

# Quiz 1

Spring 2016

MATH 222-004

Name: \_\_\_\_\_

**Problem 1.** Find  $\int (\sin 2\theta - \cos 3\theta)^2 d\theta$

**Solution 1.**

Expanding:

$$(\sin 2\theta - \cos 3\theta)^2 = \sin^2(2\theta) - 2\sin(2\theta)\cos(3\theta) + \cos^2(3\theta)$$

Using trig substitutions we have:

$$\sin^2(2\theta) - 2\sin(2\theta)\cos(3\theta) + \cos^2(3\theta) = \frac{1}{2}(1 - \cos(4\theta)) - \sin(2\theta + 3\theta) - \sin(2\theta - 3\theta) + \frac{1}{2}(1 + \cos(6\theta))$$

Now we can simplify and integrate to find:

$$\int (\sin 2\theta - \cos 3\theta)^2 d\theta = \theta - 1/8 \sin(4\theta) + 1/12 \sin(6\theta) - \cos(\theta) + 1/5 \cos(5\theta) + C$$

□

**Problem 2.** Compute  $\int x \ln(x) dx$

**Solution 2.**

We integrate by parts. Let  $u = \ln(x)$  and  $v' = x$ . Then  $u' = 1/x dx$  and  $v = x^2/2$ . We then know:

$$\int x \ln(x) dx = uv - \int vu' = \ln(x)(x^2/2) - \int \frac{x}{2} dx = \frac{x^2 \ln(x)}{2} - x^2/4 + C$$

□