Math 132 - September 9, 2016
Solutions

Warm-up Problems

1. (a) What is an even function? Draw an example of a graph of an even function.
   (b) What is an odd function? Draw an example of a graph of an odd function.

2. Compute the integrals, if possible, using the given u-substitution.

   (a) $\displaystyle\int \frac{15}{3-2x}\,dx = -\frac{15}{2}\ln|3-2x| + C$
   $u = 3-2x$
   $du = -2\,dx$

   (b) $\displaystyle\int \frac{1}{x^2\left(1+\frac{1}{x}\right)}\,dx = \frac{x}{x+1} + C$
   $u = 1+\frac{1}{x}$
   $du = -\frac{1}{x^2}\,dx$

   (c) $\displaystyle\int (2x+1)e^{x^2+2x+3}\,dx = e^{x^2+2x+3} + C$
   $u = x^2+2x+3$
   $du = 2x+2\,dx$

   (d) $\displaystyle\int \sqrt{7x+9}\,dx = \frac{2}{21}(7x+9)^{3/2} + C$
   $u = 7x+9$
   $du = 7\,dx$

   (e) $\displaystyle\int x\sqrt{4-x}\,dx$
   $u = x$
   $du = \,dx$

   (f) $\displaystyle\int x\sqrt{4-x}\,dx\frac{2}{5}(4-x)^{5/2} - \frac{8}{3}(4-x)^{3/2} + C$
   $u = 4-x$
   $du = -\,dx$

3. $\boxed{\textbf{Clicker}}$ Select the best substitution for the integral.

$$\int 3x^2\csc^2(x^3+1)\,dx$$

   (a) $3x^2$
   (b) $\csc^2(x^3+1)$
   (c) x^3
   (d) x^3+1

   Solution: If $u = x^3+1$, $du = 3x^2\,dx$ and the integral transforms to
   $\displaystyle\int \csc^2 u\,du = -\cot u + C = -\cot(x^3+1) + C$

Class Problems

4. Make the substitution $u = \ln x$ and select the integral below that is equal to

$$\int_1^e \frac{\ln x}{x}\,dx$$

(a) $\int_1^e u\,du$

(b) $\int_0^1 u\,du$ $\boxed{\textbf{Correct}}$

(c) $\int u\,du$

(d) $\int_0^e u\,du$

(e) They are all equal

5. Compute the definite integrals with substitution in two ways:
(1) change the limits to u-limits and use these u-limits and
(2) keep the x-limits and make sure you change back to x.

(a) $\int_1^2 x\sqrt{x-1}\,dx = \frac{16}{15}$

(b) $\int_0^3 \frac{1}{5x+1}\,dx = \frac{\ln 18}{5} - \frac{\ln 3}{5}$

(c) $\int_1^2 \frac{e^{1/x}}{x^2}\,dx = e - \sqrt{e}$

(d) $\int_1^3 \frac{x}{1+2x}\,dx = 3$

(e) $\int_0^1 \frac{1}{(1+\sqrt{x})^4}\,dx = \frac{1}{6}$

6. $\boxed{\textbf{Clicker}}$ Select the best substitution for the integral.

$$\int_{-1}^1 x^5\sqrt[3]{x^4+1}\,dx$$

(a) $u = x^5$

(b) $u = x^4 + 1$

(c) $u = x$

(d) $u = \sqrt[3]{x^4+1}$

(e) Help! I'm going to fail this on the test!

Solution: This is actually a trick question! (Can you believe it!?) The answer is that the integral is equal to 0, but substitution isn't going to solve this question. None of the substitutions are useful.