

1. (5 points each) Compute the following integrals.

(a)  $\int_1^{e^3} x(\ln x)^2 dx$

(b)  $\int \tan^3(4x) dx$

(c)  $\int \cos^5(3x) dx$

(d)  $\int_0^{\pi/3} \sin^2(3x) dx$

$$(e) \int \frac{\sec^{-1} x}{x\sqrt{x^2-1}} dx$$

$$(f) \int \frac{4x dx}{\sqrt{9-x^2}}$$

$$(g) \int \frac{dx}{x+x(\ln x)^2} dx$$

$$(h) \int_1^{\sqrt{3}} \frac{2^{\tan^{-1} x}}{1+x^2} dx$$

2. (5 points each) Compute the following limits. No work need be shown, but you will lose points for writing false arguments.

(a)  $\lim_{x \rightarrow \infty} (e^{-3x+2} + \tan^{-1}(x))$

(b)  $\lim_{n \rightarrow \infty} \left(1 - \frac{5}{3n}\right)^{n/5}$

(c)  $\lim_{n \rightarrow \infty} \frac{(\ln n)^3}{n^{1/15}}$

(d)  $\lim_{x \rightarrow 0} (\ln(\sin x) - \ln(x))$

(e)  $\lim_{n \rightarrow \infty} \sqrt[n]{5n^2 + 7}$

(f)  $\lim_{x \rightarrow 0^+} \frac{1}{\sin(x) - x}$

(g)  $\lim_{x \rightarrow \infty} \frac{\sin x}{x}$  (Careful!)

(h)  $\lim_{x \rightarrow \pi} \frac{\sin^{-1}(x - \pi)}{x - \pi}$

3. (20 points) Compute the following limits. You will be graded on the correctness and clarity of your arguments.

(a)  $\lim_{x \rightarrow \infty} (e^{3x} + 1/x)^{1/x}$ .

(b)  $\lim_{x \rightarrow 0^-} \frac{\cos x - 1}{e^x - x - 1}$

4. (20 points) Compute  $\int \frac{\sqrt{y^2 - 25}}{y^3} dy$ . Be sure to substitute back to the original variable.