

Day 4

1. Find the first and second derivatives of the following equations:
  - a.  $-7x^3$
  - b.  $3x^2-9x+7x^{2/5}-3x^{1/2}$
  - c.  $\frac{x}{x^2+1}$
  - d.  $(x^3 + 2x)^3(4x + 5)^2$
  - e.  $\ln(x^4 + 2)^2$
  - f.  $\frac{x}{e^x}$
  - g.  $e^{x^2+3x-2}$
  - h.  $\frac{x}{\ln x}$
2. Show that the midpoint of a linear demand curve is unit elastic ( $\epsilon=-1$ ).
3. Assume  $TR=PQ$ ,  $P=A-BQ$ ,  $TC=Q^2$ . Find the optimal  $Q$  and verify that it is optimal. How does the optimal  $Q$  change with a change in  $A$ ? With a change in  $B$ ?
4. For each of the following, find the local and global max and min if they exist. Over what regions are the curves concave, quasi-concave, convex, and quasi-convex? Which are  $\in C^1$ ?
  - a.  $\frac{1}{x}$  on  $(1,2)$ , on  $[-1,2]$
  - b.  $x^3 + 3x$  on  $(-\infty, 100]$ , on  $[100, \infty)$
  - c.  $\frac{x^2}{(x+1)}$  on  $[0, 10]$ , on  $[-2, 2]$
  - d.  $3x^5 - 5x^3$  on  $(-\infty, \infty)$
  - e.  $-|x| - |x - 2|$  on  $(-\infty, \infty)$
5. Find the 3<sup>rd</sup> order Taylor series approximation to  $7x^5 + 4x^3 + 2x + 7$  at  $x_0=1$ .
6. Find inverses of
  - a.  $3x + 6$
  - b.  $\frac{1}{1+x}$
  - c.  $x^{2/3}$
7. Find  $f_{xx}$ ,  $f_{xy}$ ,  $f_{yx}$ , and  $f_{yy}$  for each of the following:
  - a.  $x^{1/2}y^{1/2}$
  - b.  $x^2y+xy^2-xy+4$
  - c.  $y\ln x + e^{xy}$
  - d.  $x^2 + y^2$
  - e.  $\frac{xy}{x^2+y^2}$
8. What is the slope of the level curve through  $(1,1)$  for each of the equations above?