

*Applied Mathematics 30*

**Student Project:  
Kayaking the Clayoquot  
Sound, Tofino, B.C.**



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# *Applied Mathematics 30*

## *Project: Kayaking the Clayoquot Sound, Tofino, B.C.*

### *Introduction*

Your graduating class is planning a four-day, three-night kayaking trip. You need to explore the costs and the mass of supplies needed for the trip. Using tidal charts, you will also plot the course that you will travel by kayak.

### *Part A*

Through fundraising, the class has covered the cost for everyone to travel to Tofino, which is the departure point for the kayaking trip. Therefore, any costs associated with travelling to and from Tofino should not be included in your budget. However, you will need to budget \$600 for supplies and the cost of renting equipment. The list on pages 2 and 3 shows the supplies and equipment required for the kayaking trip. Some of the items on the list will not need to be purchased because they are either part of the kayak rental or it is assumed that you have these items. For such items, N/A appears in the cost column of the list. You will need to research the cost of the items that you need to purchase. You will also need to research the cost of renting a kayak for 4 days. Include 6% GST in the cost of all items, except food, that you will need to buy.

The kayak that you will rent has a maximum capacity of 160 kg. This includes your mass as well as the mass of all your equipment and supplies. The mass of some of the items is provided. You will need to research the mass of the items for which no mass is provided.

The following list of web sites may help you in your research. You may also refer to catalogues, or you may price items at stores.

[www.tofino-kayaking.com](http://www.tofino-kayaking.com)

[www.mec.ca](http://www.mec.ca)

[www.tofino-bc.com](http://www.tofino-bc.com)

[www.jamies.com](http://www.jamies.com)

[www.totemoutfitters.com](http://www.totemoutfitters.com)

[www.tofino.worldweb.com](http://www.tofino.worldweb.com)

**Note:** Web site addresses sometimes change. If the web sites listed above are not available, use a search engine and type in keywords such as *kayaking* and *Tofino*.

1. Design a spreadsheet that will allow you to keep track of the cost of supplies and the kayak rental, including GST. Your mass and the mass of your equipment and supplies must also be included on the spreadsheet. Make sure that your costs stay within the \$600 budget and that the total mass does not exceed 160 kg.

- Supply a printout of your spreadsheet showing the masses, costs, and totals.

	Cost (\$)	Mass (kg)
<b>Kayak Equipment</b>		
Kayak rental		N/A
Paddle with drip rings	N/A	
Spray skirt	N/A	
Collapsible spare paddle	N/A	
Waterproof storage bags (3)		
Personal flotation device (Coast Guard Approved)	N/A	
First aid kit	N/A	
Sponge	N/A	
<b>Safety Essentials</b>		
Sunglasses	N/A	
Sunscreen and lip balm	N/A	0.35
Water bottle	N/A	
Nylon cord (50 feet)	N/A	0.25
Waterproof/windproof matches		
Flashlight	N/A	
Pocket knife		
Emergency space blanket		
Whistle	N/A	0.01
Insect repellent	N/A	0.26
Resealable plastic bags	N/A	0.30
<b>Clothing</b>		
Shorts, T-shirts, long pants, long-sleeved shirt, socks, long underwear, bathing suit, etc.	N/A	
Insulated hat/rain hat/sun hat	N/A	0.20
Fleece jacket	N/A	
Rain suit (jacket and pants)	N/A	
Gloves	N/A	
Quick-drying towel	N/A	0.50
Paddling shoes or wetsuit booties		
Hiking shoes or all-terrain sandals	N/A	
<b>Personal</b>		
Hygiene items (toothpaste, soap, etc.)	N/A	
<b>Camping Gear</b>		
Compact tent (1- or 2-person)	N/A	
Sleeping bag and pad	N/A	
Backpacking stove and one 650 mL fuel bottle		
Cooking pot	N/A	
Cup, plate, and eating utensils	N/A	
Bag for hanging food off ground	N/A	
Daypack for side trips out of kayak	N/A	
Camping chair		

	Cost (\$)	Mass (kg)
<b>Optional Items</b>		
Fishing gear		
Digital camera		
Sewing kit		
Snorkel and mask		
Guidebooks		
Binoculars		
<b>Food</b>		
Four breakfasts and four dinners (provided)	70.00	9.00
Snacks		
Four lunches		
Water	N/A	30.00

- In which of the cells in your spreadsheet are formulas used? Indicate which formulas are used in these cells.

**Part B**

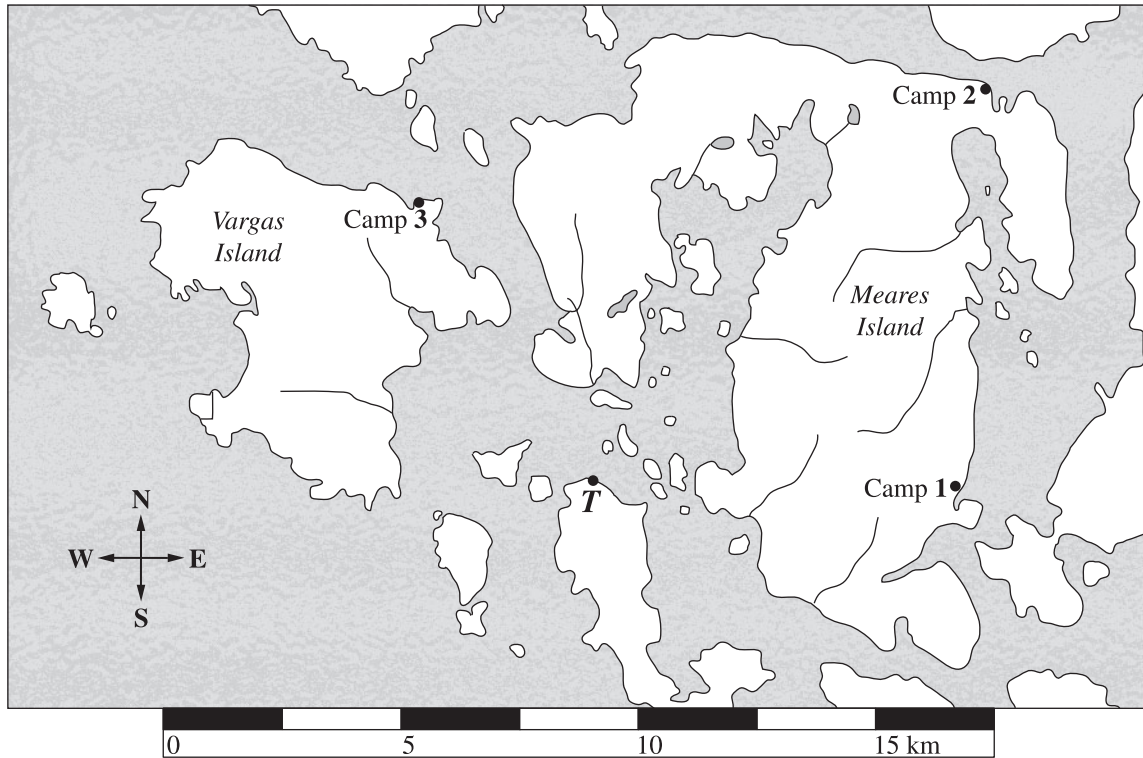
The table below shows data from the kayaking trip taken by a previous graduating class.

<b>Previous Graduation Kayak Trip</b>	
<b>Student</b>	<b>Total mass of student, equipment, and supplies (kg)</b>
Marc	148
Carole	126
George	135
Colleen	129
Phil	137
Ahmed	146
Trahn	158
Ralph	126
Lisa	132
Jane	131

1. Determine the mean and standard deviation of the 10 masses in the table.
2. Determine the  $z$ -score that corresponds to the maximum allowable mass of 160 kg.
3. Use the total mass, which must include your own mass, from your spreadsheet to determine the percentage of students that can be expected to have a greater total mass than your total mass. Assume that the total masses form a normal distribution with the same mean and standard deviation as the data from the previous graduation kayaking trip.

### Part C

On the map below,  $T$  represents Tofino, your departure and return point. The map also shows the location of the camps for each of the three nights. On the first day, you will kayak from  $T$  to Camp 1; on the second day, you will kayak from Camp 1 to Camp 2; on the third day, you will kayak from Camp 2 to Camp 3; and on the fourth day, you will kayak from Camp 3 to  $T$ . You can use vectors to do the initial planning of your kayaking route.



1.
  - On the map above, use vectors to plot your kayaking course for each leg of the trip.
  - Using your vector diagrams, determine the distance that you will kayak each day.
  - Determine the travel time for each leg of the trip, assuming an average travel speed of 5 km/h.

### Part D

The table below lists the height that the tide reaches and the time of day at which that height occurs for the four days of the trip. The time is given in terms of the number of hours and minutes after midnight on June 30: the first two digits are the number of hours and the last two digits are the number of minutes. For example, the fifth time entry, 2826, indicates 28 hours and 26 minutes after midnight on June 30, which is 4:26 A.M. on July 2.

Time (hours and minutes after midnight on June 30)	Tide height (m)
0333	0.7
0947	2.7
1518	1.4
2130	3.4
2826	0.6
3446	2.8
4011	1.5
4617	3.4
5313	0.5
5936	2.9
6459	1.5
7100	3.4
7755	0.4
8422	2.9
8944	1.6
9541	3.4

1. Use the information in the table above to determine the best possible start time for each day of kayaking so that you are paddling in the direction of the tide and not against it. This means that the tide must be rising for the first day (from the departure point,  $T$ , to Camp 1). The direction of the tide does not matter for the second day (from Camp 1 to Camp 2); it must be falling for the third day (from Camp 2 to Camp 3); and it must be rising for the fourth day (from Camp 3 to the return point,  $T$ ). Explain your choice of start time for each day.
2. Convert the time in hours and minutes after midnight on June 30 from the table into decimal hours. Input these values along with the tide height, in metres, into a spreadsheet. Use the spreadsheet utilities to draw a scatter plot graph, with the points connected by a smooth curve, that models the time changes of the tide for these four days. Supply a printout of both the spreadsheet and the graph.

3.
  - Use the same data that you used in the spreadsheet to determine a regression equation with your calculator. Explain your choice of type of regression.
  - Graph the regression equation using an appropriate window setting.
4. Compare the graph that you created using the spreadsheet utilities with the graph that you created using your calculator and a regression equation. Which graph is the best model of tide height versus time in decimal hours? Justify your answer. You may wish to investigate west coast ocean tides at [www.physicalgeography.net/fundamentals/8r.html](http://www.physicalgeography.net/fundamentals/8r.html) to help in making your choice.

**Note:** Web site addresses sometimes change. If the web site given above is not available, use a search engine and type in keywords such as *ocean tides*.

### ***Part E***

During the course of this project, you have been exposed to various aspects of a kayaking trip. You have answered questions related to budgeting, total masses, and tides. Prepare a poster for the next graduating class that illustrates the mathematical skills used when planning the kayaking trip.