Math 21B
Disussion Sheet 5 - Key
Answers by Doug
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Note: These answers are not endorsed by Dr. Gravner and may be incorrect!

1. Compute

a) $\int \mathbf{x^3 e^{x^2}}\ \mathbf{dx}$

Let $u = x^2$, then $du = 2x\ dx$, so we obtain

$$\int x^3 e^{x^2}\ dx = \int \frac{1}{2} u e^u\ du$$

Then by integration by parts, let $w = \frac{1}{2}u$, and $dv = e^u$, then we get

$$\int \frac{1}{2} u e^u\ du = \frac{1}{2} u e^u - \int \frac{1}{2} e^u\ du = \frac{1}{2}(x^2 - 1)e^{x^2}$$

b) $\int \arcsin \mathbf{x}\ \mathbf{dx}$

By integration by parts, let $u = \arcsin x$ and $dv = dx$, then

$$\int \arcsin x\ dx = x \arcsin x - \int \frac{x}{\sqrt{1-x^2}}\ dx = x \arcsin x + \frac{1}{2} \ln \left|1 - x^2\right| + C$$

c) $\int \arccos \mathbf{x}\ \mathbf{dx}$

We would solve this the same way, so this would be

$$x \arccos x + \frac{1}{2} \ln \left|1 + x^2\right| + C$$

2. Compute

a) $\int \sin \mathbf{3x} \cos \mathbf{4x}\ \mathbf{dx}$

b) $\int \sin^{\mathbf{4}} \mathbf{x} \cos^{\mathbf{4}} \mathbf{x}\ \mathbf{dx}$

c) $\int (\sin \mathbf{2x})^{\mathbf{2}} \sin^{\mathbf{2}} \mathbf{x}\ \mathbf{dx}$

d) $\int \frac{\tan \mathbf{x}}{\cos^{\mathbf{2}} \mathbf{x}}\ \mathbf{dx}$

3. Compute

a) $\int_{\pi}^{\pi} (\sin \mathbf{2x})^{\mathbf{3}} \sin^{\mathbf{2}} \mathbf{x}\ \mathbf{dx}$

b) $\int_{\pi}^{\mathbf{17}\pi} (\sin \mathbf{2x})^{\mathbf{3}} \sin^{\mathbf{2}} \mathbf{x}\ \mathbf{dx}$

c) $\int_{\pi/\mathbf{2}}^{\pi/\mathbf{2}} \cos^{\mathbf{2}}(\mathbf{2x})\ \mathbf{dx}$

4. Compute $\int \frac{x^2}{\sqrt{x^2+9}}\, dx$