MATH 141, Fall 2025, POP QUIZ A answers.

Every problem was an indefinite integral, so the answer is only certain up to adding an arbitrary constant. The "+C" is necessary, or your answer is not correct.

1. $\displaystyle\int \frac{1}{1+x^2}\,\mathrm{d}x = \arctan x + C.$

No tools. Just an antiderivative.

2. $\displaystyle\int \frac{x}{1+x^2}\,\mathrm{d}x$ substitution: $u = 1+x^2$, $\mathrm{d}u = 2x\,\mathrm{d}x.$

$$= \frac{1}{2}\int \frac{1}{u}\,\mathrm{d}u = \frac{1}{2}\ln|u| + C = \frac{1}{2}\ln(1+x^2) + C$$

3. $\displaystyle\int xe^x\,\mathrm{d}x$ parts: $u = x$, $v = e^x$, $\mathrm{d}u = \mathrm{d}x$, $\mathrm{d}v = e^x\,\mathrm{d}x$

$$= xe^x - \int e^x\,\mathrm{d}x = xe^x - e^x + C$$

Get into the habit of writing $\mathrm{d}x$ *in your work as you do integration by parts! Why? Because it will help you not to make mistakes. On tests, I see some people make mistakes because they put* v *where* $\mathrm{d}v$ *should have been, etc. But if you have a* $\mathrm{d}x$ *in your expression for* $\mathrm{d}v$*, it's easier to notice your mistakes, because you'll see a* $\mathrm{d}x$ *where it shouldn't be, or you'll be missing a* $\mathrm{d}x$*, and you'll notice that.*

4. $\displaystyle\int \frac{\ln x}{x^8}\,\mathrm{d}x$ parts: $u = \ln x$, $v = -\frac{1}{7x^7}$, $\mathrm{d}u = \frac{1}{x}\,\mathrm{d}x$, $\mathrm{d}v = \frac{1}{x^8}\,\mathrm{d}x$

$$= \frac{-\ln x}{7x^7} + \frac{1}{7}\int \frac{1}{x^8}\,\mathrm{d}x = \frac{-\ln x}{7x^7} - \frac{1}{49x^7} + C$$

Putting $\mathrm{d}v = x^8\,\mathrm{d}x$ *was not right! Since the powers of* x *are in the numerator, you need* $\mathrm{d}v = x^{-8}\,\mathrm{d}x$.

5. $\displaystyle\int \ln x\,\mathrm{d}x$ parts: $u = \ln x$, $v = x$, $\mathrm{d}u = \frac{1}{x}\,\mathrm{d}x$, $\mathrm{d}v = \mathrm{d}x$

$$= x\ln x - \int 1\,\mathrm{d}x = x\ln x - x + C$$