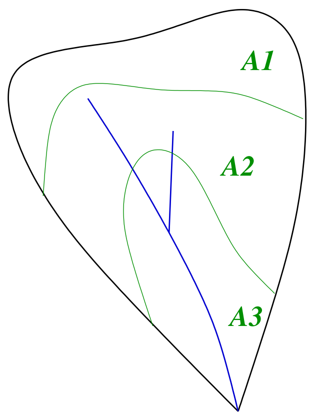
TD 603- Tutorial 2b

1. Consider the maps given at the links below and the points on map. Outline the watershed for each of the points shown:

   - `http://www.cse.iitb.ac.in/ sohoni/TD603/TutMap1.jpg`
   - `http://www.cse.iitb.ac.in/ sohoni/TD603/TutMap2.jpg`

2. If the normal at a given point p is $[0.05, 0.1, 1]$, what is the direction of steepest descent? What is the slope, i.e., θ and $\tan(\theta)$.

3. Please study the following figure of a watershed covering about 3000 Ha. The watershed may be divided into 3 regions, A_1, A_2 and A_3, where A_1 is sloping with bad soil and is not used for agriculture. A_2 allows only for *kharif* while A_3 allows for both *rabi* and *kharif*. Each crop is of 15 weeks with a gap of 2 weeks between *rabi* and *kharif*. The ET load is uniform with an ideal value of 4mm per day. The number I gives the infiltration fraction. GW moves from A_i to A_{i+1}. Its is modeled here as follows. The fraction F of the total GW stock at A_i moves to A_{i+1} and is available to it after 2 weeks. On the other hand, run-off moves immediately.



Name Name	Area (Ha.)	I	F	ET (mm)
A_1	700	0.4	0.5	200
A_2	1500	0.5	0.3	400
A_3	800	0.6	0.1	650

Suppose that the village decides to execute the above cropping pattern whose details are given in the last column above (where ET for the net ET load). Assume a rainfall of 700mm in the year, with a uniform 10mm/day for 10 weeks.

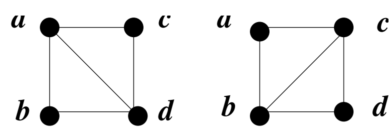
Assume that GW is the only stock and all regions begin with zero. *Kharif* is planted 1 week after the start of the monsoon and *rabi* is planted, 2 weeks after *kharif* has ended. Prepare an end-of-week water balance for 32 weeks for each region. An example appears below.

A_2	Week 4	Ha.m.	
x	GW stock		
a	Rain	105	$1500 \times 0.01 \times 7$
b	Infiltration	52	available for crop
c	Run-off	53	
d	GW from A_1 in Week 2		
e	Total GW stock available for ET	$x + b + d$	
f	Desired ET	42	
g	Actual ET	$\min(42, e)$	
h	Intermediate GW	$e - g$	
k	GW outflow to A_3	$F \cdot h$	
x	Final GW stock	$h - k$	

4. A square in a DEM grid is composed of 4 points a, b, c, d sampled at 100m apart. The elevations are

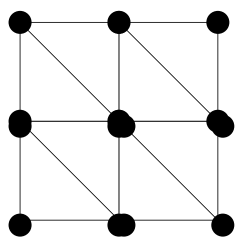
210	213
212	214

. Consider the two possible triangulations as shown in the figure.



Label the diagonal as being convex (i.e., a ridge) or concave (i.e., a valley). Prove that for any such z-values, that one will be convex and the other concave, will always hold.

5. Consider the grid of 9 locations, again sampled at 100m. The grid and the z-values appear below.



100.5	101	101.5
102	100	100.5
101	99.5	100

Each node represents an area of 100×100 meters. Now suppose that there is a run-off of 10mm in an hour and it flows down by the edge with the maximum slope. For each node, compute the net amount of water it will receive in an hour.