# Math 307 Integral Review

## Integration by Parts

1. $$\int xe^x \, dx = e^x(x-1) + C.$$

2. $$\int x \sin x \, dx = \sin(x) - x\cos(x) + C.$$

3. (*)
$$\int e^x \sin x \, dx = \frac{e^x}{2}(\sin(x) - \cos(x)) + C.$$

4. (*)
$$\int \log x \, dx = x\log x - x + C.$$

## Substitution

1. $$\int \frac{4x}{(1+x^2)^2} \, dx = \frac{-2}{1+x^2} + C.$$

2. $$\int xe^{x^2} \, dx = \frac{e^{x^2}}{2} + C.$$

3. (*)
$$\int x^3 e^{x^2} \, dx = \frac{e^{x^2}(x^2-1)}{2} + C.$$

## Trig Identities/Substitution

1. $$\int \sin^2(x) \, dx = \frac{x}{2} - \frac{\sin(2x)}{4} + C.$$

2. $$\int \sin(2x)\cos(x) + \sin(x)\cos(2x) \, dx = \frac{-\cos(3x)}{3} + C.$$

3. $$\int \frac{1}{1+x^2} \, dx = \tan^{-1}(x) + C.$$

4. $$\int \frac{1}{x^2+2x+2} \, dx = \tan^{-1}(x+1) + C.$$

5. $$\int \frac{1}{\sqrt{1-x^2}} \, dx = \sin^{-1}(x) + C.$$

6. $$\int \frac{1}{\sqrt{-x^2+2x+3}} \, dx = -\sin^{-1}((1-x)/2) + C.$$

## Partial Fractions

1. $$\int \frac{x}{x^2-2x-3} \, dx = \frac{3}{4}\log|3-x| + \frac{1}{4}\log|1+x| + C.$$

2. (*)
$$\int \frac{1+x}{x^3-2x^2+x} \, dx = \frac{-2}{x-1} - \log|x-1| + \log|x| + C.$$

3. (*)
$$\int \frac{x^2}{x^2-5x+6} \, dx = x - 4\log|2-x| + 9\log|3-x| + C.$$