

## Math 143 – Practice Midterm Exam 1

1. Find the following integrals:

a)  $\int (\ln x)^2 dx.$

b)  $\int x^2 \sin(\pi x) dx.$

c)  $\int \sin^4(x) \cos^3(x) dx.$

d)  $\int_{\sqrt{2}}^2 \frac{1}{t^3 \sqrt{t^2 - 1}} dx.$

e)  $\int \frac{2x + 3}{(x - 1)(x^2 + 1)^2}.$

f)  $\int_0^1 \frac{x}{x^2 + 4x + 13} dx.$

2. Calculate the following limits:

a)  $\lim_{x \rightarrow 0} \frac{x3^x}{3^x - 1}.$

b)  $\lim_{x \rightarrow \infty} (x - \ln x).$

c)  $\lim_{x \rightarrow 0^+} (\tan 2x)^x.$

d)  $\lim_{x \rightarrow 0} \cot 2x \sin 6x.$

e)  $\lim_{x \rightarrow 0} \frac{x}{\tan^{-1}(4x)}.$

3. (a) Find the approximations  $T_6, M_6, S_6$  for  $\int_0^\pi \sin x dx$  and the corresponding errors  $E_T, E_M, E_S$ .

(b) How large do we have to choose  $n$  so that the approximations  $T_n, M_n, S_n$  to the integral in part (a) are accurate to within 0.00001?

4. Determine whether each improper integral is convergent or divergent. Evaluate those that are convergent.

(a)  $\int_{-\infty}^0 x e^{2x} dx.$

(b)  $\int_6^8 \frac{4}{(x - 6)^3} dx.$

(c)  $\int_0^9 \frac{1}{\sqrt[3]{x - 1}}.$

(d)  $\int_1^\infty \frac{1}{x^2 + x} dx.$

5. Use the Comparison Theorem to determine whether the integral is convergent or divergent.

(a)  $\int_1^\infty \frac{2 + e^{-x}}{x} dx.$

(b)  $\int_0^1 \frac{\sec^2 x}{x\sqrt{x}} dx.$