BBA9
BITL2

Worksheet 8

Math Lab
Fall 2020

29 October 2020

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1. **Warm up:** What are the derivatives of the following functions?

   (a) x^2 (c) 2^x (e) x^{-2}

   (b) $x+2$ (d) $(x^{1/2})^{1/2}$ (f) $e^{2x}/2^{ex}$

2. Recall that $\lim_{n\to\infty}(1+\frac{1}{n})^n = e$. Using this, evaluate the following limits.

   (a) $\lim_{t\to 0}(1+t)^{1/t}$

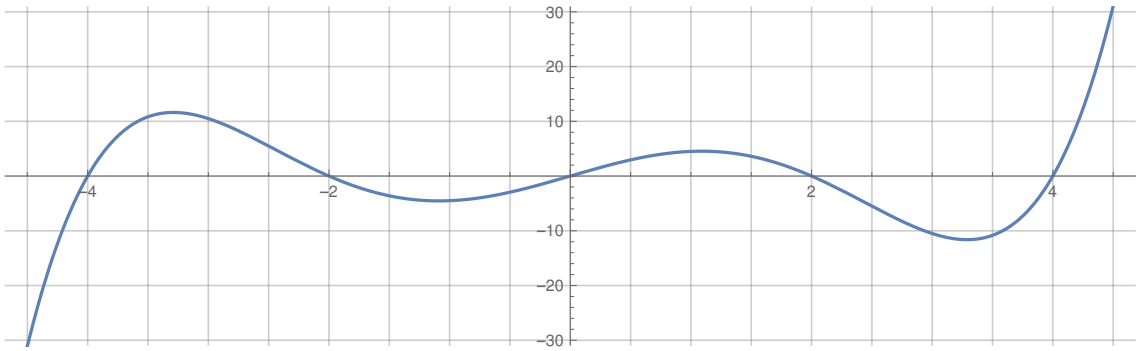
   (b) $\lim_{n\to\infty}\left(1+\dfrac{6}{2-n}\right)^{n+1}$

   (c) $\lim_{x\to\infty}\left(\dfrac{2x-3}{2x+1}\right)^{\frac{x+1}{3}}$

   (d) $\lim_{n\to-\infty}(\frac{n}{n-1})^{2n}$

3. Use the limit definition of the derivative to find $f'(2)$ for $f(x) = 2x - 4x^{-1}$.

4. Below is the graph of $f(x) = \frac{x}{10}(x+2)(x-2)(x+4)(x-4)$.



   (a) Compute the derivative $f'(x)$.

   (b) At what x-values will the tangent line to f be horizontal?

   (c) What will be the y-values at the given x-values from part (b)?

5. Draw the graph of a continuous function f that satisfies the following conditions:

   - $f'(-1) = f'(1) = 0$
   - $f'(-2) = f'(2) = 1$
   - $f'(x) < 0$ when $x \leqslant -3$ and $f'(x) > 0$ when $x \geqslant 3$

6. Let $f(x) = 2x^2 + 5$ and $g(x) = 4e^x - 1$.

   (a) What is the function $f(g(x))$? What is $g(f(x))$?

   (b) Compute the derivative $f'(x)$ and $g'(x)$.

   (c) What is $f'(g(x))$? What is $g'(f(x))$?