MATH 2205: Multivariate Calculus
Homework 2, due 12:45 Monday 20 February 2017

You must justify your answers to receive full credit.

Some antiderivatives you may find useful:

$$\int \sec^2 x\,dx = \tan x + C, \qquad \int \csc^2 x\,dx = -\cot x + C,$$

$$\int \sec x \tan x\,dx = \sec x + C, \qquad \int \csc x \cot x\,dx = -\csc x + C,$$

$$\int \frac{1}{\sqrt{1-x^2}}\,dx = \sin^{-1} x + C, \qquad \int \frac{1}{1+x^2}\,dx = \tan^{-1} x + C,$$

$$\int \sin^2 x\,dx = \frac{1}{2}(x - \sin x \cos x) + C,$$
$$\int \sin^3 x\,dx = -\cos x + \frac{1}{3}\cos^3 x + C.$$
$$\int \sin^4 x\,dx = \frac{1}{8}(3x - 3\sin x\cos x - 2\sin^3 x \cos x) + C,$$

$$\int \cos^2 x\,dx = \frac{1}{2}(x + \sin x \cos x) + C,$$
$$\int \cos^3 x\,dx = \sin x - \frac{1}{3}\sin^3 x + C.$$
$$\int \cos^4 x\,dx = \frac{1}{8}(3x + 3\sin x\cos x + 2\cos^3 x \sin x) + C.$$

- 5.4: Q9, 12: by using the properties of the definite integral and interpreting integrals as areas, evaluate $\displaystyle\int_{-\pi}^{\pi} \sin(x^3)\,dx$, $\displaystyle\int_0^2 \sqrt{2x - x^2}\,dx$.
- 5.5: Q4, 8, 11, 17: evaluate $\displaystyle\int_{-2}^{-1} \frac{1}{x^2} - \frac{1}{x^3}\,dx$, $\displaystyle\int_4^9 \sqrt{x} - \frac{1}{\sqrt{x}}\,dx$, $\displaystyle\int_{\pi/4}^{\pi/3} \sin\theta\,d\theta$, $\displaystyle\int_{-1}^{1} \frac{1}{1+x^2}\,dx$.
- 5.4 Q35, 5.5 Q33: find $\displaystyle\int_0^2 g(x)\,dx$, where $g(x) = \begin{cases} x^2 & \text{if } 0 \le x \le 1 \\ x & \text{if } 1 \le x \le 2 \end{cases}$, evaluate $\displaystyle\int_0^{3\pi/2} |\cos x|\,dx$.
  (You can use FTC2 on both of these.)
- 5.6: Q3, 14: evaluate $\displaystyle\int \sqrt{3x+4}\,dx$, $\displaystyle\int \frac{x+1}{\sqrt{x^2+2x+3}}\,dx$,

- 5.6: Q19, 20: evaluate $\int \tan x \ln \cos x \, dx, \quad \int \frac{x+1}{\sqrt{1-x^2}} \, dx.$
- 5.6: Q39, 40, 43: evaluate $\int_0^4 x^3(x^2+1)^{-1/2} \, dx, \quad \int_1^{\sqrt{e}} \frac{\sin(\pi \ln x)}{x} \, dx, \quad \int_e^{e^2} \frac{dt}{t \ln t}.$
  (Hint: the notation in Q43 means $\int_e^{e^2} \frac{1}{t \ln t} \, dt.$)
- 5.7: Q5, 10, 11: sketch and find the area of the plane region bounded by the given curves: $2y = 4x - x^2$ and $2y + 3x = 6$; $\quad x = y^2$ and $x = 2y^2 - y - 2$; $\quad y = \frac{1}{x}$ and $2x + 2y = 5$.
- 14.2: Q2, 9
- 14.2: Q14, 21

1. Sketch the region bounded by the curves $y = 3\cos 2x$, $y = 6x + 3$, $x = \frac{\pi}{6}$, and find its area.

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