

### Problem 1 – How Steep are the Steps?

In this activity, you are going to measure the steepness of stairs and look at how slope can help you compare the steepness of different sets of stairs or different objects.

1. First, measure the set of stairs that your teacher has put the string along.

|      | Centimeters<br>(nearest tenth) | Inches (nearest<br>eighth of inch) | Convert cm to inches<br>using Convert function |
|------|--------------------------------|------------------------------------|--|
| Rise |                                |                                    |  |
| Run  |                                |                                    |  |

To convert a measurement from cm to inches, enter the number, press  $\boxed{2nd}$   $\boxed{UNIT}$ , select "Length", then press  $\boxed{2}$  (cm),  $\boxed{4}$  (inches), and  $\boxed{ENTER}$ .

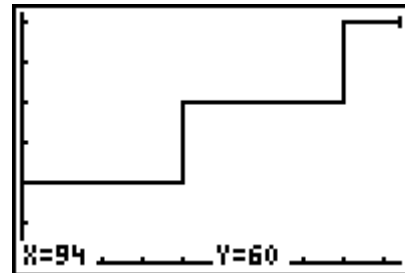
2. What is the ratio of rise to run? \_\_\_\_\_

3. Set your Window settings to those shown at the right. Now use the **Draw** feature to replicate the stairs on your calculator.

```

WINDOW
Xmin=0
Xmax=94
ΔX=1
Xscl=10
Ymin=0
Ymax=62
Yscl=10
  
```

- Press  $\boxed{DRAW}$  and choose **8: Pen**. Move the cursor to (0, 0) as the starting point of the first stair. Press  $\boxed{ENTER}$  to start drawing.
- Move the cursor **up** the number of centimeters of your set of stairs (in this case, 20 cm was used).
- Move the cursor to the **right** the depth of your stairs (in this case, 40 cm was used).
- Continue until you have replicated the set of stairs. Press  $\boxed{ENTER}$  again to turn the pen off.
- Draw your stairs over the ones shown at the right. Store your picture with  $\boxed{DRAW}$   $\boxed{\leftarrow}$   $\boxed{1}$   $\boxed{1}$   $\boxed{ENTER}$ .



4. Use the **Manual-Fit** command to draw a "string" from one step to the next, like the string your teacher hung.

- From the Home screen, press  $\boxed{2nd}$   $\boxed{LIST}$   $\boxed{\leftarrow}$  and select **Manual-Fit**. Press  $\boxed{2nd}$   $\boxed{APPS}$   $\boxed{2}$   $\boxed{1}$   $\boxed{ENTER}$ .
- Move to the edge of Step 1 and press  $\boxed{ENTER}$ . Move to the corner of Step 2 and press  $\boxed{ENTER}$  again. Once the graph appears, press  $\boxed{ENTER}$  one more time to copy the equation that appears to the Y= screen. (Your stairs will disappear.)

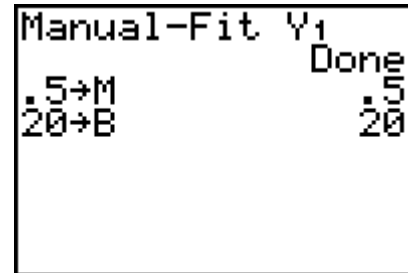
What equation appeared? \_\_\_\_\_

- Now, store **MX+B** to Y2. Press  $\boxed{Y=}$   $\boxed{\downarrow}$   $\boxed{2nd}$   $\boxed{MATH}$ , select M, press  $\boxed{ENTER}$ , select X, press  $\boxed{ENTER}$   $\boxed{+}$ , select B and press  $\boxed{ENTER}$ , then select Done and press  $\boxed{ENTER}$  again.

5. What are your values of M and B? M=\_\_\_\_\_ B=\_\_\_\_\_

**Problem 2 – Exploring Other Lines**

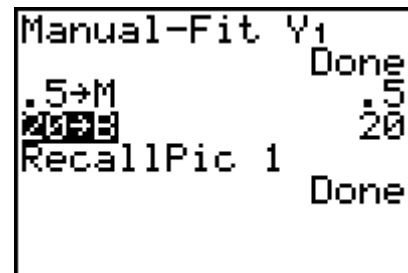
6. Store **your** values to M and B. (Do not use the values shown at the right.) Enter your M value, press **[STO▶]**, then press **[2nd] [MATH]**, select M and press **[ENTER]**, then select Done and press **[ENTER]**.



Press **[ENTER]** one more time to execute the command. Repeat to store your B value.

7. Press **[GRAPH]** to see both equations. Press **[DRAW] [◀] [2] [1] [ENTER]** to recall your picture of the stairs. Describe what you see. Do you have one line or two? Why? \_\_\_\_\_

8. Go back to the Home screen and change your B value to 0. Use the **[▲]** to move up to the line where you stored the original B value.



Press **[ENTER]** to copy it to the edit line. Change 20 to 0 and press **[ENTER]**.

Press **[GRAPH]** again and recall your Pic 1. How does the slope of this new line compare to the slope of the stairs (the string)? \_\_\_\_\_

9. Explain what you think the values of M and B stand for in the graphs of the equation  $Y=MX+B$ . \_\_\_\_\_

10. Repeat the steps in Question 8 to change the M value to something slightly greater than your original M value ( $M+0.5$ ). Explain what relationship this new graph has to your original. \_\_\_\_\_

11. Change the M value to something slightly less than your original M value ( $M-0.5$ ). Explain this relationship to your original. \_\_\_\_\_

12. Calculate the slope ratio using your centimeter measurements. Then, use the inches measurements. cm slope = \_\_\_\_\_ inch slope = \_\_\_\_\_

13. How did the two ratios in Question 12 compare? \_\_\_\_\_

14. Does your answer to Question 9 change? If yes, explain. \_\_\_\_\_