Math 111 Exam 1 Quick Review

A **secant** line goes through a graph of a curve at two points.

A **diagonal** line goes through the origin.

A **tangent** line "just touches" the graph at a point with same slope as graph.

$f(b) - f(a)$ = "change in height from x=a to x=b"

$\frac{f(b)-f(a)}{b-a}$ = "slope of secant from x = a to x = b"
= "ave. rate"

$\frac{f(b)-f(0)}{b-0}$ = "slope of secant to f(x) from x=0 to x=b"
= "**overall** ave. rate"

$\frac{f(b)}{b}$ = "slope of the diagonal line to f(x) at x=b"

TR(q) = price · quantity	$TC(q) = FC + VC(q)$	$P(q) = TR(q) - TC(q)$
$MR(q) = \frac{TR(q+1)-TR(q)}{q+1-q}$	$MC(q) = \frac{TC(q+1)-TC(q)}{q+1-q}$	$MP(q) = MR(q) - MC(q)$
$AR(q) = \frac{TR(q)}{q}$	$AC(q) = \frac{TC(q)}{q}$	$AVC(q) = \frac{VC(q)}{q}$
D(t) = distance traveled	$ATS(t) = \frac{D(t)}{t}$	$AS(t) = \frac{D(b)-D(a)}{b-a}$
A(t) = total amount (stock, reservoir, *etc*)	Overall ave. rate = $\frac{A(b)-A(0)}{b-0}$	Average rate = $\frac{A(b)-A(a)}{b-a}$

For total amount graphs

Get your ruler out.

When asked for a rate: Draw the appropriate line, get two easy to read points, compute slope.

When given a rate: Draw a reference line, and slide your ruler parallel to the desired interval, read off the intersections.

For graphs that give rates or increments

Put ruler away!

Carefully read! Make a table of what the first several dots represent. Write down the relevant definitions. Then for each question, you will read an individual dot or value and use formulas/definitions to answer the question. You will not be comparing dots; that doesn't make sense.

Business Specific Applications:

1. Given a selling price, *p*:
   TR(q) = pq is a diagonal line with slope *p*.
   MR(q) = p is a horizontal line at *p*.

2. The graphs of TC(q) and VC(q) are the same just shifted by FC.

3. Profit, P(q), is the vertical gap between TR(q) and TC(q) (positive for TR above TC, negative for TR below TC).

4. **Profit is maximized at the quantity** when
   (a) Largest vertical gap TR is above TC.
   (b) The slope of the tangent to TR <u>matches</u> the slope of the tangent to TC, and
   (c) When MR(q) intersects MC(q).

5. **BEP = Break Even Price** is the price at which it no longer becomes possible to have a positive profit. It can be found by:
   (a) Drawing the lowest diagonal (TR) line that just touches TC and finding the slope.
   (b) Finding the lowest y-value of AC.
   (c) Finding the value at which AC=MC.

6. **SDP = Shutdown Price** is the price at which it no longer becomes possible to recover any fixed costs. It can be found by:
   (a) Drawing the lowest diagonal (TR) line that just touches VC and finding the slope.
   (b) Finding the lowest y-value of AVC.
   (c) Finding the y-value at which AVC=MC.

Algebra:
Be able to find the equation of a line.

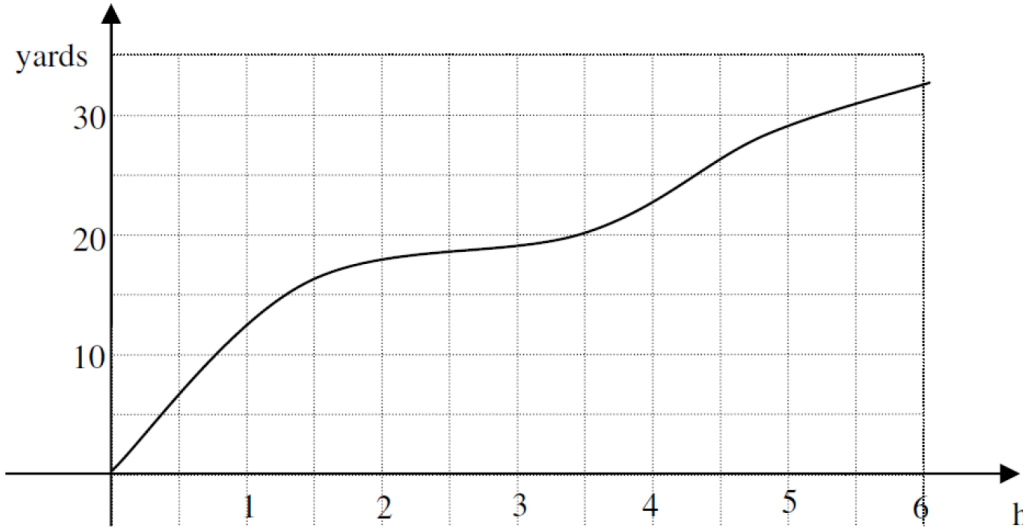
Be able to solve linear equations and inequalities.

Be able to set up and solve questions that are similar to the homework.

Be able to answer basic questions about linear TR/TC/Profit and MR/MC questions that involved linear functions.

Old Exam Questions:

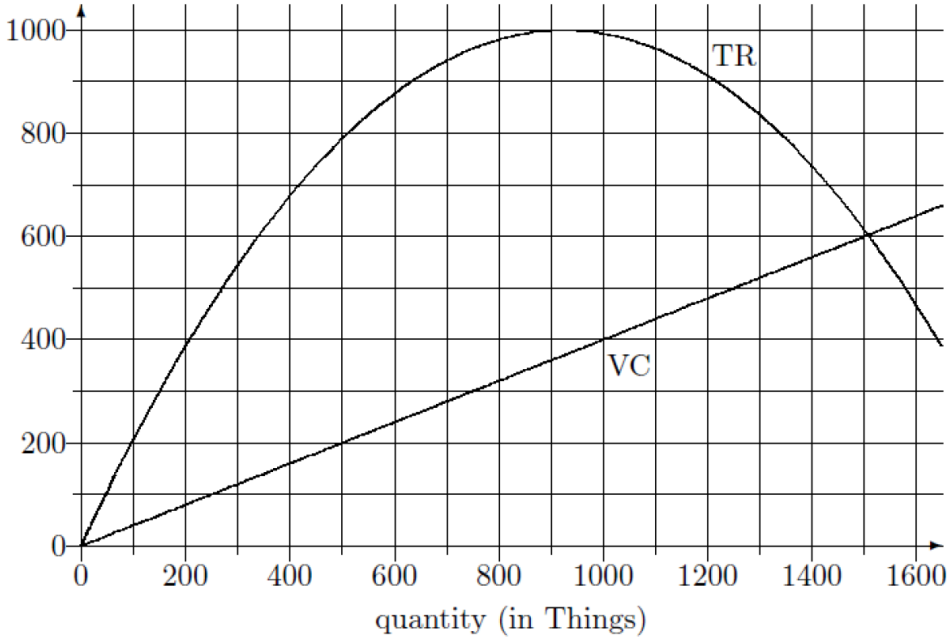
The graph below represents the **distance** (in yards), D(t), traveled by the Mars Rover vehicle up to time (in hours).



(a) How long did it take the Rover to travel the first 25 yards?

(b) What was the ATS of the Rover at two hours?

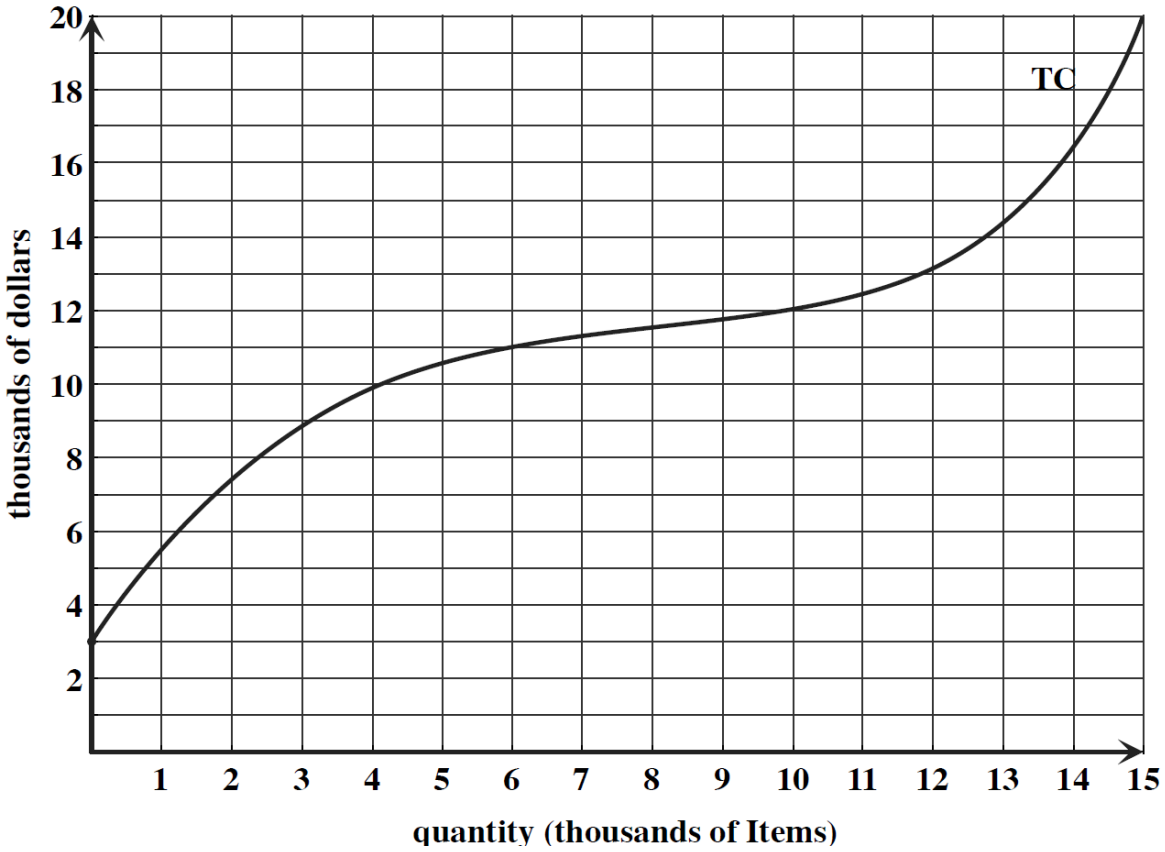
(c) Find a time t such that $\frac{D(t)-D(2)}{t-2} = 2.5$



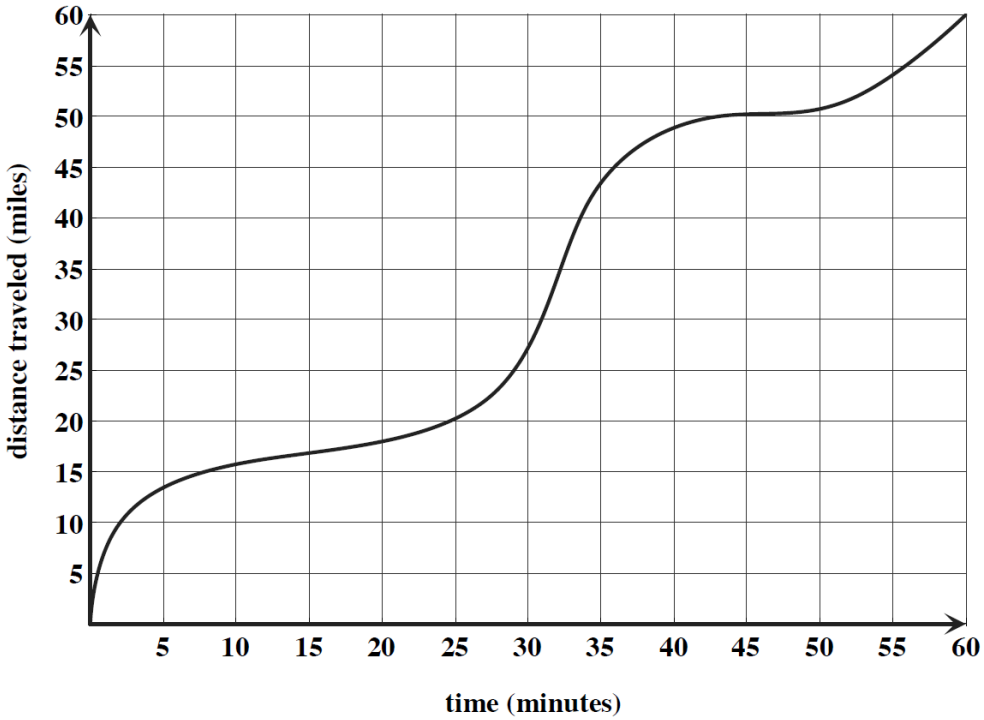
(a) Compute the MR at q = 300 Things.

(b) Find the longest interval over which the AR is between 0.50 and 0.80 dollars per Thing.

(c) Suppose FC = $300. What quantity will maximize profit and what is the maximum profit?



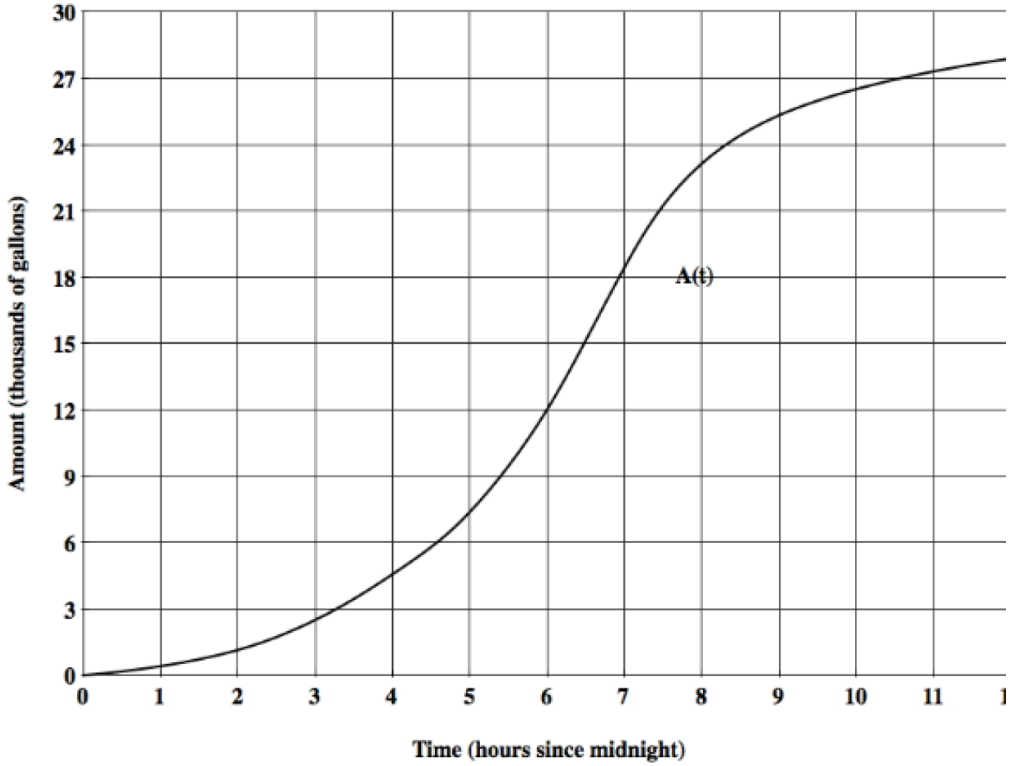
(a) Compute BEP.
(b) Compute MC at q = 5
(c) Compute change in TC from 7 to 15
(d) Compute AVC(6)
(e) If market price is $1.25, what is the value of maximum profit?



(a) Find the time at which ATS is 2 mile per minute.

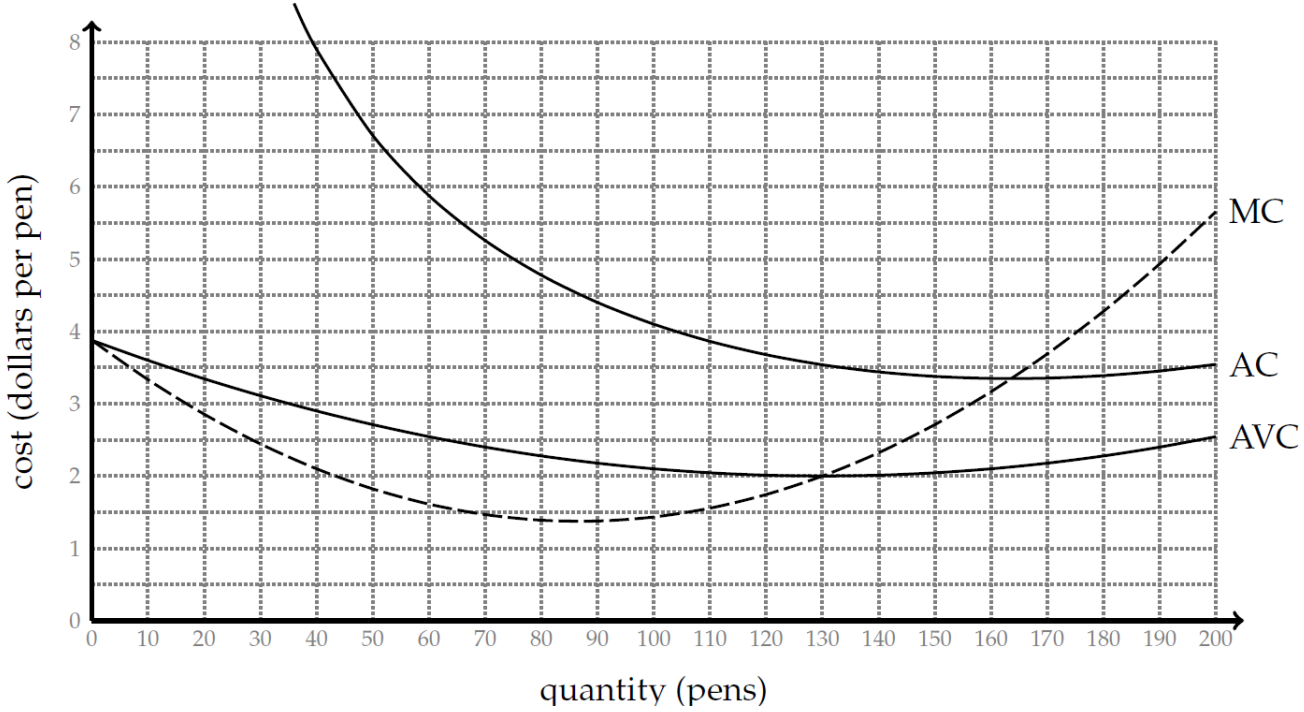
(b) The car's average speed from t = 15 to t = *b* is 0.5 miles per minute. What is *b*?

The graph below gives the total amount of water A(t) that flows into a reservoir.



(a) Compute the largest value of $\frac{A(t)}{t}$

(b) Find the average rate of flow of water into the reservoir from 8am to 11am.



(a) Compute the total cost of producing 90 pens.

(b) Suppose market price is $2.50 per pen. Should you shut down production?

(c) Suppose market price is $4.50 per pen. What is the maximum possible profit?