MATH 111
REVIEW FOR EXAM II

- Be able to find a linear formula from a verbal description. Phrases to watch for:
  - "...is a linear function of..."
  - "...has a straight-line graph..."
  - "Items sell for \$0.15 each." (Tells you TR is linear with slope 0.15.)
  - "It costs you \$10 to make each Item." (Tells you TC is linear with slope 10.)
  - "... [something] changes at a constant rate c..." (Tells you that [something] is linear with slope c.)
- Be able to graph:
  - lines (indicating slope and intercepts)
  - parabolas (indicating vertex and intercepts)
- Remember this HOT TIP: If you are asked when some function is increasing/decreasing/highest/lowest/maximized/minimized/greatest/least, sketch a rough graph of that function and use the graph to answer the question.
- Given the formula for a function $f(x)$, be able to find formulas for:
  - the slope of the diagonal line through $f(x)$: $\dfrac{f(x)}{x}$
    Examples:
    * (average trip speed at time t) $= \frac{D(t)}{t}$
    * $AC(q) = \frac{TC(q)}{q}$
    * $AVC(q) = \frac{VC(q)}{q}$
    * $AR(q) = \frac{TR(q)}{q}$
    * overall rates of change
  - the slope of a secant line through $f(x)$: $\dfrac{f(x+h)-f(x)}{h}$
    Examples:
    * (average speed from t to $t+h$) = (average speed over the h-minute interval starting at t) $= \dfrac{D(t+h)-D(t)}{h}$
    * $MR(q) = \dfrac{TR(q+1)-TR(q)}{1}$ (how does this formula change if q is measured in hundreds or thousands of Items?)
    * $MC(q) = \dfrac{TC(q+1)-TC(q)}{1}$ (how does this formula change if q is measured in hundreds or thousands of Items?)
    * incremental rates of change
  - the area of the rectangle function: $A(x) = x \cdot f(x)$ (WS 14)
    Examples:
    * area of rectangle under price per item function gives $TR(q)$
    * area of rectangle under $AC(q)$ gives $TC(q)$

- Be able to deal with quadratics.
  - **READ** questions carefully and completely.
  - Remember that the vertex has two coordinates and the vertex formula only gives one of those.

    Some typical questions:
    * Find the time/quantity at which (some quadratic function) is largest/smallest/highest/lowest/maximized/minimized. (Give the "x"-coordinate of the vertex.)
    * Find the largest/smallest/highest/lowest/maximum/minimum value of (some quadratic function). (Give the "y"-coordinate of the vertex.)
    * Find the largest interval on which (some quadratic function) is increasing/decreasing. (Sketch the graph of the parabola to answer the question.)
  - Use the quadratic formula to *solve equations*.
- You should understand that the break even price is:
  - the smallest value of $AC(q)$; (So, if AC is a quadratic function of q, then the break even price is the "y"-coordinate of its vertex.)
  - the "y"-coordinate of the point where AC and MC intersect.
- You should understand that the shut down price is:
  - the smallest value of $AVC(q)$; (So, if AVC is a quadratic function of q, then the shut down price is the "y"-coordinate of its vertex.)
  - the "y"-coordinate of the point where AVC and MC intersect.
- Be able to find the quantity that maximizes profit. Either:
  - directly from the formula for profit: $P(q) = TR(q) - TC(q)$. If $P(q)$ is a quadratic whose graph is a parabola that opens downward, then profit is maximized at the q-coordinate of the vertex.
  - using marginal analysis: set $MR = MC$ and solve for q. If you get two positive quantities at which $MR = MC$, then remember that profit is maximized at the transition from $MR > MC$ to $MR < MC$.
- Be able to take a linear formula for instantaneous speed and get formulas for distance using the method developed in Worksheet 16. Be able to go backwards from MR and MC to TR and TC using formulas like those in Worksheet 16, #16 and 18.