Maximizing the Area of a Garden:
Step-by-Step Guide for use with TI-Nspire CAS

1. Press the home key.
2. Press 6 (New Document) to open a new document.
   - You may be asked if you want to save this document, use the navpad to click no
3. Press 2 (Add Graphs & Geometry) to add a new Graphs & Geometry page.
4. Press menu, 2 (View), 2 (Plane Geometry View) – This will open a plane geometry view screen on the Graphs & Geometry page.
5. Scroll to the top-right corner of the screen where the scale feature is located.
   - Double click on the “1 cm” and change it to “5 ft”, press enter.
6. Press menu, 6 (Points & Lines), 5 (Segment)
   - Create two line segments on the screen, similar to the segments shown below.

7. **Label** the left endpoint of the lower line segment “A” by:
   - Press menu, 1 (Actions), 6 (Text)
   - Move the cursor over the point until it is flashing
   - Click on the point
   - Use the green letter keys to label the point “A”
   - Press enter
     - Note: If your letters are not capital, press the up-arrow/CAPS key located directly below the “ctrl” key before pressing “A”
8. Now we need to create a point on each of our line segments
   - Press menu, 6 (Points & Lines), 2 (Point On)
   - Construct and label points “B” and “C” on the line segments as shown below
     - To be reminded how to label, directions for labeling can be found in step 7!

9. We are now going to label the barn:
   - Click above the top line segment and type “BARN”
     - To be reminded how to label, directions for labeling can be found in step 7!
       - If you need to move the text, press esc, then move the cursor over the text until a hand appears. Hold down the middle button of the NavPad and use the cursor to move the text to the desired place!

10. Press menu, 7 (Measurement), 1 (Length)
    - Click point A, then point B
    - Use the Navpad to move the value to the bottom, right-hand corner of the screen. When the value is where you want it, press enter to set the value in place.
      - Note: This measurement value will be used as our width value!

11. To construct a perpendicular line at point C:
    - Press menu, 9 (Construction), 1 (Perpendicular)
    - Click on point C, then the line segment through point C

12. Now we will construct two vectors (one from point C pointing South and one from point C pointing East).
    - Press menu, 6 (Points & Lines), 8 (Vector)
    - First click on point C, and then click on the perpendicular line somewhere below point C
      - You have just created the “South Vector”!
13. We will now create an expression for length in terms of width.
   *Please answer question number 3 on your question sheet!!

14. Since we know the perimeter of the barn is 62 feet, then the length of one side of the barn (in terms of width) can be expressed as: 62-2w.

15. Use the text tool to type “62-2w” somewhere along the left side of the screen. Press enter once the expression is typed.

16. We now need to calculate the value of the width.
17. Press menu, 1 (Actions), 8 (Calculate)
   - Click on the expression for length (62-2w)
     o You will now be prompted to select “w”
   - Click on the value for width (in the bottom, right-hand corner!), then use the Navpad to move the resulting value somewhere near the expression for length (62-2w)
   - Click when you reach the desired location
18. Now we are going to transfer the values for length and width into the vectors that we just created in our diagram
   - Press menu, 9 (Construction), 8 (Measurement Transfer)
   - *Note: The next step will place a point somewhere along the direction of the vector, so pay attention, as you click on the vector, to where the point is being placed!!
• Click on the value for width (located in the bottom, right-hand corner), and then click on the vector pointing South
  o This will place a point somewhere along the vector pointing South
  o Click esc
  o Label this new point “E”
• We will transfer the value for length the same way. Press menu, 9 (Construction), 8 (Measurement Transfer)
• Click on the value for length (located somewhere on the left side of your screen by the expression 62–2w), and then click on the vector pointing East
  o This will place a point somewhere along the vector pointing East.
  o Click esc
  o Label this new point “D”
  *Your screen should look similar to the screen shown below!*

*Please answer question number 4 on your question sheet!!

19. If you click and hold point B, it can be dragged to the left and right using the Navpad. Notice how this effects the location of points E and D!

*Please answer question number 5 on your question sheet!!

20. Now we’re going to hide some items that we do not want shown.
• To hide items:
  o Press menu, 1 (Actions), 3 (Hide/Show)
  o Click on the items that you want to hide
    ▪ We want to hide:
- The Vectors and the points at the tip of the vector’s arrow
- The perpendicular line
  - Click esc

*Your screen should look something like the one shown below!*

21. The top horizontal line segment may need to be extended to pass through point D.
   (If your line segment already passes through point D – skip to step 22!!)
   - Move the cursor over the right endpoint of the line segment until a “cupped-shape” hand appears and “point” shows up next to the cursor.
   - Click and hold the cursor down on the point until the point is grasped
   - Use the Navpad to drag the line segment to the right until it passes through point D
   - Press enter

22. Now we will create the rectangle that represents our garden
23. Construct a line segment (Press menu, 6 (Points & Lines), 5 (Segment)) connecting point C to point E
24. Construct a perpendicular to line segment CE through point E by:
   - Press menu, 9 (Construction), 1 (Perpendicular)
   - Click on point E
   - Click on the line segment CE
25. Construct a perpendicular to line CD through point D by:
   - Press menu, 9 (Construction), 1 (Perpendicular)
   - Click on point D
   - Click on the line segment passing through point D
26. The perpendicular line to CE may need to be extended to intersect the perpendicular line through point D. (If the two lines already intersect, skip to step 27!!)
Place the cursor over the right end of the perpendicular line to CE (an arrow should show up) hold the cursor down until the hand closes, and then use the Navpad to move the line to the right until it intersects the perpendicular line through point D

Press enter

27. Now we will insert the intersection point.

- Press menu, 6 (Points & Lines), 3 (Intersection Points(s))
- Click on each of the two perpendicular lines that were just constructed. The intersection point will appear.
- Label the point of intersection “F”

28. Now, hide the intersecting lines EF and DF

29. Construct line segment EF and line segment DF

30. We will now assign variables to the length (L) and width (W)

- Click on the value for width (bottom, right-hand corner) so that it is highlighted
- Press the var key (located to the left of the ‘A’ green button)
- Press 1
- Press the up arrow/CAPS key, then the green W key (be sure the variable is assigned a capital W)
- Press enter

31. Now we will assign the variable to length (L) (by the expression 62–2w). In the same procedure as step 30, assign the value for length the variable “L”.

32. In the top, left-hand corner of your screen use the text tool to type “CE:EF” (Again, be sure the letters are typed in capital letters.)

*Please answer question number 6 on your question sheet!!
33. We will now calculate the value of the expression $CE \cdot EF$.
   - Press menu, 1 (Actions), 8 (Calculate)
   - Move the cursor to the expression $CE \cdot EF$ and click
   - You will be prompted to click “CE”, move the cursor to the value for $W$ and click
   - It will now prompt you to click on “EF”, move the cursor to the value for $L$ and click
   - Move the resulting value under the expression $CE \cdot EF$ and click

34. Now, we will assign a value for $CE \cdot EF$. Since this value represents area, we will call this variable “area”:
   - Click on the value for $CE \cdot EF$
   - Press the var key
   - Type “area”
   - Press enter

   Now we’re ready for to make a new page!! 😊

1. Press the home key, 3 (Lists & Spreadsheet)
2. We will label columns A and B
   - Move so that the white space in column A (where the A is located) is highlighted
   - Click
   - Type “awidth” in that space (in lower-case letters)
   - Press enter
   - Do the same process with column B, except type “aarea”
3. Move the cursor so that the formula line is highlighted in column A (the light gray box under the label)
   - Press menu, 3 (Data), 2 (Data Capture), 1 (Automated Data Capture)
   - A formula will appear with “var” highlighted, to replace “var” type our variable for width: “$W$”
   - Press enter
   - A dialog box will pop up (Conflict Detected!). Use the Navpad to press down to select “Variable Reference”, click
   - Press tab, so that “OK” is highlighted, click
4. Follow the same procedure in step 3 for column B, except type “area” as the ‘var’ (The error message may not show up this time!)
   *Although your columns may be more narrow, your screen should look similar to the figure below.
Now we’re ready for to make another new page!! 😊

1. Press the home key, 2 (Graphs & Geometry)
2. Press menu, 3 (Graph Type), 4 (Scatter Plot)
3. Press enter to chose your x-variable
   - Use the Navpad to select “awidth” for the x-variable
4. Press tab
5. Press enter to chose your y-variable
   - Use the Navpad to select “aarea” for the y-variable
6. We will now change the window settings to accommodate our data
   - Press menu, 4 (Window), 1 (Window Settings)
   - Change the values as shown in the figure below
     (Note: X-scale and Y-scale can stay at “auto”)

7. Press ctrl, then left arrow on the Navpad (Repeat this, until you are back at the first Graphs & Geometry page – with the barn!(Problem page 1.1))
8. Grab point B and slowly move it from the left endpoint to the right endpoint a few times

   *Please answer question number 7 on your question sheet!!

9. Press ctrl, then right arrow on the Navpad (Repeat this, until you are at the second Graphs & Geometry page (Problem page 1.3))

   *Please answer question number 8 on your question sheet!!
10. To test and see if the relationship really is quadratic:
   - Press menu, 3 (Graph Type), 1 (Function)
   - Type the equation \( f_1(x) = x(62-2x) \)
   - Press enter
   *Note: Your screen should look similar to the figure below.

   ![Graph](image)

   *Please answer question number 9 on your question sheet!!

11. Press ctrl, then left arrow on the Navpad (This will bring you to the Lists & Spreadsheets page)
12. In the formula line of column C:
   - Press " =f1(width)"*
   - Press enter
   *Please answer question number 10 on your question sheet!!

13. Press ctrl, then right arrow on the Navpad to move back to the second Graphs & Geometry page (page 1.3)
14. Press menu, 5 (Trace), 1 (Graph Trace)
15. Use the left and right arrows on the Navpad to trace the graph
   - Move the trace point until a capital “M” appears
   *Please answer question numbers 11 & 12 on your question sheet!!