1 L'Hôspital's Rule

1. Compute the following limits.

   (a) $\lim_{x\to 0} \dfrac{e^x - 1}{x}$

   (b) $\lim_{x\to 0} \dfrac{e^{x^2} - 1}{x}$

   (c) $\lim_{x\to 0} \dfrac{e^{x^2} - 1}{x^2}$

   (d) $\lim_{x\to 0} \dfrac{e^{3x} - 1}{\sin(4x)}$

   (e) $\lim_{x\to 0} \dfrac{e^x - 1 - x}{x\sin(4x)}$

   (f) $\lim_{n\to\infty} e^{-n}(n^2 + 1)$

   (g) $\lim_{x\to 0^+} x\ln(x)$

   (h) $\lim_{x\to 0^+} \dfrac{\ln(1 - 3x)}{x}$

   (i) $\lim_{x\to 0^+} \dfrac{\ln(1 - 3x^2)}{4x^2}$

   (j) $\lim_{x\to 0^+} (1 - 3x)^{\frac{1}{x}}$

   (k) $\lim_{x\to 0^+} (1 + 3x^2)^{\frac{2}{x^2}}$

   (l) $\lim_{n\to\infty} (1 + \dfrac{2}{n})^n$

   (m) $\lim_{x\to 0^+} x^x$

   (n) $\lim_{x\to 0^+} x^{\sin(x)}$

   (o) $\lim_{x\to 0^+} [\sin(x)]^x$

   (p) $\lim_{x\to 0^+} (x^2)^x$

2 Integrals

2. Compute the following.

   (a) $\displaystyle\int 7\sec^2(x) - 3\,dx$

   (b) $\displaystyle\int 3x^3 - \sqrt{x} - \frac{3}{x} + \frac{1}{\sqrt{x}}\,dx$

(c) $\int x(x^2-1)\,dx$

(d) $\int \frac{11}{\sqrt{1-x^2}} - \frac{3}{x}\,dx$

(e) $\int \frac{4}{1+x^2} - \frac{1+x^2}{4}\,dx$

(f) $\int \frac{4x}{1+x^2}\,dx$ Hint use u-sub for this one

(g) $\int \sin(2x-3)\,dx$

(h) $\int e^{x+2}\,dx$

(i) $\int xe^{1+x^2}\,dx$

(j) $\int x\sqrt{1+x^2}\,dx$

(k) $\int x\sin(1+x^2)\,dx$

(l) $\int x\csc^2(1+x^2)\,dx$

(m) $\int e^x\sqrt{e^x+1}\,dx$

(n) $\int (\sin(x)+1)^4\cos(x)\,dx$

3 Everything from Practice Test 3

4 From Practice Test 1

3. Compute the derivative using the **definition** of the derivative

   (a) $f(x) = 3x+5$ at $x=-1$

   (b) $f(x) = x^2$ at $x=2$

   (c) $f(x) = x^2$

   (d) $f(x) = 5x+1$

   (e) $f(x) = \sqrt{x}$

   (f) $f(x) = \frac{1}{x}$

4. Compute the derivative using implicit differentiation.

(a) $x^3 + y^3 = 2x + 5$

(b) $x^3y^3 = 2x + 5$

(c) $\sin(x^3) + \sin(y^3) = 2x + 5$

(d) $\sin(x^3y^3) = 2x + 5$

(e) $\sin(xy^2) = 2x + 5y - 7$

(f) $y = 2^x$ use logarithmic differentiation here.

(g) $y = x^x$ use logarithmic differentiation here.

(h) $y = x^{x^2}$ use logarithmic differentiation here.

(i) $y = x^{2^x}$ use logarithmic differentiation here.

(j) $y = \sin(x)^x$ use logarithmic differentiation here.

(k) $y = \sin(x)^{e^x}$ use logarithmic differentiation here.

5. Let $s(t) = -4.9t^2 + 3t + 1$ represent the height of a ball we through up in the air at time $t = 0$.

   (a) What is the height of the ball at time $t = 0$?

   (b) What is the speed of the ball at time $t = 0$?

   (c) When does the ball have a velocity of zero?

   (d) When does the ball hit the ground?

   (e) What is the velocity of the ball when it hits the ground?

   (f) Write out the velocity and acceleration equations (maybe you should do this question first).