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**MATH 009C - Summer 2017**

Practice Problems for Limits and Improper Integrals

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1. Compute the following limits:

- (a)  $\lim_{x \rightarrow \infty} x^2 e^{-x}$
- (b)  $\lim_{x \rightarrow \infty} \frac{\ln(x)}{x}$
- (c)  $\lim_{x \rightarrow 0^+} x e^{-1/x}$
- (d)  $\lim_{x \rightarrow 0^+} (1+x)^{1/x}$
- (e)  $\lim_{x \rightarrow \infty} (1+x)^{1/x}$
- (f)  $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$
- (g)  $\lim_{x \rightarrow \infty} x \sin\left(\frac{1}{x}\right)$

2. Determine whether the following improper integrals are convergent or divergent:

- (a)  $\int_1^{\infty} \frac{1}{x^3} dx$
- (b)  $\int_2^{\infty} \frac{1}{(x-1)^2} dx$
- (c)  $\int_1^{\infty} \frac{1}{x^2+9} dx$
- (d)  $\int_0^{\infty} x e^{-x^2} dx$
- (e)  $\int_1^{\infty} \frac{1+e^{-x}}{x} dx$
- (f)  $\int_1^{\infty} \frac{1}{\sqrt{x^4+1}} dx$

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**Please, show all work.**