CLASS XII - MATHEMATICS:

1) Solve for x : $\sin^{-1} 6x + \sin^{-1} 6\sqrt{3}\, x = -\frac{\pi}{2}$

2) Prove that $2\sin^{-1}\frac{3}{5} - \tan^{-1}\frac{17}{31} = \frac{\pi}{4}$

3) If $y^x + x^y + x^x = a^b$ find $\frac{dy}{dx}$

4) $x = \sin t$, $y = \sin kt$, Show that
$$(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + k^2 y = 0.$$

5) Prove that $\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3 = \pi$

6) Solve for x, $\sin^{-1}(1-x) - 2\sin^{-1} x = \frac{\pi}{2}$

7) If $y = (\sin^{-1} x)^2$, Show that $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} = 2$.

8) Prove that $\sin\left[\cot^{-1}\left\{\cos(\tan^{-1} x)\right\}\right] = \sqrt{\frac{x^2+1}{x^2+2}}$

9) Prove that $\cot^{-1} 7 + \cot^{-1} 8 + \cot^{-1} 18 = \cot^{-1} 3$.

10) If $\tan\left(\frac{x^2-y^2}{x^2+y^2}\right) = a$ Prove that $\frac{dy}{dx} = \frac{y}{x}$

11) If $y = \frac{\sin^{-1} x}{\sqrt{1-x^2}}$ Prove that $(1-x^2)\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} - y = 0$

12) Differentiate $\tan^{-1}\left(\frac{\sqrt{1+x^2} - \sqrt{1-x^2}}{\sqrt{1+x^2} + \sqrt{1-x^2}}\right)$ w.r.t $\cos^{-1} x^2$

13) Differentiate $\log\left(x^{\sin x} + \cot^2 x\right)$ w.r.t x

14) $y = \log\left(x + \sqrt{x^2+1}\right)$

P.T $(x^2+1)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0$

15) P.T $\sin^{-1}\frac{4}{5} + \sin^{-1}\frac{5}{13} + \sin^{-1}\frac{16}{65} = \frac{\pi}{2}$

16) Solve $\cos(\tan^{-1}x) = \sin\left(\cot^{-1}\frac{3}{4}\right)$

17) If $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)$

Prove that $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$

18) If $y = \cos^{-1}\left(\frac{2x - 3\sqrt{1-x^2}}{\sqrt{13}}\right)$ find $\frac{dy}{dx}$

19) Prove that $\frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\frac{1}{3} = \frac{9}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$

20) Find the intervals in which of the following function is (a) increasing (b) decreasing.

$f(x) = 2x^3 - 9x^2 + 12x + 15$