MATH111 200530 Problem Set 5 Hints

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2. (d) There is a typo: dx should only appear once. Fixed in the online copy.

3. (a) Using reduction formula 86 in the back of the book with $m = 0$, or the simplified version in problem 8.1.42(a),

$$\begin{aligned}\int \cos^6\theta\, d\theta &= \frac{\sin\theta\cos^5\theta}{6} + \frac{5}{6}\int \cos^4\theta\, d\theta \\ &= \frac{\sin\theta\cos^5\theta}{6} + \frac{5}{6}\left(\frac{\sin\theta\cos^3\theta}{4} + \frac{3}{4}\int \cos^2\theta\, d\theta\right) \\ &= \frac{\sin\theta\cos^5\theta}{6} + \frac{5}{6}\left(\frac{\sin\theta\cos^3\theta}{4} + \frac{3}{4}\left(\frac{\sin\theta\cos\theta}{2} + \frac{1}{2}\int \cos^0\theta\, d\theta\right)\right).\end{aligned}$$

Therefore

$$\int \cos^6\theta\, d\theta = \frac{1}{6}\sin\theta\cos^5\theta + \frac{5}{24}\sin\theta\cos^3\theta + \frac{15}{48}\sin\theta\cos\theta + \frac{15}{48}\theta + C.$$

4. (b) Use integration formula 15 in the back of the textbook:

$$\int \csc\theta\, d\theta = \ln|\csc\theta - \cot\theta| + C.$$

5. You can use the fact that

$$\lim_{t\to\infty} t^n e^{at} = 0$$

which can be proven using L'Hôpital's rule repeatedly.