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1) $y = 1 + x - \cos x$

$y' = 1 - (-\sin x)$

$y' = 1 + \sin x$

3) $y = \frac{1}{x} + 5\sin x$

$y = x^{-1} + 5\sin x$

$y' = -x^{-2} + 5\cos x = -\frac{1}{x^2} + 5\cos x$

5) $y = 4 - x^2 \sin x$

$y' = -x^2(\cos x) + \sin x(-2x) = \boxed{-x^2\cos x - 2x\sin x}$

7) $y = \frac{4}{\cos x} = 4\sec x$

$y' = \boxed{4\sec x \tan x}$

If Quotient Rule

$y' = \frac{\cos x(0) - 4(-\sin x)}{\cos^2 x}$

$\frac{4\sin x}{\cos^2 x}$

$y' = 4\frac{\sin x}{\cos x} \cdot \frac{1}{\cos x}$

9) $y = \frac{\cot x}{1 + \cot x}$

$y' = \frac{(1+\cot x)(-\csc^2 x) - \cot x(-\csc^2 x)}{(1+\cot x)^2}$

y

$y' = \frac{-\csc^2 x(1 + \cot x - \cot x)}{(1+\cot x)^2}$

? $y' = \boxed{-\frac{\csc^2 x}{(1+\cot x)^2}} = -\frac{1}{(\sin x + \cos x)^2}$.

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21) $y = \sin x + 3$ at $x = \pi$ $\quad y(\pi) = \sin\pi + 3 = 3$

$y' = \cos x$ $\quad (\pi, 3)$

$y'(\pi) = \cos\pi = -1$ $\quad m_{Tan} = -1$ $\quad m_{Nor} = 1$

Tangent $\boxed{y - 3 = -(x - \pi)}$ $\quad y = -x + \pi + 3$

Normal $\boxed{y - 3 = (x - \pi)}$ $\quad y = x - \pi + 3$

31) $y = 4 + \cot x - 2\csc x$

$y' = -\csc^2 x - 2(-\csc x \cot x)$

$y' = -\csc^2 x + 2\csc x \cot x$

a) tangent to curve at $P(\frac{\pi}{2}, 2)$

$y'(\frac{\pi}{2}) = -(\csc\frac{\pi}{2})^2 + 2\csc\frac{\pi}{2}\cot\frac{\pi}{2}$

$= -(1)^2 + 2(1)(0) = \boxed{-1}$

$\boxed{y - 2 = -(x - \frac{\pi}{2})}$

$y = -x + \frac{\pi}{2} + 2$

b) Horizontal tangent at Q.

$0 = -\csc^2 x + 2\csc x \cot x$

$0 = -\csc x(\csc x - 2\cot x)$

$0 = -\csc x\left(\frac{1}{\sin x} - \frac{2\cos x}{\sin x}\right)$

$-\csc x = 0$ $\quad \frac{1 - 2\cos x}{\sin x} = 0$

$-\frac{1}{\sin x} = 0$ $\quad 1 - 2\cos x = 0$

ϕ $\quad \cos x = \frac{1}{2}$

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

$y(\frac{\pi}{3}) = 4 + \cot\frac{\pi}{3} - 2\csc\frac{\pi}{3}$

$= 4 + \frac{\sqrt{3}}{3} - 2\left(\frac{2\sqrt{3}}{3}\right)$

$4 - \frac{3\sqrt{3}}{3} = 4 - \sqrt{3}$

$(\frac{\pi}{3}, 4 - \sqrt{3})$

$\boxed{y = 4 - \sqrt{3}}$ ←

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47) Which is an equation of the normal line to $y = \sin x + \cos x$ at $x = \pi$.

$y' = \cos x - \sin x$

$y'(\pi) = \cos\pi - \sin\pi$

$-1 - 0 = \boxed{-1}$

$y(\pi) = \sin\pi + \cos\pi$

$= 0 + (-1) = -1$

$(\pi, -1)$

$m_{Nor} = 1$

$y + 1 = 1(x - \pi)$

$y = x - \pi - 1$

[B]

48) Find y'' if $y = x\sin x$

$y' = x(\cos x) + \sin x(1)$

$y' = x\cos x + \sin x$

$y'' = x(-\sin x) + \cos x(1) + \cos x$

$y'' = -x\sin x + 2\cos x$

[C]