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QUIZ 25 

MATH 200
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1. $\int e^{2x^2} 4x\, dx = \int e^u\, du = e^u + C = \boxed{e^{2x^2} + C}$

$u = 2x^2$

$\frac{du}{dx} = 4x$

$du = 4x\, dx$

2. $\int \frac{1}{x^2}\sqrt{2 - \frac{1}{x}}\, dx = \int \sqrt{2 - \frac{1}{x}}\, \frac{1}{x^2}\, dx = \int \sqrt{u}\, du = \int u^{\frac{1}{2}}\, du = \frac{u^{3/2}}{\frac{3}{2}} + C$

$= \frac{2}{3}\sqrt{u}^{\,3} + C = \boxed{\frac{2}{3}\sqrt{2 - \frac{1}{x}}^{\,3} + C}$

$u = 2 - \frac{1}{x}$

$\frac{du}{dx} = 0 - \frac{-1}{x^2} = \frac{1}{x^2}$

$du = \frac{1}{x^2}\, dx$

3. $\int \frac{6x^3 + 6}{x^4 + 4x}\, dx = \int \frac{1}{x^4 + 4x}(6x^3 + 6)\, dx = \int \frac{1}{u}\, \frac{3}{2}\, du = \frac{3}{2}\int \frac{1}{u}\, du$

$u = x^4 + 4x$

$\frac{du}{dx} = 4x^3 + 4$

$du = 4(x^3 + 1)\, dx$

$\frac{6}{4}\, du = \frac{6}{4}\, 4(x^3 + 1)\, dx$

$\frac{3}{2}\, du = (6x^3 + 6)\, dx$

$= \frac{3}{2}\ln|u| + C$

$= \boxed{\frac{3}{2}\ln|x^4 + 4x| + C}$

4. Find the area under the graph of $x\sin(x^2)$ between 0 and $\sqrt{\pi/6}$.

$\int_0^{\sqrt{\pi/6}} \sin(x^2)\, x\, dx = \frac{1}{2}\int_0^{\sqrt{\pi/6}} \sin(x^2)\, 2x\, dx = \frac{1}{2}\int_{0^2}^{\sqrt{\pi/6}^{\,2}} \sin(u)\, du$

$u = x^2$

$\frac{du}{dx} = 2x$

$du = 2x\, dx$

$= \frac{1}{2}\Big[-\cos(u)\Big]_0^{\pi/6} = \frac{1}{2}\left(-\cos\left(\frac{\pi}{6}\right) - (-\cos(0))\right)$

$= \frac{1}{2}\left(\frac{-\sqrt{3}}{2} + 1\right) = \boxed{\frac{1}{2} - \frac{\sqrt{3}}{4} \text{ square units}}$