2924 Problem Review Session
September 17, 2019

PROBLEM 1. Below there is a list of integrals all of which can be worked out in closed form.
(a) Which integrals have integrand being a product of trig functions? Work one or two of these.
(b) Which integrals can be calculated using integration by parts? Work one or two of these.
(c) Which integrals might be solved using a trig substitution? Work one or two of these.
(d) For which of the integrals is the integrand a rational function? (These are sometimes amenable to using partial fractions, which we haven't discussed in class quite yet.)
(e) Work one or two of the integrals that you didn't list in (a)-(d). (This could be open to argument but I would say there are 3 such integrals.)

PROBLEM 2. For what positive values of c does the equation $\ln(x) = cx^2$ have exactly one solution? (This problem is discussed on page 508 of Stewart's book.)
HINT: Consider the function $F(x) = \ln(x) - cx^2$. Does this function have any local extremes? Sketch a rough graph of $y = F(x)$.

SOME DOABLE INTEGRALS:

1. $\displaystyle\int xe^{3x+1}\,dx$
2. $\displaystyle\int \tan(x)\sec^2(x)\,dx$
3. $\displaystyle\int x\sec^2(x)\,dx$
4. $\displaystyle\int \frac{1}{\sin(x)\cos(x)}\,dx$
5. $\displaystyle\int \frac{\tan(x)}{\sec(x)}\,dx$
6. $\displaystyle\int \frac{x^2+1}{\sqrt{x+1}}\,dx$
7. $\displaystyle\int \frac{1}{x^2\sqrt{x^2-1}}\,dx$
8. $\displaystyle\int x^2\ln(x)\,dx$
9. $\displaystyle\int \sin^5(x)\,dx$

10. $\int \frac{5}{2x+1}\ dx$
11. $\int \frac{5}{(2x+1)^2}\ dx$
12. $\int \frac{1}{\sqrt{x^2-2x+2}}\ dx$
13. Find the average value of the function $f(x) = \frac{1}{1+x^2}$ on the interval $[0, A]$ where $A > 0$.
14. $\int \frac{1}{25+x^2}\ dx$
15. $\int \frac{1}{(25+x^2)^2}\ dx$
16. $\int \frac{\sec^4(t)}{\tan(t)}\ dx$
17. $\int \frac{\sec^4(t)}{\tan^2(t)}\ dt$
18. $\int \sec^4(x)\ dx$
19. $\int \tan^4(x)\ dx$
20. $\int (x^2-1)\cos(x)\ dx$
21. $\int \sqrt{x^2+1}\ dx$
22. $\int \frac{1}{1-\sin(x)}\ dx$
23. $\int \sin^2(x)\cos^3(x)\ dx$
24. $\int \frac{1}{\sqrt{1-x^2}}\ dx$
25. $\int \sqrt{1-9x^2}\ dx$
26. $\int \sqrt{9-x^2}\ dx$
27. $\int \ln(x^2)\ dx$
28. $\int \ln(x^2+1)\ dx$