Math 31B
Homework 3
Due Thursday, February 2, 2023

Instructions: Show all work that was done to arrive at your answer. Answers with no work will not receive credit. Use full sentences when necessary.

Do the following problems from each section of the textbook:

- 8.2: 26,30,35,36,42

- 8.3: 14,18,22,25,32

- 8.5: 8,16,24,34,39,51

Do the following additional problems:

1. In an alternate universe, one of your homework problems was to compute $\int \sin^2(x)\cos^3(x)\,dx$. Using what you learned in class, you carry out the computation and compute that

$$\int \sin^2(x)\cos^3(x)\,dx = \frac{1}{3}\sin^3(x) - \frac{1}{5}\sin^5(x) + C.$$

When you check your computation on WolframAlpha, it spits out

$$\int \sin^2(x)\cos^3(x)\,dx = \frac{1}{30}(7 + 3\cos(2x))\sin^3(x) + C.$$

Show by differentiation that both answers are correct. Explain why this means $\frac{1}{3}\sin^3(x) - \frac{1}{5}\sin^5(x)$ and $\frac{1}{30}(7 + 3\cos(2x))\sin^3(x)$ must therefore differ by a constant. (*Hint: what does this mean about the derivative of their difference?*)

2. For each of the following integrals, identify the technique you would use to carry out the computation. Your choices are: substitution (specify u), integration by parts (specify u and dv), trigonometric identities, trigonometric substitution (specify), or partial fractions. You do **not** need to compute the integral, although I encourage you to do so if you have time!

   (a) $\int x\sec^2(x)\,dx$
   (b) $\int \sqrt{4x^2 - 1}\,dx$
   (c) $\int \cos^2(x)\sin(x)\,dx$
   (d) $\int \frac{1+x^2}{1-x^2}\,dx$
   (e) $\int \sin(2x)\cos(2x)\,dx$
   (f) $\int x^2\sqrt{x+1}\,dx$