

# Calculus II

## Homework

### L'Hospital's rule

1. Compute the limits. The answer key has not been fully proofread, use with caution.

(a)  $\lim_{x \rightarrow 0} \frac{\sin x}{x}.$

(b)  $\lim_{x \rightarrow 0} \frac{x}{\ln(1+x)}.$

(c)  $\lim_{x \rightarrow 0} \frac{x^2}{x - \ln(1+x)}.$

(d)  $\lim_{x \rightarrow 0} \frac{x^2}{\sin x \ln(1+x)}.$

(e)  $\lim_{x \rightarrow 0} \frac{\sin^2 x}{(\ln(1+x))^2}.$

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

(g)  $\lim_{x \rightarrow 0} \frac{\arctan x - x}{x^3}.$

(h)  $\lim_{x \rightarrow 0} \frac{\arcsin x - x}{x^3}.$

(i)  $\lim_{x \rightarrow 1} \frac{x}{x-1} - \frac{1}{\ln x}.$

(j)  $\lim_{x \rightarrow 0} \frac{\cos(nx) - \cos(mx)}{x^2}.$

(k)  $\lim_{x \rightarrow 0} \frac{\arcsin x - x - \frac{1}{6}x^3}{\sin^5 x}.$

(l)  $\lim_{x \rightarrow 1} \frac{\sin(\pi x) \ln x}{\cos(\pi x) + 1}.$

(m)  $\lim_{x \rightarrow 0} \frac{\sin x - x}{\arcsin x - x}.$

(n)  $\lim_{x \rightarrow 0} \frac{\sin x - x}{\arctan x - x}.$

(o)  $\lim_{x \rightarrow \infty} x \sin\left(\frac{2}{x}\right).$

2. Compute the limit.

(a)  $\lim_{x \rightarrow \infty} \left(\frac{x-2}{x}\right)^x.$

(b)  $\lim_{x \rightarrow \infty} \left(\frac{x-2}{x}\right)^{2x}$

(c)  $\lim_{x \rightarrow \infty} \left(\frac{x}{x+3}\right)^{2x}$

3. Find the limit.

(a)  $\lim_{x \rightarrow \infty} \left(1 - \frac{2}{x}\right)^x.$

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

(c)  $\lim_{x \rightarrow \infty} \left(\frac{x}{x-5}\right)^x.$

(d)  $\lim_{x \rightarrow \infty} \left(\frac{x}{x-2}\right)^{3x+2}.$