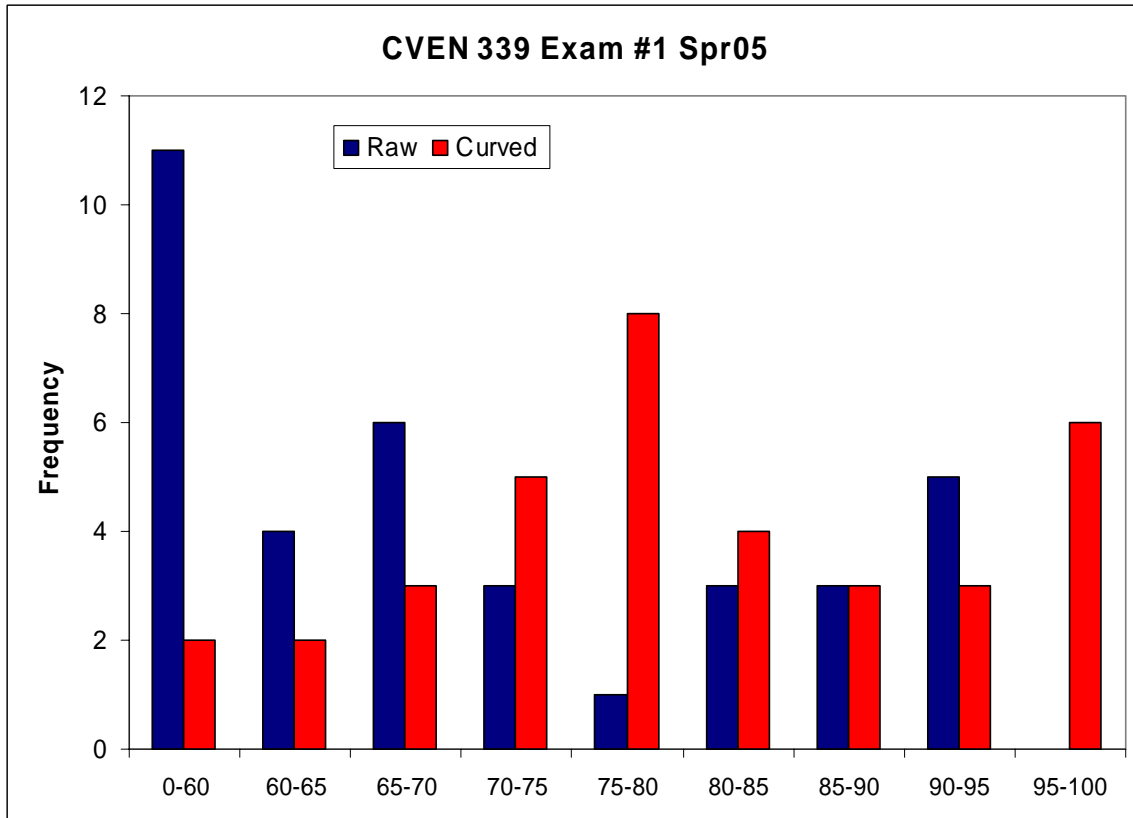


CVEN 339 – Spring 2005 – Exam #1

60 minutes allowed

	<u>Raw</u>	<u>Curved</u>
Median	67	79.1
Mean	68.3	80.0
Std. Dev.	17.3	12.0
High	95	98.5



Name: _____

CVEN 339 – Water Resources Engineering
Spring Semester 2005
Dr. Kelly Brumbelow, Texas A&M University

Exam #1

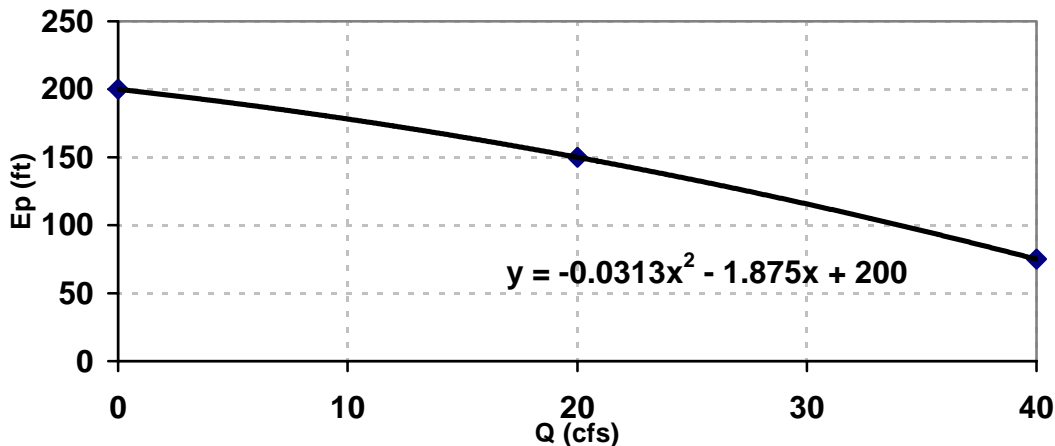
Open-book, Open-notes (2 questions)

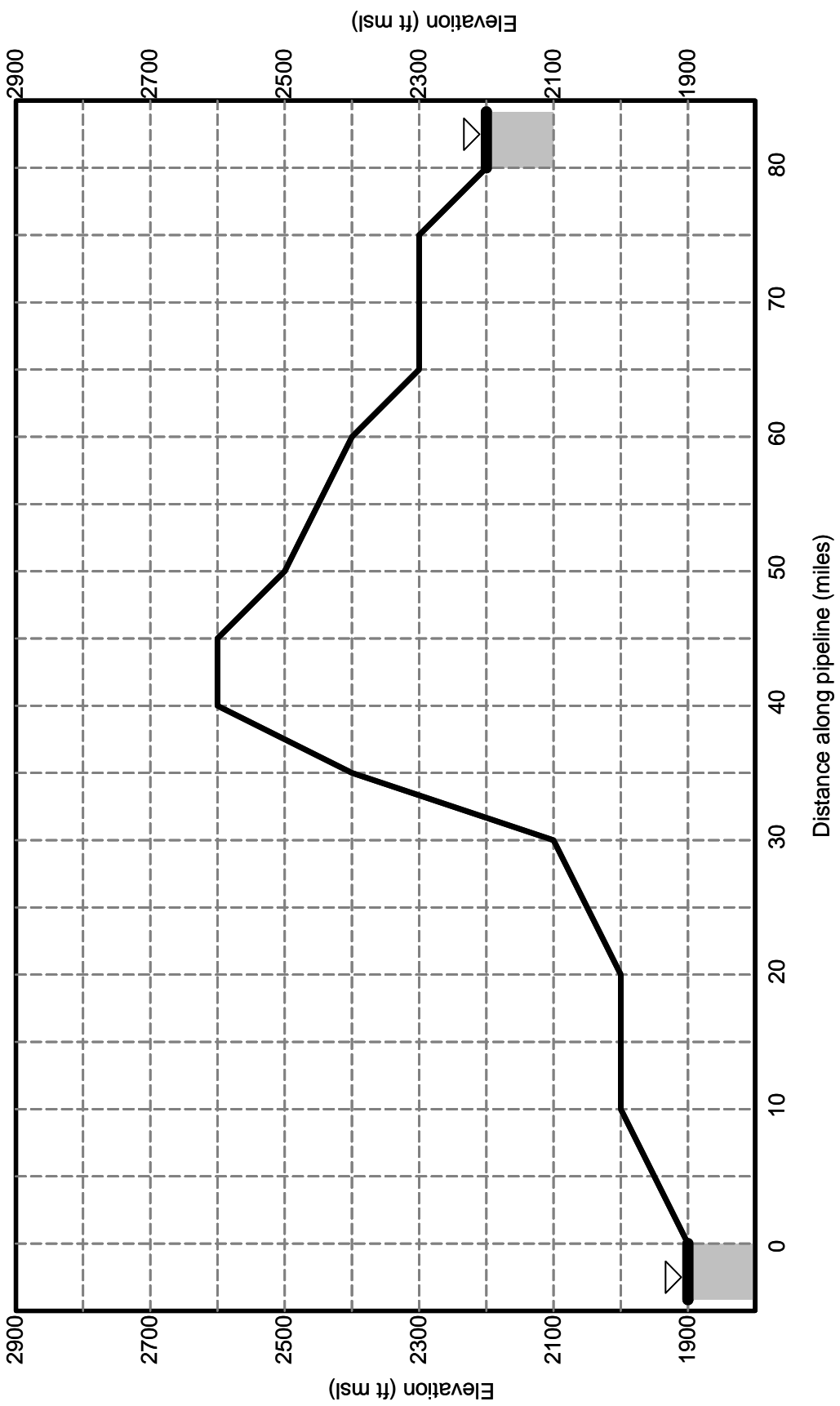
1. You are involved in the design of a 80 mile long water supply pipeline that will transmit water from the Howells Reservoir (elevation 1,900 ft msl) to Lake Elgar (2,200 ft msl), crossing the Stanford Range of mountains along the route. A scaled elevation drawing of the route is given on the next page, and the pipeline will be installed at ground level over its entire route. The pipeline will be 48 inch reinforced concrete ($\epsilon = 1.3$ mm) pipe. At least one pumping station will be needed at the Howells Reservoir. It is not yet known if other pumping stations will be needed. Although each pumping station will have a number of parallel pumps, the composite characteristic curve for each station as a whole has been determined and is given below. Negative pressures will not be allowed at any point in the pipeline. To prevent excessive pressures in the downhill section of the pipeline, a series of 8 pressure reducing valves will be installed with each valve having a minor loss coefficient $K_M = 1525$. No other minor losses need to be considered.

The pipeline and its pumping stations must be designed to meet 2 minimum criteria: (1) negative pressure is not allowed anywhere in the pipeline, and (2) minimum flowrate into Lake Elgar is 15.0 cfs.

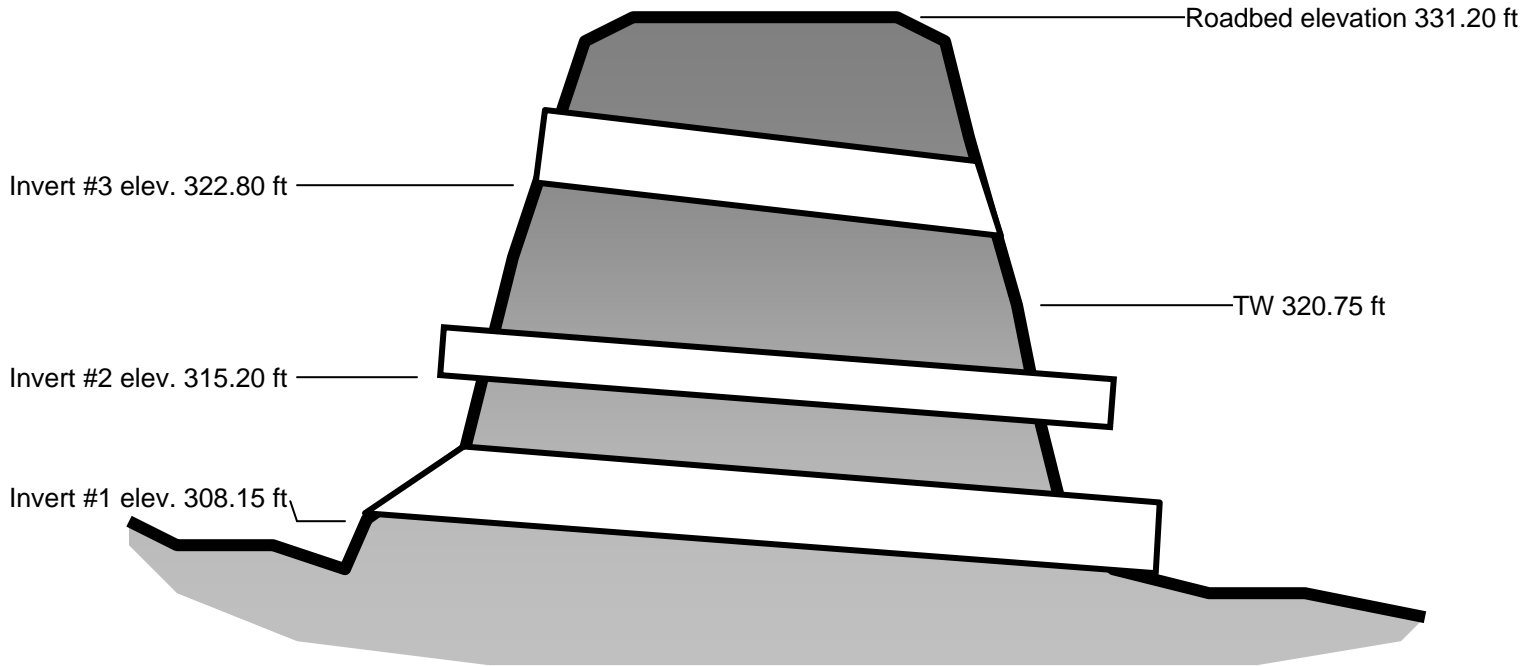
- (a) What is the minimum number of pumping stations that will be required along the pipeline?
- (b) What will be the flowrate into Lake Elgar?

(60 points)





2. Shown in the diagram below is a road embankment with a set of 3 culverts installed at different elevations. If the tailwater elevation is expected to be 320.75 ft msl, *what is the maximum flow that can be passed through the embankment without overtopping the roadway?*
 (40 points)



Culvert #1 (bottom): 36 in diameter reinforced concrete pipe ($\epsilon = 1.4$ mm)
 133.5 ft long
 mitered entrance

Culvert #2 (middle): 24 in diameter corrugated metal pipe
 126.4 ft long
 projecting entrance

Culvert #3 (top): 36 in diameter corrugated metal pipe
 103.2 ft long
 projecting entrance & mitered exit