Math Camp 2020 Summer
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Homework 1

Show that $\lim_{x\to 0} x^2 \sin\frac{1}{x} = 0$. (Hint: use squeeze theorem)
Compute $\lim_{x\to\infty}\left(\sqrt{x^2+1}-x\right)$.
Find the horizontal and vertical asymptotes of the graph of the function $f(x) = \frac{\sqrt{2x^2+1}}{3x-5}$
Evaluate $\lim_{x\to\infty} \frac{3x^2-x-2}{5x^2+4x+1}$
Find $\lim_{x\to\infty}(x^2-x)$.
Find $\lim_{x\to\infty} x^3$ and $\lim_{x\to-\infty} x^3$.
Find $\lim_{x\to\infty} \frac{x^2+x}{3-x}$.
If $f(x)=\sqrt{x}$, find the derivative of f. State the domain of f'.
Find f' if $f(x)=\frac{1-x}{2+x}$.

If $f(x) = e^x - x$, find f' and f''. Compare the graphs of f and f'.

(a) If $f(x) = xe^x$, find $f'(x)$.
(b) Find the nth derivative, $f^{(n)}(x)$.

Find an equation of the tangent line to the curve $y = e^x/(1 + x^2)$ at the point $\left(1, \frac{1}{2}e\right)$.

Find the derivative of the function

$$g(t) = \left(\frac{t-2}{2t+1}\right)^9$$

Find y' if $\sin(x + y) = y^2 \cos x$.

Differentiate $y = \dfrac{x^{3/4}\sqrt{x^2+1}}{(3x+2)^5}$.

(Hint: The calculation of derivatives of complicated functions involving products, quotients, or powers can often be simplified by taking logarithms. The method used in the following example is called logarithmic differentiation).

Differentiate $y = x^{\sqrt{x}}$.

Calculate $\lim\limits_{x\to\infty} \dfrac{\ln x}{\sqrt[3]{x}}$.

Evaluate $\lim\limits_{x\to 0^+} x \ln x$.

Find $\lim\limits_{x\to 0^+} x^x$.