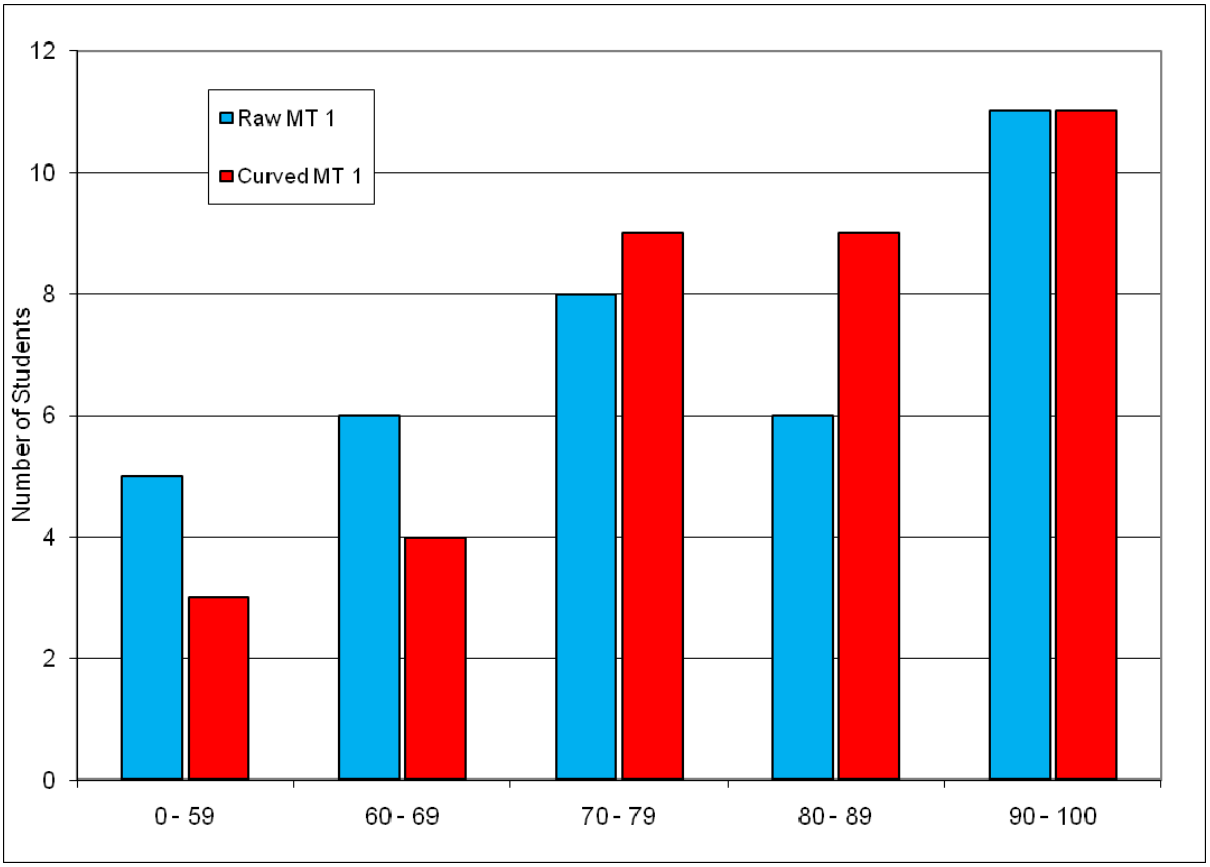
CVEN 339 – Summer 2009 – Exam #1

120 minutes allowed

36 Students

	Raw	Curved
Median	78.5	81.3
Mean	77.1	81.1
Std. Dev.	16.9	12.7
High	100	100
Low	41	55.3



Name: _____

CVEN 339 – Water Resources Engineering
Summer Semester 2009
Dr. Kelly Brumbelow, Texas A&M University

Exam #1

Open-book, Open-notes (7 pages, 3 questions); Time allowed: 120 minutes

1. A simple water distribution system is shown in the diagram below.

Determine the following:
(a) Flowrate (cfs) and direction of flow in each pipe; and
(b) Pressure (psi) at each node.

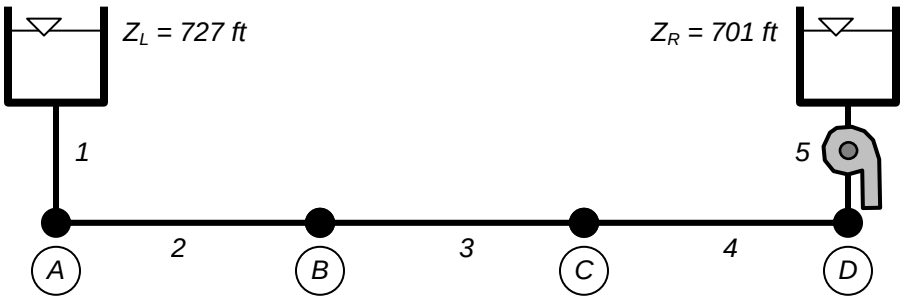
(40 points)

Node	Demand (cfs)	Elevation (ft)
A	1.5	600
B	2.2	615
C	0.8	592
D	1.1	584

Pipes 1 and 5: L = 150 ft, D = 14 in, f = 0.017

Pipes 2-4: L = 2000 ft, D = 12 in, f = 0.014

Pump (flow is from FGN *R* to node *D*):
[E_P] = ft, [Q] = cfs
$E_P = -0.625\ Q^2 - 1.25\ Q + 30$

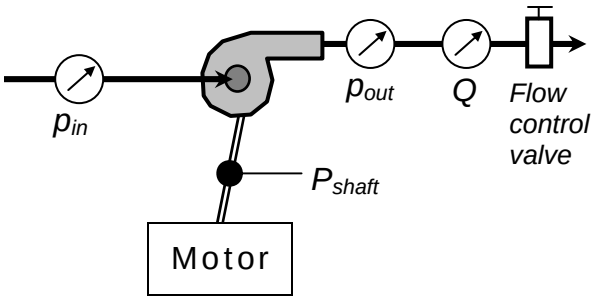


(Work space for #1)

2. A pump installed several years ago has been field tested to assess its current condition. The original manufacturer's pump data is given on the next page. The testing setup is shown in the schematic below, and test data is given in the table.

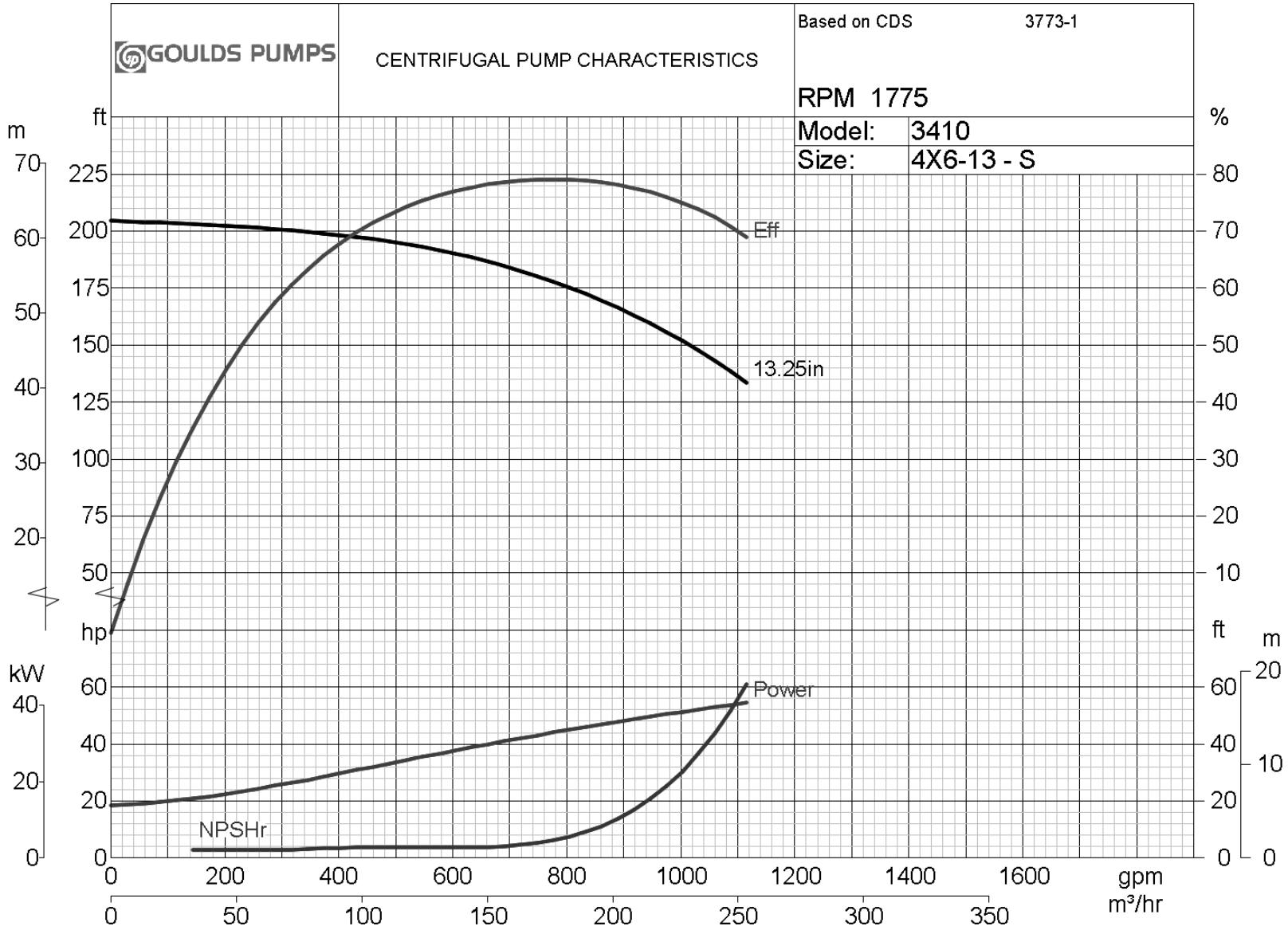
(a) Based on the test data, determine the pump's current characteristic curve and draw it on the next page; and
(b) Determine the value of the pump's hydraulic efficiency at its current best efficiency point.

(40 points)



{1 hp = 550 ft·lb/sec} {1 cfs = 448.8 gpm}

Trial	p_{in} (psi)	p_{out} (psi)	Q (gpm)	P_{shaft} (hp)
#1	5.2	85.4	503	38
#2	6.8	80.5	692	48
#3	4.1	61.3	1008	62



Item No: ITEM 001
Service:
Rated Flow: 1,000.0 gpm
Rated TDH: 150.0 ft
Imp. Diam.: 13.2500 in

Rev.: 0

ITT

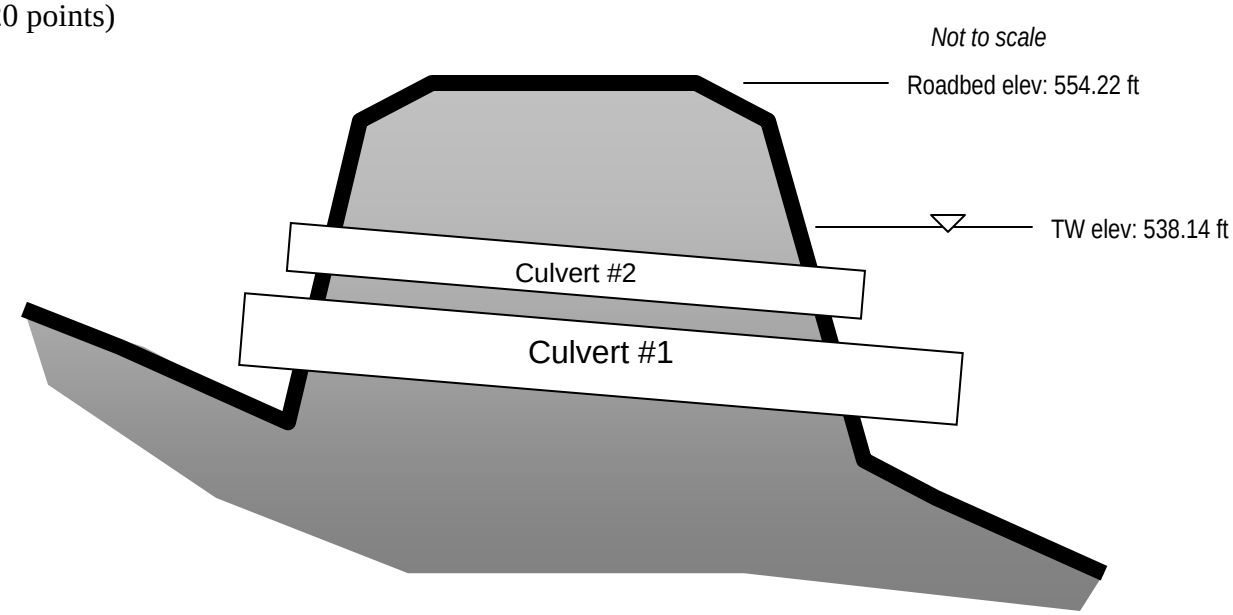
(Work space for #2)

3. A roadway next to a lake depends for drainage on 2 culverts installed in parallel (sketched below). The lake water surface elevation is constant at the level indicated in the drawing. The DOT is concerned about the possibility that objects may enter a culvert inlet and clog it completely. It is possible to install grates across the inlets, but these will entail a new minor loss (K_M = 0.26).

For maximum headwater elevation, determine the total flow capacity of the culvert pair for the following scenarios:

(a) No inlet grates, both inlets clear of obstructions
(b) No inlet grates, culvert #1 clogged (no flow)
(c) Both inlet grates installed, no clogs

(20 points)



Culvert	Diameter (in)	Length (ft)	Material (*n* value)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)
#1	48	135.6	Concrete (0.015)	532.1	517.3
#2	24	108.7	Corr. Metal (0.025)	537.9	530.6

(Work space for #3)