

Lost at Sea

ID: 13692

Time required

45 minutes

Activity Overview

In this activity, students will gather data by recording estimates of how long they think they can hold their breath and the actual amount of time. Then, they will create scatter plots and box plots to analyze the data.

Topic: Geometry & Measurements

- *Ordered pairs, graphing ordered pairs*
- *Scatter plots, box plots*

Teacher Preparation and Notes

- *Prior to this activity, students should have had some experience with graphing scatter plots and box plots.*
- *TI-Navigator is not required for this activity, but an extension is given for those teachers that would like to use it.*
- ***To download the student worksheet and TI-Navigator files, go to education.ti.com/exchange and enter “13692” in the quick search box.***

Associated Materials

- *MGAct26_LostAtSea_worksheet_TI73.doc*
- *MGAct26_LostAtSea_Nav01_TI73.act*
- *MGAct26_LostAtSea_Nav02_TI73.act*

Suggested Related Activities

To download the activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Scatter Plots (TI-73 Explorer) — 2255*
- *Measure Up! (TI-73 explorer) — 3880*
- *The Candy Caper (TI-73 explorer) — 4225*

Problem 1 – Estimate Vs. Actual Time

The scenario given for this problem is that Brian has dropped his watch into 20 feet of water. He needs to dive down nearly 20 feet, locate the watch, grab it, and swim back to the surface. Students will gather their own data about how long they can hold their breaths and then plot that data to analyze it.

Questions 1–3

First have students estimate how long they think they can hold their breaths. Then, perform 3 timed trials for each student. Students will sometimes want to average the three trials but it is appropriate to simply use the longest trial in each case.

Question 4

After students have gathered their data, they will need to enter the estimated values (x-values) into **L1** and the actual times (y-values) into **L2**.

To enter the lists, press **[LIST]**. If there are already values in L1 or L2, move to the top of each list and press **[CLEAR]** **[ENTER]** to empty the list before starting.

Then, have students enter the values, pressing **[ENTER]** after each data point. Sample data is shown at the right.

Students will then set up a scatter plot of L1 (estimated) versus L2 (actual). Press **[2nd]** **[Y=]** to access the stat plots. Set up **Plot1** as shown.

Spend time helping students find an appropriate window in which to graph their data. A sample window is shown but it may need to be adjusted based on your class data. Change the **Xmin** and **Xmax** and this will automatically adjust **ΔX**. Do not change **ΔX**.

Questions 5–6

Have students explore the scatter plot using the **[TRACE]** key. Lead students to see that if the estimate and the actual were exactly the same that the x-value and y-value would be exactly the same.

L1	L2	L3	1
20	23	-----	
30	25		
27	27		
40	30		
15	30		
25	34		
30	35		

L1(1)=20

```
Plot1  Off
Type:     
         
Xlist: L1
Ylist: L2
Mark:  + .
```

```
WINDOW
Xmin=15
Xmax=95
ΔX=.8510638297...
Xscl=5
Ymin=15
Ymax=95
Yscl=5
```

Problem 2 – X-Y Line

After students have concluded that if the actual and estimate were exactly the same that the x-value and y-value would be exactly the same, they will then graph the X-Y line.

Questions 7–8

Students will now need to copy **L2** into **L3** to replicate the estimate being exactly the same as the actual. To do this, move to the top of L3 and press **[2nd] [LIST] [2] [ENTER]**. This will duplicate the numbers in L2 into L3.

Now, set up **Plot2** exactly like **Plot1** except select L2 and L3. Have students turn Plot1 off *before* graphing Plot2.

Press **[2nd] [Y=] [ENTER] [▶] [ENTER]** to turn the plot off.

When students graph L2 versus L3, they will get the X-Y line. A few sample data points are shown at the right.

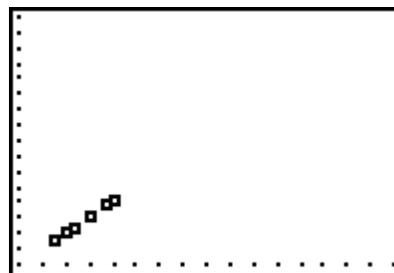
L1	L2	L3
20	23	-----
30	25	
27	27	
40	30	
15	30	
25	34	
30	35	
L3=L2		

Questions 9–10

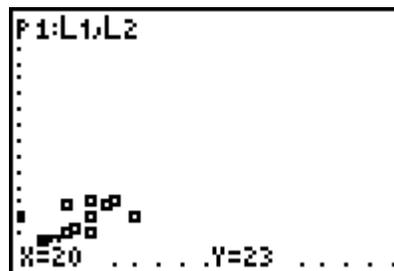
Now, turn Plot1 back on to view both at the same time.

Use the **[TRACE]** key to explore Plot1 compared to Plot2.

Make sure students understand that the **P1** in the top left corner indicates Plot1 and shows which lists are graphed.



They should quickly begin to realize that there are P1 values above and below P2 values. Guide students to conclude that the values above P2 are points where the actual value is greater than the estimated value. (The student could hold their breath longer than they thought they could.) The points below P2 show where the estimate was greater than the actual value. (The student did not hold their breath as long as they thought they could).



Questions 11–12

As students explore the data, they will likely see that more points are above the X-Y line than below. Almost always, middle school students underestimate the length of time they can hold their breath.

Lead students to see that the person best to help would be the student with the data point highest along the y-axis, regardless of where this point falls along the x-axis. Help students see that the x-axis location is the *estimated* time only, not the actual time.

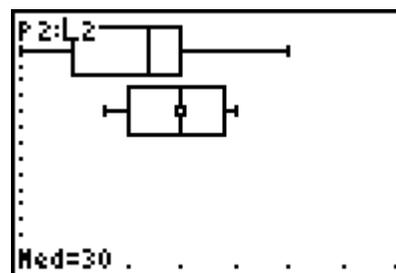
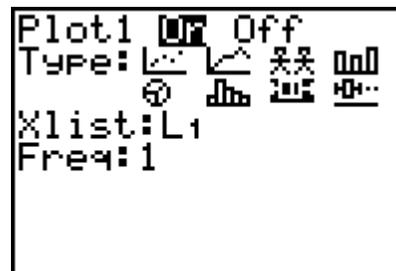
Problem 3 – Box Plots

Finally, students will create a box plot of both the estimated times and the actual times. Looking at these on the same screen should help students even more clearly see that the estimated times are generally lower than the actual data values.

Question 13

If students have had little experience with box plots, you may want to have them go through the steps of creating a box plot on the board before the TI-73 creates the box plot for them (sort the list, find the quartiles, etc).

To change **Plot1**, press $\boxed{2nd} \boxed{Y=}$ and select Plot1. Adjust the settings as show at the right. Change **Plot2** to use an Xlist of L2. After the plots are set up, press \boxed{GRAPH} . A sample screen is shown at the right.



Questions 14–17

Have students explore the values associated with the box plot. Press \boxed{TRACE} and they will see **P1: L1** appear in the top corner and **Med=** appear along the bottom of the

screen. Clarify that they know which plot they are tracing (estimate or actual) and that they know which statistic the point represents. Use the $\boxed{\uparrow}$ or $\boxed{\downarrow}$ to move between plots (P1 and P2) and use the $\boxed{\leftarrow}$ and $\boxed{\rightarrow}$ to move along the box plot.

Just like students noticed in the XY-line plot, the box plot of L1 will show that the estimated times are regularly below the actual times.

In this representation of the data, students should conclude that the person best suited to help Brian retrieve his watch is the person with the greatest actual time. (maxX).

Extension – TI-Navigator™

1. TI-Navigator can help students input their timed trial and to redistribute the lists to the class. Open **MGAct26_LostAtSea_Nav01_TI73.act**. Start the activity and students will see two lists where they can input their estimated value and the greatest of their three timed trials.

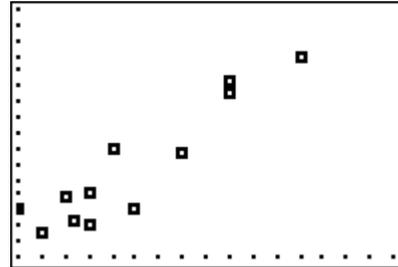
After all students have input their data, stop the activity. Then, load **MGAct26_LostAtSea_Nav02_TI73.act**. When you load this file you will receive a warning message that asks if you would like the data replaced or use existing data. Select “no” so you can keep the existing data. Start the activity and all the data collected will be sent back out to all students.

2. Use **Screen Capture** throughout to monitor student progress.
3. Use **Quick Poll** to ask students questions about the scatter plots and box plots. For example, for Question 9, you could move to a particular point on the scatter plot and ask students if the Exact or Estimate is greater. By seeing how students respond, you can determine if students understand the visual relationship between the values in the list.

Solutions – student worksheet

Problem 1

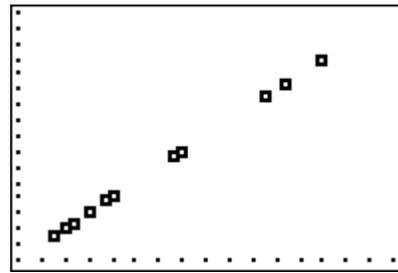
1. Answers will vary. Accept reasonable answers.
2. Answers will vary. Accept reasonable answers.
3. See students' work.
4. Answer will vary. Scatter plot could look similar to the screenshot at the right.



5. Students should conclude that the actual times for holding their breaths were generally greater than their estimates.
6. If the actual and estimate matched, the data would create a straight line where $x = y$.

Problem 2

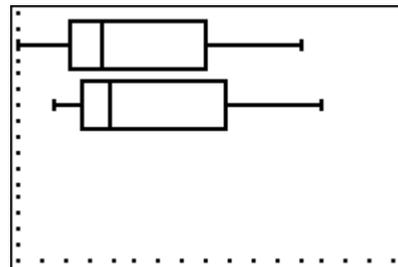
7. Students should see that a straight line has been created where $x = y$.
8. A sample screen could look like the screenshot at the right.



9. The point above Plot 2 tells me that the actual was greater than the estimate.
10. The point below Plot 2 tells me that the actual was less than the estimate.
11. Students should see that students more often underestimate how long they can hold their breaths. This may vary based on your class data.
12. Answers will vary. This should be the student that has the greatest actual trial time.

Problem 3

13. Graphs will depend on class data. A screen could resemble the screenshot at the right.
14. Students should comment on the maximum, minimum, median, and other summary statistics. References to actual numbers will be based on class data.



15. Students should comment on the maximum, minimum, median, and other summary statistics. References to actual numbers will be based on class data.
16. Again, students should see that the estimates are less than the actual data. This may vary by classroom however.
17. In this representation, the student with the maximum value for their time trial should help retrieve the watch.