## SOLUTIONS CHAPTER 16.4

MATH 132 - WI00

What I'll do in the following... since you are now skilled in computing integrals ... will be just give you the idea (the $u$, that is) and the result you should get. Mind the fact that you might follow a different method (there's no mathematics problem that admits only one solution!!), and you might get a **different looking result** - then your job will also be to check your answer :), since the answers should be the same.

**6.** Take $u = e^{x^2} - 2$.

Reasons:

• taking just $x^2$ is not enough (try it!), so this would be the next step

• this $u$ combines a constant too - always take the expression that has constants in it for $u$, since by differentiation it will vanish (as opposed to NOT showing up after differentiation)

Result:

$$\frac{1}{2}\ln(e^{x^2} - 2) + C$$

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**12.** We can use the $u$-trick here, but with a twist!

Since we have $x - 5$ as the denominator, and we cannot really get rid of it, the one thing we can do to simplify our work is to call it $u$:

$$u = x - 5 \Rightarrow du = dx$$

$$u = x - 5 \Rightarrow x = u + 5$$

and now change all possible $x$ into $u$:

$$\frac{(2x-1)(x+3)}{x-5} = \frac{(2(u+5)-1)((u+5)+3)}{u} = \frac{(2u+9)(u+8)}{u}$$

so then the integral becomes (again, mind the fact that $du = dx$!)

$$\int \frac{(2u+9)(u+8)}{u}\,du = \frac{2u^2+25u+72}{u}\,du =$$

$$= \int (2u + 25 + 72 \cdot \frac{1}{u})\,du = 2 \cdot \frac{u^2}{2} + 25u + 72\ln u + C =$$

$$= (x-5)^2 + 25(x-5) + 72\ln|x-5| + C$$

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**14.** First of all, since it's not very clear what power we have for $e$, let's compute it:

$$(e^{4-3x})^2 = e^{(4-3x)^2} = e^{8-6x}$$

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Now it's clear! Take $u = 8 - 6x$ ... result

$$-\frac{1}{6}e^{8-6x} + C$$

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**22.** Same trick as in previous chapter, the last problem: no polinomials, but let's rewrite the expression as combination of powers of x:

$$\frac{\sqrt{1+\sqrt{x}}}{\sqrt{x}} = \frac{\sqrt{1+x^{\frac{1}{2}}}}{x^{\frac{1}{2}}}$$

Take $u = 1 + x^{\frac{1}{2}}$ ... this particular $u$ combines a constant.
Result:

$$2\,\frac{(1+x^{\frac{1}{2}})^{\frac{3}{2}}}{\frac{3}{2}} + C$$

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**42.** For this problem, you have the first choice of $u = x^2 + 1$ ... but you'll realize soon that it's not enough (expression you get still has x's in it ... or you get something which is not easy to integrate yet). Next try would be $u = \ln(x^2+1)$. This will be it!

Result (mind the double $\ln$!!):

$$\frac{1}{2}\ln\ln(x^2+1) + C$$

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**52.** Choice is first $u = x$ ... but it's not enough. Try $u = \ln x$ (not $(\ln x)^3$!! notice that it's the logarithm cubed, not the $x$ cubed inside the $\ln$).

Result:

$$\frac{1}{3}\,\frac{1}{4}(\ln x)^4 + C$$

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