Exam 1 **Calculus 2** **2/2/22**

Each problem is worth 10 points. For full credit provide good justification for your answers.

1. Evaluate

$$\int \frac{1}{3x+2}\,dx$$

2. Evaluate

$$\int x \sin x \, dx$$

3. Evaluate

$$\int \cos^4 \theta \sin \theta \, d\theta$$

4. Evaluate

$$\int \frac{5x}{(x+3)(x-2)}\,dx$$

5. Evaluate

$$\int \frac{x^3}{\sqrt{1-x^2}}\,dx$$

6. Evaluate

$$\int_0^{\pi/2} \cos^2 \theta \, d\theta$$

7. Bunny is a Calculus student at Enormous State University, and she's having some trouble. Bunny says "Ohmygod, Calc is tough! This partial fractal stuff is totally impossible! I think it's totally random, like, sometimes you put just A or B and some other times you put, like, $Cx + D$, and there's totally no way to know which is which, it's just what the professor decides, right?"

   Help Bunny out by giving a good example to illustrate when to use which kind of numerator in a partial fractions decomposition. You do not need to carry out the decomposition, just give and explain to Bunny what form the decomposition should take.

8. Evaluate

$$\int_0^5 \frac{1}{x-3}\,dx$$

9. Derive the reduction formula

$$\int (\ln x)^n \, dx = x(\ln x)^n - n \int (\ln x)^{n-1} \, dx$$

10. Derive Line 39 from the Table of Integrals,

$$\int \sqrt{u^2 - a^2}\, du = \frac{u}{2}\sqrt{u^2 - a^2} - \frac{a^2}{2} \ln \left| u + \sqrt{u^2 - a^2} \right| + C$$

Extra Credit [5 points possible]: Derive Line 98 from the Table of Integrals,

$$\int e^{au} \sin bu \, du = \frac{e^{au}}{a^2 + b^2} (a \sin bu - b \cos bu) + C$$

(feel free to warm up with the basic version where a and b are both 1).