Class worksheet 9: Mathematical analysis 1

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Name: _____

This is just to practice, no points are awarded. $\mathbb{N} = \{1, 2, \dots\}$, log with unspecified base is the natural logarithm.

1. Calculate the indefinite integrals and give the underlying domain.
   a) $\int x^3 - 3x^2 + \frac{x}{5} + 1 \, dx$
   b) $\int 10e^x + e^{4x} - \frac{1}{x} + \cos x \, dx$
   c) $\int \sqrt{x^6} \, dx$
   d) $\int \frac{(1-x)^3}{x \sqrt[3]{x}} \, dx$
2. Using integration by parts, calculate the following indefinite integrals.
   a) $\int x \sin x \, dx$.
   b) $\int e^x \sin x \, dx$.
   c) $\int x^a \log x \, dx$, where $a > 0$.
   d) $\int \log x \, dx$.
   e) $\int (\log x)^2 \, dx$.
   f) $\int \arctan x \, dx$.
3. Integrate
   a) $\int \frac{x^7-5}{x^2-1} \, dx$
   b) $\int \frac{x}{x^3-3x+2} \, dx$
   c) $\int \frac{x^2}{(x+2)^2(x+4)^2} \, dx$
   d) $\int \frac{e^x}{e^x+1} \, dx$
   e) $\int \frac{\cos x}{\sin^2 x - 4} \, dx$
   f) $\int \frac{x^4}{x^4+5x^2+4} \, dx$

g) $\int \frac{3x+5}{2x^2+3x+7}\,dx$

4. Evaluate the following integrals.

   a) $\int_{1/e}^{e} |\log x|\,dx$.

   b) $\int_0^1 (\cos x)^3 \sin x\,dx$.

   c) $\int_{-1}^{1} \sqrt{\frac{1-x}{1+x}}\,dx$.