

Activity Overview

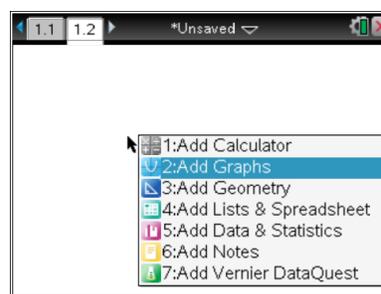
In this activity, you will draw triangles and polygons and find their area geometrically and through the use of determinants.

Materials

- Technology needed (TI-Nspire™ handheld, computer software)

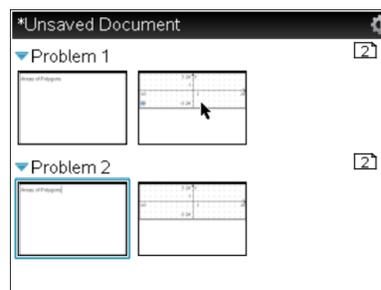
Step 1: Getting the document ready

- Press **⏏** > **New Document** > **Add Notes** and type “Areas of Polygons”.
- Press **ctrl** **doc** and choose add a Graphs page.
- Press **Menu** > **View** > **Grid** > **Dot Grid**.
- Press **ctrl** **G** to hide the entry line.
- Press **doc** > **Page Layout** > **Select Layout** > **Layout 3**.
- Press **Menu** > **Window / Zoom** > **Standard**.
- Using the **Click Pad** or **Touch Pad**, click the newly created page section. (When selected, a box should appear around it.)
- Press **Menu** > **Add Notes**.
- Press **ctrl** **tab** to select the Graphs section of the page. (When the Graphs portion is selected, a box should appear around it.)



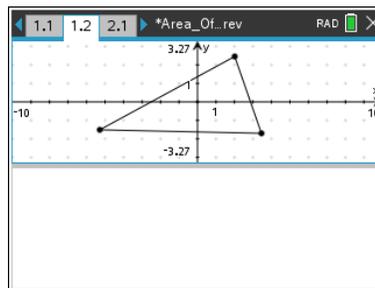
Step 2: Making a copy and saving the document

- Press **ctrl** **▲** to open the page sorter.
- Use the **Click Pad** or **Touch Pad** to select the words *Problem 1*. Press **ctrl** **C** to copy the problem.
- Press **ctrl** **V** to paste one copy of Problem 1. Delete the first page of problem 2 by pressing **del**.
- Use the **Click Pad** or **Touch Pad** to select the second page of problem 1 and press **enter**.
- Page 1.2 should now be the active page.
- To save this document, press **doc** > **File** > **Save As** and enter *Areas_of_Polygons*.



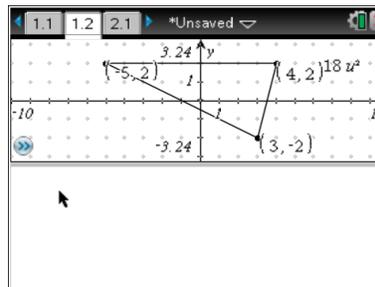
Step 3: Creating a triangle and measuring its area

1. Press **Menu >Geometry>Shapes>Triangle**.
2. To create the vertices, move the cursor to each desired grid point until the phrase *point on* appears. Press  to create each vertex.
3. Press **Menu>Geometry>Measurement>Area**.
4. Move the cursor to the triangle. The word *triangle* should appear when the cursor hovers over the triangle.
5. Press  to select the triangle, use the touchpad to move the calculated area to an open location in Quadrant I, and press  again to permanently display the measured area.



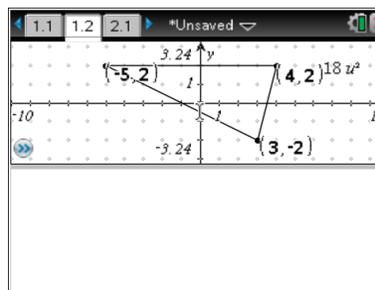
Step 4: Displaying the coordinates of the triangle vertices

1. Press **Menu > Actions > Coordinates and Equations**.
2. Move the cursor to a vertex of the triangle. The word *point* as well as its coordinates should appear when the cursor hovers above one of the vertices.
3. Press  to select the vertex, and press  again to permanently display the coordinates.
4. Repeat for all vertices.
5. Press **esc**.



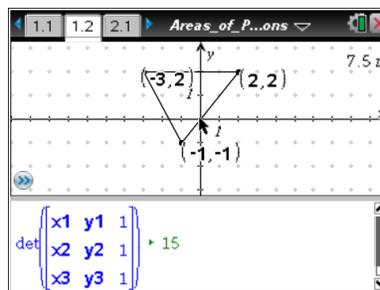
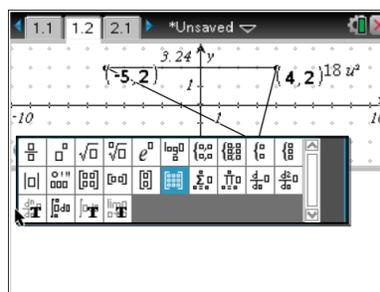
Step 5: Linking the coordinates to variables

1. Move the cursor to the value of the x-coordinate of one of the vertices. The word *text* will appear.
2. Press **ctrl Menu > Store**, enter x_1 , then press **enter**. Notice that the value of the x-coordinate is now **bold**. Any value that is stored as a variable appears in **bold** text.
3. Move the cursor to the value of the y-coordinate of the same vertex.
4. Press **ctrl Menu > Store**, enter y_1 , then press **enter**.
5. Repeat this for the other two vertices, but use x_2 , y_2 and x_3 , y_3 .



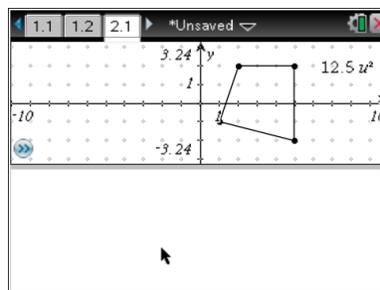
Step 6: Adding the matrix area calculation to the Notes page

1. Press **ctrl** **tab** to select the Notes portion of the page. Insert a math box into the Notes section of the page by pressing **ctrl** **M**.
2. Enter the determinant function into the Notes section by typing **D E T (**
3. Enter a 3×3 matrix template into the Notes section by pressing **⌘** and selecting the 3×3 matrix template. A matrix window appears with fields for the numbers of rows and columns. Type 3 in the row field, type 3 in the column field, and press **enter**.
4. Fill in the template to form the matrix $\begin{bmatrix} x1 & y1 & 1 \\ x2 & y2 & 1 \\ x3 & y3 & 1 \end{bmatrix}$, then press **enter**.



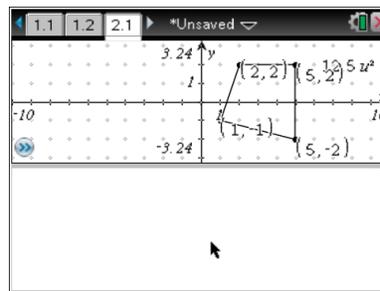
Step 7: Creating a quadrilateral and measuring its area

1. Press **ctrl** **▶** to move to the page 2.1.
2. Press **Menu > Geometry > Shapes > Polygon**.
3. To create the vertices, use the **Pad** to move the cursor to the desired grid point until the phrase *point on* appears. Press **⌘** to create each vertex. After creating the fourth vertex, press **⌘** again to finish the shape.
4. Press **Menu > Geometry > Measurement > Area**.
5. Move the cursor to the quadrilateral. The word *polygon* should appear when the cursor hovers over the quadrilateral.
6. Press **⌘** to select the quadrilateral. Use the **Touch Pad** to move the calculated area to an open location in Quadrant I and press **⌘** again to permanently display the measured area.



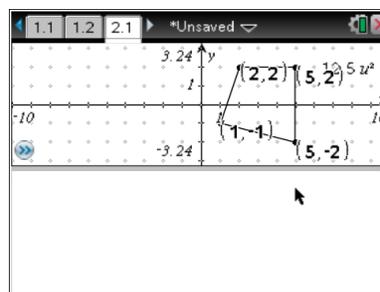
Step 8: Displaying the coordinates of the quadrilateral vertices

1. Press **Menu > Actions > Coordinates and Equations**.
2. Move the cursor to a vertex of the quadrilateral. The word *point* as well as its coordinates should appear when the cursor is above one of the vertices.
3. Press  to select the vertex, and press  again to permanently display the coordinates.
4. Repeat for all vertices.
5. Press **esc**.



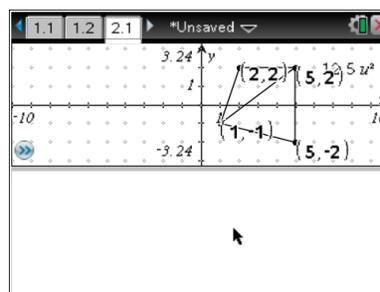
Step 9: Linking the coordinates to variables

1. Move the cursor to the value of the x-coordinate of the bottom-right vertex. The word *text* will appear.
2. Press **ctrl Menu > Store**, enter x1, then press **enter**. Notice that the value of the x-coordinate is now **bold**. Any value that is stored as a variable appears in **bold** text.
3. Move the cursor to the value of the y-coordinate of the same vertex.
4. Press **ctrl Menu > Store**, enter y1, then press **enter**.
5. Choosing the remaining vertices in a counterclockwise manner from the first one chosen, repeat this for the other three vertices, but use x2, y2 and x3, y3 and x4, y4.



Step 10: Dividing the quadrilateral into two triangles

1. Press **Menu > Geometry > Points and Lines > Segment**.
2. Move the cursor to a vertex on the left side of the polygon.
3. Press **enter**. To finish drawing the line segment, move the cursor to a vertex on the opposite side to form a diagonal and press **enter**. The quadrilateral is now divided into two triangles.
4. Press **esc**.
5. Move the cursor to the diagonal and press **ctrl Menu > Attributes**.
6. Arrow down one and to the right and change the appearance of the diagonal to dotted. Press .



Step 11: Adding the matrix area calculations to the Notes page

1. Press **ctrl** **tab** to select the Notes portion of the page. Insert a math box into the Notes section of the page by pressing **ctrl** **M**.

Now sum the determinants of each triangle formed by the diagonal.

2. Enter the determinant function into the Notes section by typing **D E T (**
3. Enter a matrix template into the Notes section by pressing **|x|y|z|** and selecting the 3×3 matrix template. A matrix window appears, with fields for the number of rows and columns. Type 3 in the row field, type 3 in the column field, and press **enter**.

4. The idea is to list the vertices of each triangle.

5. Fill in the template to form the matrix $\begin{bmatrix} x2 & y2 & 1 \\ x3 & y3 & 1 \\ x4 & y4 & 1 \end{bmatrix}$. Click to move

right of the parentheses, then press **+**.

6. For the second triangle, enter the second determinant function into the Notes section by typing **D E T (**.
7. Press **|x|y|z|** and select the 3×3 matrix template. A matrix window appears, with fields for the number of rows and columns. Type 3 in the row field, type 3 in the column field, and press **enter**.

8. Fill in the template to form the matrix $\begin{bmatrix} x1 & y1 & 1 \\ x2 & y2 & 1 \\ x4 & y4 & 1 \end{bmatrix}$, then press **enter**.

9. Save the document again.

