Mathematical Studies

Pre-Course - Ways of Thinking

Day 2 Summary

Firstly a 30 minute review of Day 1 and then ….

God makes rain.

Humans control (to a degree) the flow once it hits falls

In more recent times engineers have build lakes to store storm water

Construction of Lake Hugh Muntz started in the early 1980s. The lake is in a well-established urban area in Mermaid Waters and is about 17 hectares in size and up to 12 metres deep in places. It holds around 704,472 metres3 of water.

How many PAC swimming pools is that?

The shape of the lake was designed to ensure maximum waterfront land, resulting in an extensive shoreline of 3298 metres.

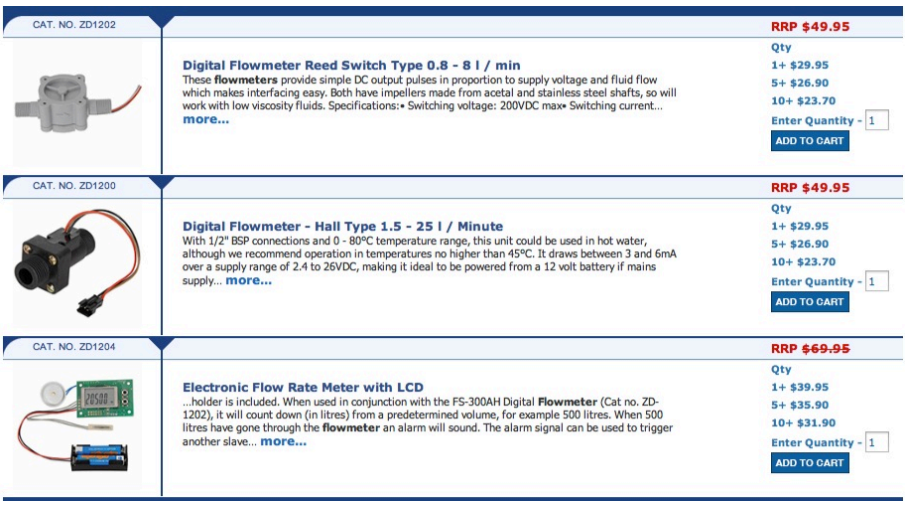
Run-off from the catchment of around 43 hectares is controlled through 16 constructed stormwater pipes that discharge into the lake at various locations around the shoreline. Water discharge from the lake is via overflow pipes at Barrier Reef Drive and into the adjacent canal.
Prior to urban development, the site was part of an extensive wetland and floodplain, consisting of vegetation communities such as Melaleuca swamp land. There is little evidence of these historical communities remaining.
A range of recreational activities occur on the lake including fishing, swimming, kayaking, surf skiing and paddle boarding. Organised surf club and triathlon events also utilise the protected waters of the lake.
Reference: Australian Wetlands 2008, Lake Hugh Muntz Management Plan prepared for the Gold Coast City Council by Australian Wetlands, Gold Coast, Queensland.

South Australia has similar lakes, one is at Campbelltown.

Review Task 1

What do the engineers have to take into account when designing these lakes?

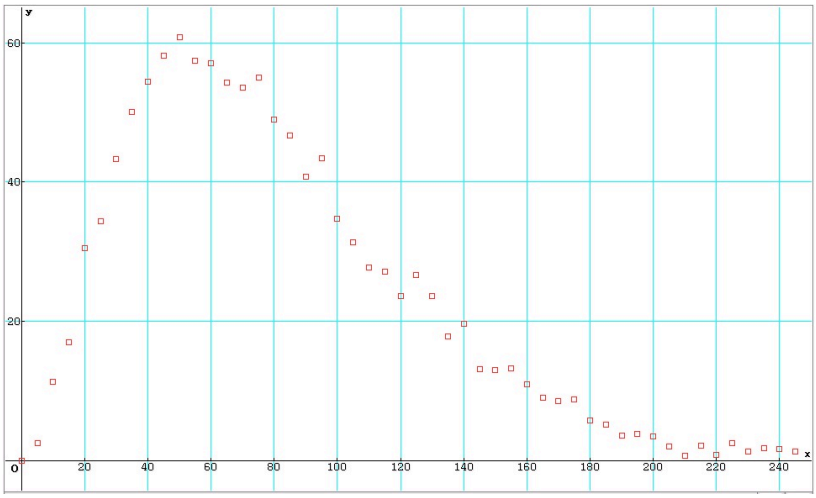
Catching water in measuring jugs does not work too well for the volumes involved in these situations – enter flow meters.



A rain-storm for analysis

t - time (minutes)	***R*** - flow rate (litres/min)	***t*** - time (minutes)	***R*** - flow rate (litres/min)
0	0.00	125	26.20
5	2.50	130	23.60
10	11.30	135	17.80
15	17.00	140	19.60
20	30.50	145	13.10
25	34.30	150	13.00
30	43.30	155	13.20
35	50.10	160	10.90
40	54.40	165	9.00
45	58.10	170	8.50
50	60.80	175	8.70
55	57.40	180	5.70
60	57.00	185	5.10
65	54.30	190	3.60
70	52.60	195	3.80
75	55.00	200	3.50
80	49.00	205	2.00
85	46.70	210	0.70
90	40.80	215	2.10
95	43.40	220	0.80
100	34.70	225	2.50
105	31.30	230	1.30
110	27.70	235	1.80
115	27.10	240	1.60
120	23.60	245	1.30

This graph is of R vs t



Given that:

$$R = \frac{\Delta V}{\Delta t}$$

$$\Delta V = R \times \Delta t$$

So we can calculate the volume of water by determining the area under the 'curve' and above the *x-axis*. (Or using the clever averaging that leads to a rectangle!)

Review Task 2

Write (and draw pictures) a summary account of the most important ideas of the first two days.

Review Task 3

The picture below is of the first ever mass produced television set. It was release in the US in 1946.

The table below provides data about the uptake of the TV – a never before sold product – it was a truly new experience for consumers. The table shows the % of households in the US that had purchased a TV in the corresponding year.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
% of households	0.6	1.2	2.1	5.4	9	23.5	34.2	44.7	55.7	64.5	71.8	78.6	83.2	85.9	87.1	88.8	90	91.3

Black and white television, 1 = 1946

Draw a graph of **% households** vs **year** using some form of technology.

Make a hand drawing of the plot below, but represent the situation is a curve of best-fit rather than the data.

Estimate when the sales were "at their best".
Explain how you arrived at your answer.

Review Task 4

The picture below is of a gas well in Moomba – where the natural gas that fuels your stoves and heaters comes from – massive gas reserves trapped underground being tapped and sent to us.

Month end date	Month #	Average daily flow rate R (MMscf/d)
5/31/1998	1	51.717
6/30/1998	2	47.724
7/31/1998	3	36.717
8/31/1998	4	31.755
9/30/1998	5	28.066
10/31/1998	6	22.248
11/30/1998	7	22.199
12/31/1998	8	19.154
1/31/1999	9	16.377
2/28/1999	10	14.611
3/31/1999	11	13.403
4/30/1999	12	12.72

The table above provides data about the life of one gas well. A flow meter is attached to the well to monitor flow. Flow is measured in millions of cubic feet per day.

Draw a graph of **% households** vs **Year** using some form of technology.

Make a hand drawing of the plot below, but represent the situation is a curve of best-fit rather than the data.

Estimate how much gas was removed from this reserve. Explain how you reached your answer.