1. A rectangular field is 110 meters long and 75 meters wide.

Give the length and width of another rectangular field that has the same perimeter but a smaller area.

width = meters
length = meters

2. Choose the term that has the given definition.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>{Angle, Circle, Perpendicular lines, Parallel lines, Line segment,</td>
<td>Belonging to the same plane</td>
</tr>
<tr>
<td>Congruent, Collinear, Coplanar}</td>
<td></td>
</tr>
<tr>
<td>{Angle, Circle, Perpendicular lines, Parallel lines, Line segment,</td>
<td>The set of all points in a plane that lie the same distance from a single</td>
</tr>
<tr>
<td>Congruent, Collinear, Coplanar}</td>
<td>point in the plane</td>
</tr>
<tr>
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<td>Belonging to the same line</td>
</tr>
<tr>
<td>Congruent, Collinear, Coplanar}</td>
<td></td>
</tr>
<tr>
<td>{Angle, Circle, Perpendicular lines, Parallel lines, Line segment,</td>
<td>A part of a line consisting of two endpoints and all points between them</td>
</tr>
<tr>
<td>Congruent, Collinear, Coplanar}</td>
<td></td>
</tr>
</tbody>
</table>
3. Find the length of the toothpick.

Write your answer to the nearest centimeter.

4. The figure below has a point marked with a large dot.
First, translate the figure 5 units to the right and 6 units up.
Then, give the coordinates of the marked point in the original figure and the final figure.

Point in original figure:
Point in final figure:
5. Find the perimeter of the square. Be sure to write the correct unit in your answer.

6. Consider parallelogram $EFGH$ below.
Use the information given in the figure to find $x$, $m \angle IHE$, and $m \angle IEH$. 

[Diagram of parallelogram $EFGH$ with labeled angles and sides.]
7. Use the given information to complete the proof of the following theorem.

*If opposite sides of a quadrilateral are congruent, then it is a parallelogram.*

By definition, a parallelogram is a quadrilateral in which both pairs of opposite sides are parallel. Use this definition in your proof.

Given: \( QR \cong ST \)

\[ QT \cong RS \]

Prove: \( QRST \) is a parallelogram

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
<th>Line(s) Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ( QR \cong ST )</td>
<td>Given</td>
<td>-</td>
</tr>
<tr>
<td>2 ( QT \cong RS )</td>
<td>Given</td>
<td>-</td>
</tr>
<tr>
<td>3 ( \overline{QR} \cong \overline{QR} )</td>
<td>Reflexive Property</td>
<td>-</td>
</tr>
<tr>
<td>4 ( \triangle )</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5 ( \angle 1 \cong \angle 1 )</td>
<td>CPCTC Property</td>
<td>4</td>
</tr>
<tr>
<td>6 ( \angle 2 \cong \angle 2 )</td>
<td>CPCTC Property</td>
<td>4</td>
</tr>
<tr>
<td>7 ( QR \parallel )</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8 ( QT \parallel )</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9 ( QRST ) is a parallelogram</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
8. Use the given information to complete the proof of the following theorem.

*If a quadrilateral is a parallelogram, then its opposite angles are congruent.*

By definition, a parallelogram is a quadrilateral in which both pairs of opposite sides are parallel. Use this definition in your proof.

![Parallelogram Diagram](image)

Given: \(QRST\) is a parallelogram

Prove: \(\angle R \cong \angle T\)

\(\angle Q \cong \angle S\)

<table>
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<tr>
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<th>Reason</th>
<th>Line(s) Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (QRST) is a parallelogram</td>
<td>Given</td>
<td>(\text{---})</td>
</tr>
<tr>
<td>2 (QR \parallel \quad)</td>
<td>Definition of a Parallelogram</td>
<td>1</td>
</tr>
<tr>
<td>3 (\angle \quad) and (\angle T) are supp. angles</td>
<td>(\text{---})</td>
<td>(\text{---})</td>
</tr>
<tr>
<td>4 (\angle \quad) and (\angle S) are supp. angles</td>
<td>(\text{---})</td>
<td>(\text{---})</td>
</tr>
<tr>
<td>5 (QT \parallel \quad)</td>
<td>Definition of a Parallelogram</td>
<td>1</td>
</tr>
<tr>
<td>6 (\angle \quad) and (\angle R) are supp. angles</td>
<td>(\text{---})</td>
<td>(\text{---})</td>
</tr>
<tr>
<td>7 (\angle R \cong \angle \quad)</td>
<td>If (\angle) s are supp. to the same (\angle), they are (\cong)</td>
<td>3</td>
</tr>
<tr>
<td>8 (\angle Q \cong \angle \quad)</td>
<td>If (\angle) s are supp. to the same (\angle), they are (\cong)</td>
<td>4</td>
</tr>
</tbody>
</table>

9. Three vertices of a parallelogram are shown in the figure below. Give the coordinates of the fourth vertex.

![Coordinate Diagram](image)
10. Consider quadrilateral $WXYZ$ below.

Note that $WXYZ$ has vertices $W(2, -8), X(6, -1), Y(3, 1)$, and $Z(-1, -6)$.

Complete the following to determine if $WXYZ$ is a parallelogram.

(a) Find the length of $WZ$ and the length of $XY$.
   Give exact answers (not decimal approximations).

   Length of $WZ$: 

   Length of $XY$: 

(b) Find the slope of $WZ$ and the slope of $XY$.

   Slope of $WZ$: 

   Slope of $XY$: 

(c) From parts (a) and (b), what can we conclude?

   - The quadrilateral is a parallelogram because it has one pair of opposite sides that are both congruent and parallel.
   - The quadrilateral is a parallelogram because it has one pair of opposite sides that are congruent, even though those sides are not parallel.
   - The quadrilateral is a parallelogram because it has one pair of opposite sides that are parallel, even though those sides are not congruent.
   - The quadrilateral is not a parallelogram.
   - It cannot be determined if the quadrilateral is a parallelogram.
11. Given the information marked on the figures below, classify each quadrilateral as a "Parallelogram" or "Not necessarily a parallelogram."

Note that each figure is drawn like a parallelogram, but you should not rely on how the figure is drawn in determining your answers.

![Diagram of quadrilaterals VWXW, KLML, SUST, and ABCD]
12. In the rectangle below, \( JN = 4x + 6 \), \( KN = 5x + 1 \), and \( m \measuredangle NML = 32^\circ \). Find \( JL \) and \( m \measuredangle NJM \).

\[ J \quad N \quad K \]
\[ M \quad N \quad L \]

13. Given the information marked on each figure below, select all classifications that must be true.

Note that each figure is drawn like a rectangle, but you should not rely on the way the figure is drawn in determining your answers.

--- Quadrilateral
--- Parallelogram
--- Rectangle

--- Quadrilateral
--- Parallelogram
--- Rectangle

--- Quadrilateral
--- Parallelogram
--- Rectangle

14. Consider parallelogram \( PQRS \) below.
Note that $PQRS$ has vertices $P(-1, -5)$, $Q(-4, 2)$, $R(1, 3)$, and $S(4, -4)$.

Answer the following to determine if the parallelogram is a rectangle, rhombus, square, or none of these.

(a) Find the slope of $\overline{RS}$ and the slope of a side adjacent to $\overline{RS}$.

Slope of $\overline{RS}$: 

Slope of side adjacent to $\overline{RS}$: 

(b) Find the length of $\overline{RS}$ and the length of a side adjacent to $\overline{RS}$.

Give exact answers (not decimal approximations).

Length of $\overline{RS}$:

Length of side adjacent to $\overline{RS}$:

(c) From parts (a) and (b), what can we conclude about parallelogram $PQRS$? Check all that apply.

☐ $PQRS$ is a rectangle.

☐ $PQRS$ is a rhombus.

☐ $PQRS$ is a square.

☐ $PQRS$ is none of these.
15. For the rhombus below, find the measures of $\angle 1$, $\angle 2$, $\angle 3$, and $\angle 4$.

![Rhombus Diagram]

$m \angle 1 = \underline{\quad}^\circ$

$m \angle 2 = \underline{\quad}^\circ$

$m \angle 3 = \underline{\quad}^\circ$

$m \angle 4 = \underline{\quad}^\circ$

16. shape: parallelogram -- shape: rectangle -- shape: square
Answer the questions about the figures below.

(a) Which figures are rectangles? Mark all that apply.
- Figure A
- Figure B
- Figure C
- None of the figures

(b) Which figures are parallelograms? Mark all that apply.
- Figure A
- Figure B
- Figure C
- None of the figures

(c) Which figures are squares? Mark all that apply.
- Figure A
- Figure B
- Figure C
- None of the figures
17. For each of the following quadrilaterals, select all the properties that must be true.

<table>
<thead>
<tr>
<th></th>
<th>Two pairs of parallel sides</th>
<th>Only one pair of parallel sides</th>
<th>Four right angles</th>
<th>All sides congruent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallelogram</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Trapezoid</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Square</td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

18. True or False?

a. Every quadrilateral is a square.
b. Every parallelogram is a rectangle.
c. Every rectangle is a rhombus.
d. Every rhombus with four right angles is a square.
1. width = 65 meters  
length = 120 meters

2. | Term            | Definition                                                                 |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Coplanar</td>
<td>Belonging to the same plane</td>
</tr>
<tr>
<td>Circle</td>
<td>The set of all points in a plane that lie the same distance from a single point in the plane</td>
</tr>
<tr>
<td>Collinear</td>
<td>Belonging to the same line</td>
</tr>
<tr>
<td>Line segment</td>
<td>A part of a line consisting of two endpoints and all points between them</td>
</tr>
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</table>

3. 8 centimeters
4. Point in original figure: \((-4, -8)\)
Point in final figure: \((1, -2)\)

5. 64 m

6. \(x = 3\)
\(m \angle IHE = 33^\circ\)
\(m \angle IEH = 47^\circ\)
### 7.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
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</thead>
<tbody>
<tr>
<td>$\overline{QR} \cong \overline{ST}$</td>
<td>Given</td>
<td></td>
</tr>
<tr>
<td>$\overline{QT} \cong \overline{RS}$</td>
<td>Given</td>
<td></td>
</tr>
<tr>
<td>$\overline{RT} \cong \overline{RT}$</td>
<td>Reflexive Property</td>
<td></td>
</tr>
<tr>
<td>$\triangle QRT \cong \triangle STR$</td>
<td>SSS Congruence Property</td>
<td>[1, 2, 3]</td>
</tr>
<tr>
<td>$\angle 1 \equiv \angle 4$</td>
<td>CPCTC Property</td>
<td>4</td>
</tr>
<tr>
<td>$\angle 2 \equiv \angle 3$</td>
<td>CPCTC Property</td>
<td>4</td>
</tr>
<tr>
<td>$\overline{QR} \parallel \overline{ST}$</td>
<td>If alt. int. $\angle s \cong$, then lines $\parallel$</td>
<td>[3]</td>
</tr>
<tr>
<td>$\overline{QT} \parallel \overline{RS}$</td>
<td>If alt. int. $\angle s \cong$, then lines $\parallel$</td>
<td>[3]</td>
</tr>
<tr>
<td>$QRST$ is a parallelogram</td>
<td>Definition of a Parallelogram</td>
<td>[4, 3, 2]</td>
</tr>
</tbody>
</table>

### 8.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
<th>Line(s) Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>$QRST$ is a parallelogram</td>
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<td></td>
</tr>
<tr>
<td>$\overline{QR} \parallel \overline{ST}$</td>
<td>Definition of a Parallelogram</td>
<td>1</td>
</tr>
<tr>
<td>$\angle Q$ and $\angle T$ are supp. angles</td>
<td>If lines $\parallel$, then cons. int. $\angle s$ are supp.</td>
<td>[2]</td>
</tr>
<tr>
<td>$\angle R$ and $\angle S$ are supp. angles</td>
<td>If lines $\parallel$, then cons. int. $\angle s$ are supp.</td>
<td>[2]</td>
</tr>
<tr>
<td>$\overline{QT} \parallel \overline{RS}$</td>
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<td>1</td>
</tr>
<tr>
<td>$\angle Q$ and $\angle R$ are supp. angles</td>
<td>If lines $\parallel$, then cons. int. $\angle s$ are supp.</td>
<td>[5]</td>
</tr>
<tr>
<td>$\angle R \equiv \angle T$</td>
<td>If $\angle s$ are supp. to the same $\angle$, they are $\cong$</td>
<td>3, 6</td>
</tr>
<tr>
<td>$\angle Q \equiv \angle S$</td>
<td>If $\angle s$ are supp. to the same $\angle$, they are $\cong$</td>
<td>4, 6</td>
</tr>
</tbody>
</table>

9. $(-2, 8)$
10.

(a) Find the length of $WZ$ and the length of $XY$.
Give exact answers (not decimal approximations).

<table>
<thead>
<tr>
<th>Length of $WZ$: $\sqrt{13}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of $XY$: $\sqrt{13}$</td>
</tr>
</tbody>
</table>

(b) Find the slope of $WZ$ and the slope of $XY$.

<table>
<thead>
<tr>
<th>Slope of $WZ$: $-\frac{2}{3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope of $XY$: $-\frac{2}{3}$</td>
</tr>
</tbody>
</table>

(c) From parts (a) and (b), what can we conclude?

- The quadrilateral is a parallelogram because it has one pair of opposite sides that are both congruent and parallel.
- The quadrilateral is a parallelogram because it has one pair of opposite sides that are congruent, even though those sides are not parallel.
- The quadrilateral is a parallelogram because it has one pair of opposite sides that are parallel, even though those sides are not congruent.
- The quadrilateral is not a parallelogram.
- It cannot be determined if the quadrilateral is a parallelogram.
11. 

___ Not necessarily a parallelogram

___ Not necessarily a parallelogram

___ Parallelogram

___ Parallelogram

12. 

\[ JL = 52 \]

\[ m \angle NJM = 58^\circ \]
13. (a) Quadrilateral  
✓ Parallelogram  
☐ Rectangle  
(b) Quadrilateral  
✓ Parallelogram  
✓ Rectangle  
(c) Quadrilateral  
✓ Parallelogram  
☐ Rectangle

14.  
(a) Find the slope of \( RS \) and the slope of a side adjacent to \( RS \).

Slope of \( RS \): \(-\frac{7}{3}\)

Slope of side adjacent to \( RS \): \(\frac{1}{5}\)

(b) Find the length of \( RS \) and the length of a side adjacent to \( RS \).

Length of \( RS \): \(\sqrt{58}\)

Length of side adjacent to \( RS \): \(\sqrt{26}\)

(c) From parts (a) and (b), what can we conclude about parallelogram \( PQRS \)? Check all that apply.

☐ \( PQRS \) is a rectangle.

☐ \( PQRS \) is a rhombus.

☐ \( PQRS \) is a square.

✓ \( PQRS \) is none of these.
15. \( \angle 1 = 42^\circ \)
\( \angle 2 = 48^\circ \)
\( \angle 3 = 48^\circ \)
\( \angle 4 = 48^\circ \)

16. (a) Which figures are rectangles?
Mark all that apply.

- [ ] Figure A  
- [x] Figure B  
- [x] Figure C  
- [ ] None of the figures

(b) Which figures are parallelograms?
Mark all that apply.

- [x] Figure A  
- [x] Figure B  
- [x] Figure C  
- [ ] None of the figures

(c) Which figures are squares?
Mark all that apply.

- [ ] Figure A  
- [ ] Figure B  
- [x] Figure C  
- [ ] None of the figures

17. 

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<tr>
<td>Trapezoid</td>
<td>[ ]</td>
<td>[x]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Square</td>
<td>[x]</td>
<td>[ ]</td>
<td>[x]</td>
<td>[x]</td>
</tr>
</tbody>
</table>

18. 

a. Every quadrilateral is a square.
   False

b. Every parallelogram is a rectangle.
   False

c. Every rectangle is a rhombus.
   False

d. Every rhombus with four right angles is a square.
   True