



EDUCATOR'S GUIDE

Jesse Steam: Solving Mysteries through Science, Technology, Engineering, Art & Math

Title: *The Vexing Hectare Detector*

Series Overview

Ten-year-old Jesse Steam's curiosity about how the world works leads her to one mystery after another as she pedals around town, often with Mr. Stubbs, her tabby cat, keeping her company in the bike basket. Using simple scientific tools and their powers of observation, Jesse and her friends analyze, test hypotheses, and conduct experiments. If the kids get stuck, they know they can count on Professor Peach, a retired college science educator, to step in with a clear explanation.

Each title in the Jesse Steam series focuses on one **STEAM** subject: Science, Technology, Engineering, Art, or Math.

About This Book

In *The Vexing Hectare Detector*, Jesse uses various mathematical equations and her own mapmaking skills to search for a rock her teacher has hidden as part of a class contest. Will Jesse be able to solve the Riddle of the Rock?

This title focuses on **math**.

Next Generation Science Standards Alignments and Activities

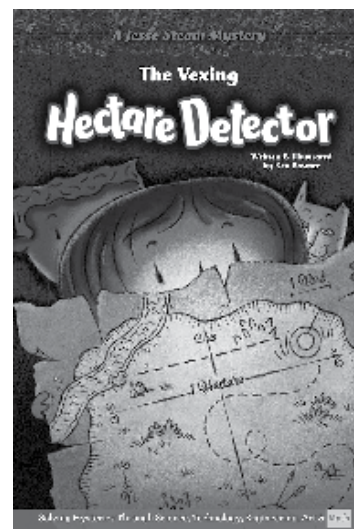
The activities and learning ideas in this guide have been correlated with the **Next Generation Science Standards (NGSS)**:

<https://bit.ly/2kx58A2>

These standards were developed by the National Research Council (NRC) of the National Academy of Sciences. The NRC's Framework for K-12 Science Education combines practices, crosscutting concepts, and disciplinary core ideas to address relevant science, technology, engineering and math (STEM) concepts that students should learn.

For this book, the standards called Engineering Practices: Using Mathematics and Computational Thinking is particularly applicable:

<https://www.nextgenscience.org/practices/using-mathematics-and-computational-thinking>



Lexile: 740 GRL: R 3,448 words



Background and Key Concepts

Jesse uses map skills, the **Pythagorean Theorem**, and metric conversions to solve some problems in *The Vexing Hectare Detector*.

A **map** has some basic features:

- The map title tells what the map is showing.
- A compass rose shows the directions north, south, east, and west.
- Map symbols are little drawings that show where certain types of places are located. For example, a little building with a flag on top could stand for a school.
- A map legend shows what the various map symbols stand for.
- A map scale shows how far apart the places on a map actually are. For example, one inch could stand for one foot or one yard.

The Pythagorean Theorem, developed by Greek philosopher Pythagoras, shows that the square of the length of the hypotenuse (c) of a right triangle equals the sum of the squares of the lengths of the other two sides ($a + b$). So, $a^2 + b^2 = c^2$.

- A right angle is an angle whose sides are perpendicular to each other, or a 90-degree angle.
- The hypotenuse is a right triangle's longest side, or the side opposite its right angle.
- To square a number, simply multiply the number by itself. So, $3^2 = 3 \times 3$, which = 9.
- So, if side A of a right triangle is 3 cm. and side b is 4 cm., the hypotenuse is 5. That's because $3^2 + 4^2$, or $9 + 16 = 25$, and the square root of 25 is 5.

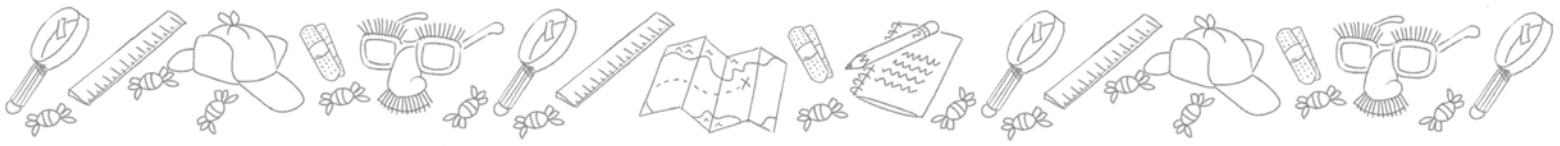
The **metric system** is a system of weights and measurements based on the kilogram and the meter. It is the primary system of measurement almost everywhere in the world except the United States.

Class Discussion

Start the discussion by asking students what a map is and what types of places maps can show (towns, cities, countries, etc.). Have students share various ways maps can be useful in daily life. Then have them turn to pp. 6–7 in the book to see the map of Deenville. Have them locate Jesse's house on the map. As they read the book, encourage students to look back at the map as Jesse visits different places to see where they are and to follow the route she may have taken to get to them.

Draw a picture of a right angle on the board. Label the two sides touching the angle "a" and "b" and label the hypotenuse "c". Underneath, write $a^2 + b^2 = c^2$. Using the information under "Background and Key Concepts", go over the Pythagorean Theorem. Explain to students that they'll see Jesse use the Pythagorean Theorem in the book.

Ask students if they know what the metric system is. Explain that it's a system of weights



and measurements based on the kilogram and the meter, and that it's the primary system of measurement almost everywhere in the world except the United States. Explain that a **hectare** is a metric unit of square measure that's equal to 100 ares or 10,000 square meters. In the U.S. system of measurement, that's 2.471 acres—about the size of two football fields!

Student Activity

Classroom Map

Break students into groups of two to four. Give each group a large piece of white paper, a yardstick, a ruler, and a pencil for each student.

Ask each group to create a map of the classroom. Challenge them to include as many map features as they can. They can use the yardstick to measure the distance between things in feet or yards, then use the ruler to portray those distances in centimeters or inches. The groups can then take turns presenting their maps to the class.

Units of Length

Break students into groups of two to four. Give each group a ruler. Have them use the ruler to help them complete the "Units of Length" Worksheet (below).

Additional Online Resources:

https://www.ducksters.com/kidsmath/pythagorean_theorem.php

<https://kids.kiddle.co/Map>

<https://www.nist.gov/pml/weights-and-measures/approximate-conversions-metric-us-customary-measures>

Videos

Pythagorean Theorem:

<https://www.pbslearningmedia.org/resource/mgbh-math-ee-gshreepthag/pythagorean-theorem/>

How to Make a Map:

<https://www.youtube.com/watch?v=DSnV4uGGQ>

Metric System for Kids: Explained Through Song:

<https://www.youtube.com/watch?v=h6vca9PnlyI>

Worksheet

UNITS OF LENGTH

Student Name _____

Date _____

In the U.S., we measure small items in **inches (in.)**. But in the metric system, small items are measured in **centimeters (cm.)**.

1 inch = 2.54 cm.

To make the math easier, we can say that 1 inches is about 2.5 centimeters.

Use a ruler to measure the items below in inches. Then use math to get the approximate lengths in centimeters. You can also use the rulers to help you measure in centimeters!

Item	Inches	Centimeters
Sharpened pencil		
Unused crayon		
Notebook		
Stapler		
Index card		