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大阪教育大学

2014年 第4問

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$\boxed{4}$ 以下の問に答えよ．

(1) $\sin\left(x+\frac{\pi}{4}\right)$ を $\sin x$ と $\cos x$ を用いて表せ．

(2) $f(x)=\sin^3 x$ の導関数を求めよ．

(3) $\int_0^{\frac{\pi}{6}} e^{3x}\sin^2 x\sin\left(x+\frac{\pi}{4}\right)dx$ を求めよ．

(1) $\sin\left(x+\frac{\pi}{4}\right)=\sin x\cdot\frac{\sqrt{2}}{2}+\cos x\cdot\frac{\sqrt{2}}{2}$

$=\underline{\frac{\sqrt{2}}{2}(\sin x+\cos x)}$ //

(2) $f'(x)=\underline{3\sin^2 x\cos x}$ //

(3) (与式) $=\int_0^{\frac{\pi}{6}} e^{3x}\cdot\frac{\sqrt{2}}{2}(\sin^3 x+\sin^2 x\cos x)\,dx$

$=\frac{\sqrt{2}}{2}\int_0^{\frac{\pi}{6}}\left(\frac{1}{3}e^{3x}\right)'\sin^3 x\,dx+\frac{\sqrt{2}}{2}\int_0^{\frac{\pi}{6}} e^{3x}\sin^2 x\cos x\,dx$

$=\frac{\sqrt{2}}{2}\left[\frac{1}{3}e^{3x}\sin^3 x\right]_0^{\frac{\pi}{6}}-\frac{\sqrt{2}}{2}\int_0^{\frac{\pi}{6}} e^{3x}\cdot\sin^2 x\cos x\,dx+\frac{\sqrt{2}}{2}\int_0^{\frac{\pi}{6}} e^{3x}\sin^2 x\cos x\,dx$

$=\frac{\sqrt{2}}{2}\cdot\frac{1}{3}\cdot e^{\frac{\pi}{2}}\cdot\left(\frac{1}{2}\right)^3$

$=\underline{\frac{\sqrt{2}}{48}e^{\frac{\pi}{2}}}$ //