

Clue Set #1:

1. The gold necklace is in a location where all the coordinates are positive.

This means that the necklace is in the first quadrant.

2. The change in the y-coordinates is 7.

Since the coordinates must be 9 or less (see clue #4), and the difference between the two y-coordinates must be 7, the possible y-coordinates are:

0 and 7

1 and 8

2 and 9

3. One of the y-coordinates is an even number and its x-coordinate is an odd number.

The pairs of y-coordinates given above after clue #2 each include one even number.

However, the fact that the x-coordinate is odd is helpful.

4. None of the coordinates has two digits.

This means that all of the coordinates are 9 or less.

5. You can't seem to define the slope of the necklace.

This means that the necklace makes a vertical line. The x-coordinate of both ends of the necklace is the same.

6. The y-coordinate of one end of the necklace is three more than the x-coordinate.

This means that the x-coordinate of both ends of the necklace is three less than the y-coordinate. (See clue #5 for the reason that both x-coordinates are the same.)

Subtracting 3 from each of the y-values listed under clue #2 gives:

$$y = 0 \rightarrow x = 0 - 3 = -3$$

$$y = 7 \rightarrow x = 7 - 3 = 4$$

$$y = 1 \rightarrow x = 1 - 3 = -2$$

$$y = 8 \rightarrow x = 8 - 3 = 5$$

$$y = 2 \rightarrow x = 2 - 3 = -1$$

$$y = 9 \rightarrow x = 9 - 3 = 6$$

Recall that the value of the x-coordinate must be positive (clue #1) and odd (clue #3).

The only x-coordinate from the list above that meets these criteria is  $x = 5$ .

The corresponding y-coordinate is 8.

This means that the other y-coordinate is 7 less than this, or  $8 - 7 = 1$ .

**Solution: The coordinates of the two ends of the necklace:**

Top end: (5, 8)

Bottom end: (5, 1)

Clue Set #2:

1. A treasure chest is located in the third quadrant.

This means that the x-coordinates and y-coordinates of the corner points are all negative.

2. The lower left-hand corner of the chest lies along the line with the equation  $y = x$ .

This means that the x-coordinate and the y-coordinate of the lower left-hand corner are equal.

3. The chest is rectangular and all four corners have odd coordinates.

This means that possible x-coordinates and y-coordinates have values 1, 3, 5, 7, 9, etc.

4. If you looked any lower or any farther left, you'd be in the prohibited double digits.

Since double digits are prohibited, the list of possible coordinates listed after clue #3 above should be cut off at 9.

This clue indicates that the lower left-hand corner has an x-coordinate and y-coordinate of 9, since going any farther "down" or "left" would make the coordinates 10 or more.

The coordinates of the lower left-hand corner are (-9, -9).

5. The coordinates of the lower left-hand corner are the smallest you can have.

The interpretation of "smallest" is problematic here, especially since the coordinates of the lower left-hand corner have already been determined. Presumably "smallest" is synonymous with "most negative", keeping in mind that double digits are prohibited.

6. The chest is 6 units wide and 2 units high.

Since the chest is 6 units wide, and the lower left-hand corner is known to be located at (-9, -9), the lower right-hand corner is located at:

$$(-9 + 6, -9) = (-3, -9)$$

Since the chest is 2 units high, the upper left-hand corner is located at:

$$(-9, -9 + 2) = (-9, -7)$$

Similarly, since the chest is 2 units high, the upper right-hand corner is located at:

$$(-3, -9 + 2) = (-3, -7)$$

**Solution: The coordinates of the chest are then:**

Bottom left corner: (-9, -9)

Bottom right corner: (-3, -9)

Top left corner: (-9, -7)

Top right corner: (-3, -7)

Clue Set #3:

1. The crown is buried at an angle.

This means that the sides of the crown will not be parallel to the x or y axes.

2. All the x-coordinates are positive, and all the y-coordinates are negative.

This means that the crown lies in the fourth quadrant.

3. The top of the crown is parallel to the bottom of the crown, and the top and bottom are the same length.

4. The top and bottom each have one point with odd coordinates and another point with even coordinates.

5. The difference of the y-coordinates is 3 and the difference of the x-coordinates is 3.

Since one top corner was determined to be located at (7, -3) (see clue #7 below), the y-coordinate of the other top corner must be either:

$$-3 - 3 = -6$$

or

$$-3 + 3 = 0$$

Since none of the coordinates are equal to 0 (see clue #8), the y-coordinate of the other top corner must be -6.

The corresponding x-coordinate must then be:

$$7 - 3 = 4$$

The coordinates of the second top corner are then (4, -6).

6. The corners of the top are located 1 unit north and 1 unit west of the bottom corners.

From clue #7 and clue #4, the two top corners are determined to be:

Top right corner:  $(7, -3)$

Top left corner:  $(4, -6)$

These top corners are one unit “north” and one unit “west” of the corresponding bottom points. This means that, starting at a top corner, we need to move one unit down (“south”) and one unit right (“east”) to get to the corresponding bottom corner. Moving down one unit means that we subtract 1 from the y-coordinate of the top corner, and moving right one unit means that we add 1 to the x-coordinate of the top corner, which gives:

Bottom right corner:  $(7 + 1, -3 - 1) = (8, -4)$

Bottom left corner:  $(4 + 1, -6 - 1) = (5, -7)$

7. One of the top corners is located where the lines  $y = -3$  and  $x = 7$  meet.

This means that the coordinates of one of the top corners is  $(7, -3)$ .

8. None of the corners has a coordinate of 0.

**Solution: The corners of the crown are:**

Top left corner:  $(4, -6)$

Top right corner:  $(7, -3)$

Bottom left corner:  $(5, -7)$

Bottom right corner:  $(8, -4)$

Here are the items shown on the graph:

