$\lim_{h \to 0} \dfrac{2(a+h)\sin(a+h)+(a+h)^2\cos(a+h)}{1}$

$= 2a\,\sin a + a^2\cos a$

Question 4: Solve

$\lim_{x \to \pi/4} \dfrac{\sqrt{2}\cos x - 1}{\cot x - 1}$

Solution:

$\lim_{x \to \pi/4} \dfrac{(\sqrt{2}-\sec x)\,\cos x\,(1+\cot x)}{\cot x\,[2-\sec^2 x]}$

$= \lim_{x \to \pi/4} \dfrac{\sin x\,(1+\cot x)}{(\sqrt{2}+\sec x)}$

$= \dfrac{\frac{1}{\sqrt{2}}(2)}{\sqrt{2}+\sqrt{2}}$

$= \dfrac{1}{2}$

Question 5: Solve

$\lim_{x \to 0}\left[\dfrac{x}{\tan^{-1}2x}\right]$

Solution:

Let

$\tan^{-1}2x = \theta$

$\Rightarrow x = \frac{1}{2}\tan\theta$ *and as* $x \to 0,\ \theta \to 0$

$\Rightarrow \lim_{x \to 0}\ \dfrac{x}{\tan^{-1}2x}$

$= \lim_{\theta \to 0}\ \dfrac{\frac{1}{2}\tan\theta}{\theta}$

$= \dfrac{1}{2}$

Question 6: Solve

$\lim_{x \to 0} \dfrac{\sqrt{\frac{1}{2}(1-\cos 2x)}}{x}$

Solution: