EGC Eastern Goldfields College
Upward & Onward

Student Name:_____

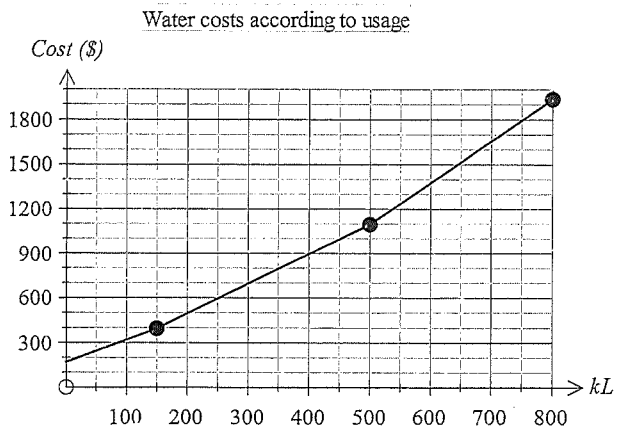
Applications – Unit 2 - 2018
Investigation 2 – Piecewise and Step Functions

Working Time: 50 mins | **Calculator, No notes** | Total Marks: 37

Task weighting: 5% (U2 10%)

VALIDATION

Question 1 – 12 marks (1, 2, 2, 2, 2, 2, 1)
Jon pays his water bill every two months. It consists of a fixed charge for the connection and sewage plus a fee that varies according to the amount of water used. The graph of the pricing schedule is shown below.



(a) Estimate the total fixed charge.

$180 ✓

(b) At what levels of water usage do the rates at which water is charged vary?

150 KL ✓ and 500 KL ✓

(c) Is it true to say that "when the rates vary, they are increasing"? How can you verify your conclusion from the graph provided?

Yes ✓, as the gradient/slope gets steeper ✓

(d) Determine the approximate charges for the following water usages.

(i) 100 kL $310 ✓ (ii) 650 kL $1520 ✓ (both for mark) (iii) 50 000 L $250 ✓

(e) Use the graph to determine the rate at which water is charged when the consumption is over 500 kL.

✓ $\frac{850}{300}$ ~ $2.80/KL ✓ (Accept $2.70 – $2.85)

(f) Explain how you can determine the equation of the first section of this piece-wise graph.

Intercept is 180 $m = \frac{220}{150} = 1.47$ (accept 1.5) ✓

Cost = 1.47 x KL + 180. ✓

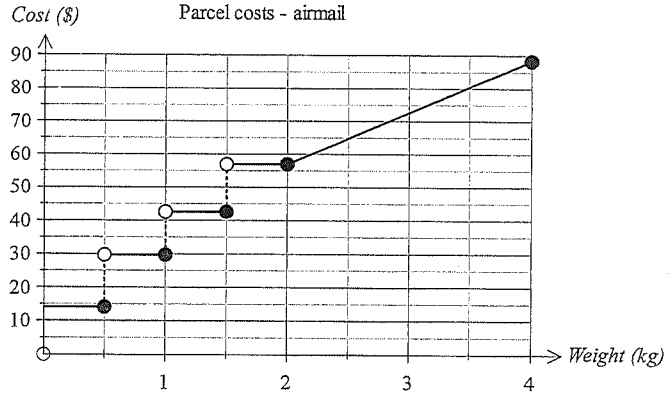
(g) The second section of this piece-wise graph has the equation

Cost = 2 x Number of kL + 95

What is the significance of "2" in the equation above?

$2 per KL of water used.

Question 2 – 10 marks (1, 3, 1, 1, 2, 2)
The graphs below show the cost of posting parcels to locations overseas in 2014. The first graph is for transport by air and the second is for sea transport.



(a) If a parcel weighed 3 kg, which mode of transport is cheaper?

Sea ✓

(b) Consider the following statement.

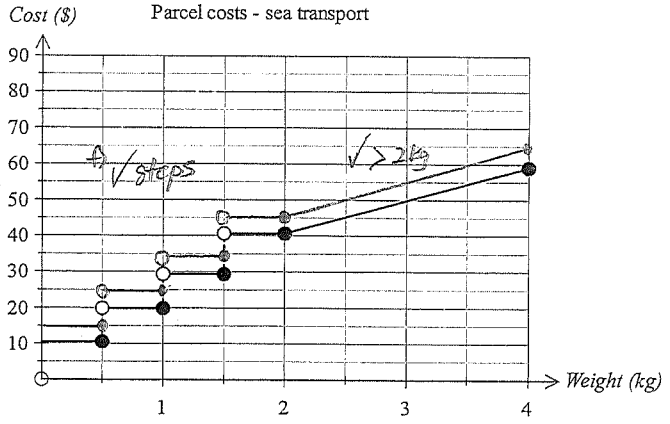
For the same weight, it is always cheaper to send the parcel by sea than by air

Is this statement always true? How would you know this from the graphs?

Yes ✓

All lines on sea graph are below/lower than air between 0 – 2kg ✓

Between 2–4kg the gradient/slope of sea is less than air ✓



(c) There is a change to pricing when the parcel is over 2 kg.

A. The price is set for a fixed range of weights
B. The price increases by a fixed amount per kg

Which of the two statements above applies when the parcel is

(i) under 2 kg in weight A
(ii) over 2 kg in weight B ✓ must get both correct for mark.

(d) Determine the rate at which the cost changes per kg, when a parcel to be sent overseas by sea, weighs more than 2 kg.

$\frac{60-50}{4-3} = \frac{10}{1}$ ↑10/kg ✓

(e) Determine the gradients of the following lines - the lines linking the costs of postage for parcels

(i) sent overseas by air and weighing less than 500 g

0 ✓

(ii) sent overseas by sea and weighing over 2 kg

10 ✓

(f) Consider the following change to the cost of sending a parcel overseas by sea transport.

The price will rise by $5 within each range of weights between 0 and 2 kg.
The cost per kg for parcels weighing more than 2 kg will remain unchanged.

Add a new graph to the second graph to reflect this change. On graph.

Question 3 – 15 marks (5, 7, 3)

In the 2014 Commonwealth games, the triathlon consisted of three stages: a 1500 m swim followed by a 40 km bike ride and then a 10 km run for both the men's and the women's events. The winners completed the three stages in the times below. SPEED = DISTANCE (Km) ÷ TIME (Hrs)

	Swim	**Cycle**	**Run**
Men's Event (actual time)	18 mins	58 mins 43 sec	31 mins 9 secs
Time in min (1 d.p.)	18 mins	58.7 mins	31.2 mins
Average Speed (km/h)	5 km/h	40.9 km/h	19.2 km/h

	Swim	**Cycle**	**Run**
Women's Event (actual time)	19 mins 37 secs	1 h 4 mins 1 sec	34 mins 21 secs
Time in min (1 d.p.)	19.6 mins	64.0 mins	34.4 mins ✓✓
Average Speed (km/h)	4.6 km/h	37.5 km/h	17.4 km/h

(a) Complete the Women's table above ✓ ✓ ✓ -1 error.

(b) Use the graph paper provided and on the same set of axes, draw two piece-wise graphs: one for the men's event and the other for the women's event, showing the distance covered for the time taken.

(c) What conclusions can you draw about each winner's performance on the different stages of the triathlon?

- Female slower than male for each stage ✓✓
- For both genders the cycle leg is fastest
- " " " " swimming leg is slowest

3 valid points

- For both the run is 4 x faster than the swim (approx)
- " " the cycle is 2x faster than the run (approx)

or similar

END OF INVESTIGATION

MEN (0,0) (18, 1·5) (~77 76.7, 41.5) (~108 107.9, 51.5)

WOMEN (0,0) (~20 19.6, 1·5) (~84 83.6, 41.5) (118, 51.5)