sqrt{1-x^2}} = \dfrac{1}{1+x^2}$

126) If $y = \tan^{-1}\left[\dfrac{\sqrt{1+t^2}+\sqrt{1-t^2}}{\sqrt{1+t^2}-\sqrt{1-t^2}}\right]$ then find the value of $\dfrac{dy}{dt}$

127) If $y = \tan^{-1}\left[\dfrac{\sqrt{1+x^2}-\sqrt{1-x^2}}{\sqrt{1+x^2}+\sqrt{1-x^2}}\right]$ then show that $\dfrac{dy}{dx} = \dfrac{x}{\sqrt{1-x^4}}$

128) If $y = \cot^{-1}\left[\dfrac{\sqrt{1+x^2}-\sqrt{1-x^2}}{\sqrt{1+x^2}+\sqrt{1-x^2}}\right]$ then find the value of $\dfrac{dy}{dx}$

129) If $y = \cot^{-1}\left[\dfrac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right]$, then show that value of $\dfrac{dy}{dx}$ at $x = \dfrac{1}{2}$ is $-\dfrac{1}{\sqrt{3}}$.

130) if $y = \tan^{-1}\left(\dfrac{\sqrt{1+\sin x}-\sqrt{1-\sin x}}{\sqrt{1+\sin x}+\sqrt{1-\sin x}}\right)$ where $0 < x < \dfrac{\pi}{2}$, then find the value of $\dfrac{dy}{dx}$

131) if $y = \cot^{-1}\left(\dfrac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right)$ then show that $\dfrac{dy}{dx} = \pm\dfrac{1}{2}$

132) If $y = \dfrac{2}{\sqrt{a^2-b^2}}\tan^{-1}\left[\sqrt{\dfrac{a-b}{a+b}}\tan\dfrac{x}{2}\right]$ then show that $\dfrac{dy}{dx} = \dfrac{1}{a+b\cos x}$

133) If $\cos^{-1} y = 2\tan^{-1}\sqrt{\dfrac{1+x}{1-x}}$, then show that $\dfrac{dy}{dx} = -1$

134) Find the derivative of $x^{\sin^{-1} x}$ w.r.t. $\sin^{-1} x$

135) Find the derivative of $\log_{10} x$ with respect to $\tan^{-1} x$

136) Find the derivative of x^2 with respect to $\log x$

137) Find $\dfrac{dy}{dx}$ where $x = \csc^{-1}\left(\dfrac{1+t^2}{2t}\right)$, $y = \tan^{-1}\left(\dfrac{3t-t^3}{1-3t^2}\right)$ where csc is abbreviation of cosec

138) Find $\dfrac{dy}{dx}$, where $x = \sec^{-1}\left(\dfrac{1+t^2}{1-t^2}\right)$ and $y = \tan^{-1}\left(\dfrac{3t-t^2}{1-3t^2}\right)$

139) Show that the derivative of $\sec^{-1}\left(\dfrac{1}{2x^2-1}\right)$ w.r.t. $\sqrt{1-x^2}$ at $x = \dfrac{1}{2}$ is 4

140) Find the derivative of $\sin^{-1}\dfrac{2x}{1+x^2}$ w.r.t. $\tan^{-1}\dfrac{2x}{1-x^2}$ where $x > 1$

141) Find the derivative of $\sin^{-1}\left(2ax\sqrt{1-a^2x^2}\right)$ w.r.t. $\sqrt{1-a^2x^2}$ where $-\dfrac{1}{\sqrt{2}} < ax < \dfrac{1}{\sqrt{2}}$

142) Find $\dfrac{dy}{dz}$ where $y = \tan^{-1}\left(\dfrac{\sqrt{1+x^2}-\sqrt{1-x^2}}{\sqrt{1+x^2}+\sqrt{1-x^2}}\right)$ and $z = \cos^{-1} x^2$

143) Find the derivative of $\tan^{-1}\left(\dfrac{t}{\sqrt{1-t^2}}\right)$ with respect to $\sec^{-1}\left(\dfrac{1}{2t^2-1}\right)$

144) Find the derivative of $\tan^{-1}\dfrac{\sqrt{1+x^2}-1}{x}$ with respect to $\tan^{-1} x$

145) Differentiate $\tan^{-1}\dfrac{\sqrt{1+x^2}-1}{x}$ w.r.t. $\cos^{-1}\left(2x\sqrt{1-x^2}\right)$ at $x = 0$

146) Find the derivative of $\tan^{-1}\dfrac{\sqrt{1+x^2}-1}{x}$ with respect to $\tan^{-1}\dfrac{2x\sqrt{1-x^2}}{1-2x^2}$ at $x=0$

147) Find the derivative of with $\tan^{-1}\dfrac{2x\sqrt{1-x^2}}{1-2x^2}$ with respect to $\tan^{-1}\dfrac{\sqrt{1+x^2}-1}{x}$ where $x \neq 0$

148) Show that the derivative of $\cot^{-1}\dfrac{2\sqrt{1+x^2}-5\sqrt{1-x^2}}{5\sqrt{1+x^2}+2\sqrt{1-x^2}}$ with respect to $\cos^{-1}\sqrt{1-x^4}$ is $-\dfrac{1}{2}$