



Holyoke Public Schools Mathematics Curriculum Map Grade 4

Penny Jars and Plant Growth

Table of Contents

Curriculum Map Outline.....	4
Mathematic Evidence of Learning Artifacts.....	5
Probing Questions for Accountable Talk.....	6
Additional Probing Questions.....	7
Goals, Content Standards, & Performance Standards.....	8
End-of-Unit Project Preview.....	9
Investigations 1 - 3.....	10
End-of-Unit Project.....	13

On-Demand Assessments.....17

HPS Mathematics Scoring Rubric.....18

Curriculum Maps

GOALS:

1. To ensure that students are exposed to a rigorous curriculum in every school and every grade.
2. To have consistent instruction and assessment district wide.
3. To prepare students for the MCAS test.
4. To explain what is expected to be covered in each CMP or Investigations Unit.

EXPECTATIONS:

The district's expectation is for students to successfully meet the Massachusetts Mathematics Standards. In order to help facilitate this, teachers are required to follow the curriculum maps. The successful implementation of these maps requires teachers to thoroughly read each lesson in the TE and work through the project and problems in the map and the text prior to planning their lessons. Work should be kept in the binder with the curriculum map. Working through the math is an essential part of lesson planning, as it helps the teacher to better understand the concept being taught and the students' possible misunderstandings.

FEEDBACK TO STUDENTS:

Feedback needs to happen daily in the classroom. There are many ways to give feedback. Conferencing, observations, questions asked during your opening, work time and closing are all forms of feedback.

MAP COMPONENTS:

1. GENERAL PROBING QUESTIONS
2. UNIT SPECIFIC PROBING QUESTIONS
3. GOALS OF UNIT, CONTENT STANDARDS, & PERFORMANCE STANDARDS
4. PROJECT- to be done at end of unit and kept in the portfolio.
 - o STUDENT MASTER – for project
5. INVESTIGATIONS:
 - o NOTEBOOK - includes: 3 Ring Binder, Bound Notebook, Portfolio
 - o ACCOUNTABLE TALK – using probing questions
5. ON-DEMAND ASSESSMENTS - to be done during teaching of unit.

Mathematics

Evidence of Learning Artifacts

Artifact	K - 1	2 - 5	6 - 8
<i>3 Ring Binder (3R)*</i>	<ul style="list-style-type: none"> ○ Student Work¹ 	<ul style="list-style-type: none"> ○ Vocabulary ○ Student sheets¹ <p style="text-align: center;"><u>All work should be dated and listed by investigation</u></p>	<ul style="list-style-type: none"> ○ Math books ○ Vocabulary ○ Core Problems¹ ○ Lab sheets <p style="text-align: center;"><u>All work should be dated and listed by investigation</u></p>
<i>Marble Notebook (MNB)</i>	<ul style="list-style-type: none"> ○ Journal entries² 	<ul style="list-style-type: none"> ○ Table of Contents ○ Problem of the day ○ Journal entries ○ Class work <p style="text-align: center;"><u>All work should be dated and listed by investigation in the Table of Contents</u></p>	<ul style="list-style-type: none"> ○ Table of Contents ○ Work time ○ Journal entries <p style="text-align: center;"><u>All work should be dated and listed by investigation in the Table of Contents</u></p>
<i>Portfolio³ (P)</i>	<ul style="list-style-type: none"> ○ On-demand tasks ○ Projects ○ Teacher anecdotal notes 	<ul style="list-style-type: none"> ○ On-demand tasks ○ Reflections ○ Projects <p style="text-align: center;"><u>All work should be dated and listed by investigation</u></p>	<ul style="list-style-type: none"> ○ On-demand tasks ○ Reflections ○ Projects <p style="text-align: center;"><u>All work should be dated and listed by investigation</u></p>

* Folders may be used in place of binders for these grade levels

¹ Send home at the end of each unit

² Use grade level math journals

³ All documents should be kept for the entire year

Penny Jars and Plant Growth **Probing Questions for Accountable Talk**

As students progress through this unit, they should be asked the following questions to assess their knowledge about problem situations that involve using tables and graphs to represent a constant range of change.

Ten Minute Math Grades

Quick Survey	Unit 2, Session1.1
Closest Estimate	Unit 8 Session 1.1

Ten Minute Math activities offer practice and review of key concepts at each grade level. After their initial introduction, these short activities, designed to take no longer than 10 minutes, support and balance the in-depth work of each curriculum unit.

Implementing Investigations in Grade 4: Please review pages 2 , 31-32, for 2 Ten Minute Math activities in this unit.

Logo Paths M1- M6

Additional Probing Questions for Accountable Talk

The teacher's role in probing for understanding is to ask questions that will:

- Clarify student understanding
- Get at the objective of the lesson
- Go deeper into the mathematics
- Uncover misconceptions and misunderstandings
- Compare and contrast

The students' role is to be an active participant by:

- Explaining their strategies
- Asking clarifying questions to teacher and other students
- Being active listeners
- Using the language of mathematics

When probing for understanding the teacher and students can use one or more of these suggested questions:

- Why are you using $< >$?
- What are the ways you could $< >$?
- What else do you know?
- How do you know that?
- Can you show that?
- What convention did you use here?
- What can you do if you do not know?
- What standard does this work apply to?
- Is this always true?
- How does this connect to other mathematics we have learned?
- What is the same and what are the differences between $< >$?
- Can you back that up?
- Where is the math in your sketch?
- What does the answer mean?
- Does the answer make sense?
- Could you have used another operation to solve this task?
- Can you give examples?
- Can you say it another way?
- What's the math?
- Tell me about the task in your own words?
- What are you trying to find?
- How did you make your estimate?
- Will your answer be an over-estimate or an under-estimate? Why?
- I noticed that you used $< \dots >$ to help you understand the task. Can you show us what you did and tell us how it helped you?
- Where do you see $< >$ in your $<$ model, diagram, number line, chart, etc. $>$?
- How can we see $< >$ in your $<$ model, diagram, number line, chart, etc. $>$?
- You have used a representation that is different from others that I've seen. Can you show us your $<$ model, diagram, number line, chart, etc. $>$, and tell us how it helped you?
- How did you decide to solve the task? Why did you choose that method?
- Did you try any method that didn't work?
 - Tell us what you tried.
 - Why didn't it work?
 - Would it ever work?

Goals, Content Standards, & Performance Standards

Unit Goals:

- Connect tables and graphs to each other and to the situations they represent.
- Make a graph on a coordinate grid from a table of values.
- Describe how a graph shows change: where the rate of change is increasing, decreasing, or remaining constant, and how differences in steepness represent differences in the rate of change.
- Take into account the starting amount and the amount of change in describing and comparing situations of constant change.
- In a situation of constant change, write rules (using words or arithmetic expressions) to determine the value of one quantity, given the value of the other.

Math Content Standards:

(4.P.1) Create, describe, extend, and explain symbolic (geometric) and numeric patterns, including multiplication patterns like 3, 30, 300, 3000, ... :

(4.P.2) Use symbol and letter variables (e.g., Δ , x) to represent unknowns or quantities that vary in expressions and in equations or inequalities (mathematical sentences that use =, <, >). λ

(4.P.4) Use pictures, models, tables, charts, graphs, words, number sentences, and mathematical notations to interpret mathematical relationships. σ

(4.P.5) Solve problems involving proportional relationships, including unit pricing (e.g., four apples cost 80¢, so one apple costs 20¢) and map interpretation (e.g., one inch represents five miles, so two inches represent ten miles). σ

(4.P.6) Determine how change in one variable relates to a change in a second variable, e.g., input-output tables. v

(4.G.6) Using ordered pairs of numbers and/or letters, graph, locate, identify points, and describe paths (first quadrant). λ

(4.M.3) Identify time to the minute on analog and digital clocks using a.m. and p.m. Compute elapsed time using a clock (e.g., hours and minutes since...) and using a calendar (e.g., days since...). λ

Performance Standards:

(M3a) Uses linear patterns to solve problems; that is shows how one quantity determines another in a linear (“repeating”) pattern.

(M3b) Uses the understanding that an equality relationship between two quantities remains the same as long as the same change is made to both quantities.

(M3d) Uses letters, boxes, or other symbols to stand for any number, measured quantity, or object in simple situations with concrete materials, i.e. demonstrate understanding and use of a beginning concept of a variable.

UNIT: Penny Jars and Plant Growth

End-of-Unit Project

GRADE: 4

End-of-Unit Project (P)

Student work should be placed in **portfolio (P)**.

The project is the culminating assessment which will allow students to apply what they learned in the unit.

It is written in MCAS form to give students the experience of answering an open-response question.

End-of-Unit Assessment: Unit 9 M37-M39 from Resource Binder, “Resources Masters and Transparencies”

UNIT: PENNY JARS AND PLANT GROWTH

Investigation 1 (1.1 – 1.2)

DAYS: 4

GRADE: 4

<p>Evidence of Learning Artifacts</p> <p>Journal and Reflection questions should be posted and referred to at the beginning of the appropriate <i>Investigation</i>.</p> <p>Journal and Reflection entries need to be done in class as part of the closure and assessment.</p>	<p>(3R) – 3 ring binder; (MNB) – marble notebook; (P) – portfolio</p> <p><i>Vocabulary</i> – graph , axis , table, diagram, representation, decrease (3R)</p> <p><i>Work Time</i> – Student Sheets 3 –12 (3R)</p> <p><i>Journal Entries</i> – (MNB) *Maximum 5 minutes</p> <p>Inv. 1.1 Which parts of the graph did you use to answer your question?</p> <p>Inv. 1.2 What does “stop”, “slow down” or “go quickly” look like on motion graph?</p> <p><i>Reflection</i> – Which strategy, (table or graph) do you find easier to use when answering questions? Use specific examples to support your answers.(P)</p>
<p>Accountable Talk</p> <p>To promote learning, explore solutions, and justify reasoning, conversations between students and students or students and teacher must be accountable – accountable to the learning community, to the mathematics discipline, and to rigorous thinking.</p>	<p><i>As a result of this Investigation, students should be able to talk and manipulate the vocabulary of the Investigation in response to this type of question:</i></p> <p>How did you know that? How can you use ...? Can you show another way? What convention did you use?</p> <p><i>These are some recommended questions that you might use. Others can be found be found at the beginning of the map and on the probing question sheet in the district mathematics guide.</i></p>

UNIT: PENNY JARS AND PLANT GROWTH
Investigation 2 (2.1 – 2.8) DAYS: 10

GRADE: 4

<p>Evidence of Learning Artifacts</p> <p>Journal and Reflection questions should be posted and referred to at the beginning of the appropriate <i>Investigation</i>.</p> <p>Journal and Reflection entries need to be done in class as part of the closure and assessment.</p>	<p>(3R) – 3 ring binder; (MNB) –marble notebook; (P) – portfolio</p> <p><i>Vocabulary</i> – table, diagram, representation, calculation, coordinate grid, plot (3R)</p> <p><i>Work Time</i> – Student Sheets 13 - 39(3R)</p> <p><i>Journal Entries</i> – (MNB) *Maximum 5 minutes</p> <p>Inv. 2.1 How many pennies would be in the jar after ten rounds? Inv. 2.2 Explain how you determined the total number of pennies in the jar. Inv. 2.3 Which strategy did you use to do your calculations and why? Inv. 2.4 How do you plot on a coordinate grid? Inv. 2.5 Predict the number of windows for a tower that has twelve floors? Inv. 2.6 How many floors does a tower have with 61 windows? Inv. 2.7 What does the steepness of each line tell you about the number of pennies in each jar? Inv. 2.8 Describe your rule for finding the total number of windows if you know the number of floors.</p> <p><i>Reflection</i> – What are 3 different ways to represent and compare situations of constant change? (P)</p>
<p>Accountable Talk</p> <p>To promote learning, explore solutions, and justify reasoning, conversations between students and students or students and teacher must be accountable – accountable to the learning community, to the mathematics discipline, and to rigorous thinking.</p>	<p><i>As a result of this Investigation, students should be able to talk and manipulate the vocabulary of the Investigation in response to this type of question:</i></p> <p style="padding-left: 40px;">How did you know...? Can you solve the problem in a different way? Does your answer make sense? What was your strategy?</p> <p><i>These are some recommended questions that you might use. Others can be found at the beginning of the map and on the probing question sheet in the district mathematics guide.</i></p>

UNIT: PENNY JARS AND PLANT GROWTH

Investigation 3 (3.1 – 3.5)

DAYS: 5

GRADE: 4

<p>Evidence of Learning Artifacts</p> <p>Journal and Reflection questions should be posted and referred to at the beginning of the appropriate <i>Investigation</i>.</p> <p>Journal and Reflection entries need to be done in class as part of the closure and assessment.</p>	<p>(3R) – 3 ring binder; (MNB) –marble notebook; (P) – portfolio</p> <p><i>Vocabulary</i> – increase, decrease (3R)</p> <p><i>Work Time</i> – Student Sheets 1-2, 59 -73 (3R)</p> <p><i>Journal Entries</i> – (MNB) *Maximum 5 minutes</p> <p>Inv. 3.1 What does the vertical axis represent on the plant heights graph?</p> <p>Inv. 3.2 How can you tell from the graph, how steadily your plant is growing?</p> <p>Inv. 3.3 How does the growth rate of the plant show up in the table? In the graph?</p> <p>Inv. 3.4 What does the shape of the graph tell you about the situation?</p> <p>Inv. 3.5 None due to assessment.</p> <p><i>Reflection</i> – How could you represent constant change in a table, a graph and an expression? (P)</p>
<p>Accountable Talk</p> <p>To promote learning, explore solutions, and justify reasoning, conversations between students and students or students and teacher must be accountable – accountable to the learning community, to the mathematics discipline, and to rigorous thinking.</p>	<p><i>As a result of this Investigation, students should be able to talk and manipulate the vocabulary of the Investigation in response to this type of question:</i></p> <p>How did you know...?</p> <p>Can you solve the problem in a different way?</p> <p>Does your answer make sense?</p> <p>What was your strategy?</p> <p><i>These are some recommended questions that you might use. Others can be found at the beginning of the map and on the probing question sheet in the district mathematics guide.</i></p>

End-of-Unit Project

Student work should be placed in **portfolio (P)**.

The project is the culminating assessment, which will allow students to apply what they learned about involve using tables and graphs to represent a constant range of change.

- . It is written in MCAS form to give students the experience of answering an open-response question.

NAME: _____

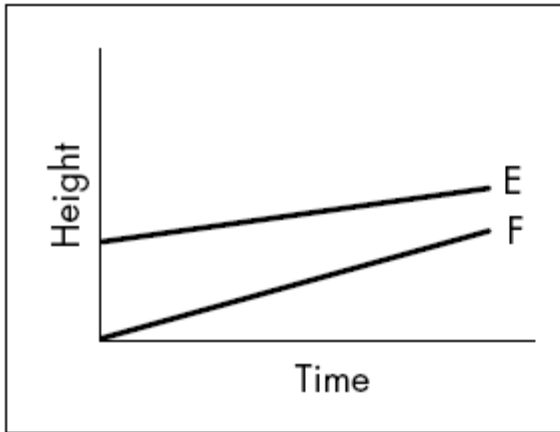
DATE: _____

End-of-Unit Project

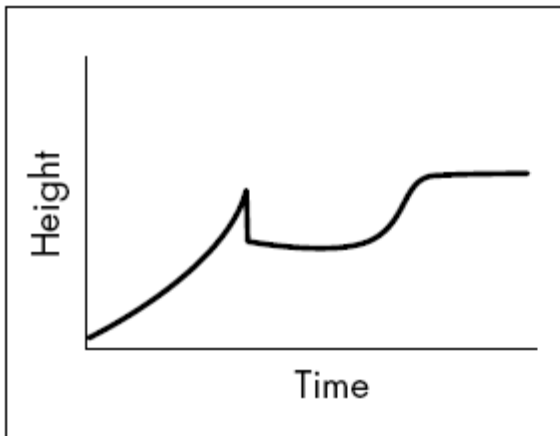
- **BE SURE TO ANSWER AND LABEL ALL PARTS OF EACH QUESTION.**
- **Show all work (diagrams, tables, and computations) on your answer sheet.**
- **If you do the work in your head, explain in writing how you did the work.**

Graphs and Stories About Plant Growth

1. Which plant is growing faster during the time shown on the graph, plant E or plant F? Tell how you decided.



2. What might have happened to this plant? Tell the story of how it grew.



- 3. a.** Draw a graph of a plant's height that matches the following story:

A plant grew slowly for 2 or 3 days, and then grew quickly for 2 or 3 days. After this fast growth, it slowed down. In a few days, it stopped growing. It had reached its full height.

Bushy's Acorns

Bushy is a squirrel that is gathering acorns for the winter. He has 5 acorns to begin with. Each day he saves 3 more.

- 4.** Complete this table:

Number of Days	Number of Acorns
Start with	5
1	
2	
3	
4	
5	
6	
7	
10	
15	
20	

- 5.** Write an arithmetic expression that shows how many acorns Bushy will have after 100 days.

On-Demand Assessments

(To be filed in portfolio)

Penny Jars and Plant Growth Investigations

In class individualized On-Demand tasks assess knowledge of mathematical facts, operations, concepts, and skills, and their efficient application to problem solving. The results of these different forms of assessment provide rich profiles of students' achievements in mathematics and serve as the basis for identifying curricula and instructional approaches to best develop their talents.

UNIT: PENNY JARS AND PLANT GROWTH

On-Demand Assessments

GRADE: 4

On-Demand Assessments (P)

Penny Jars and Plant Growth Investigations

In class individualized On-Demand tasks assess knowledge of mathematical facts, operations, concepts, and skills, and their efficient application to problem solving. The results of these different forms of assessment provide rich profiles of students' achievements in mathematics and serve as the basis for identifying curricula and instructional approaches to best develop their talents.

Inv. 2: Resource Binder: Session 2.5, M26-M27**

*Assessment Checklists should be kept with tracking sheets.(if there is an assessment that we are asking them to use

***Please refer to the section in the Teacher's Unit Guide entitled, "Professional Development" for examples of student work for each assessment.**



Holyoke Public Schools

2007 - 2008

Mathematics

Scoring Rubric

Score point 4:

The response shows a **comprehensive** understanding of the mathematical concept(s) and/or procedures embodied in the task(s). It indicates that the student has **completed the task(s) correctly**, using mathematically sound procedures. It contains **clear, complete explanations** and/or **adequate work required**.

Score point 3:

The response shows a **general** understanding of the mathematical concept(s) and/or procedures embodied in the task(s). It indicates that the student has **completed the task(s)**, using mathematically sound procedures. It contains **complete explanations** and/or **adequate work required**.

Score point 2:

The response shows a **basic** understanding of the mathematical concept(s) and/or procedures embodied in the task(s). It addresses **most aspects of the task(s)**, using mathematically sound procedures. It may contain a correct solution but provides **incomplete procedures, reasoning and/or explanations**. It may reflect **some misunderstandings** of the underlying mathematical concepts and/or procedures.

Score point 1:

The response shows a **minimal** understanding of the mathematical concepts and/or procedures embodied in the task(s). It addresses **some elements of the task(s) correctly** but reaches an **inadequate solution and/or provides reasoning that is faulty or incomplete**. It exhibits **multiple flaws related to a misunderstanding of important aspects** of the task(s), **misuse** of mathematical procedures, or faulty mathematical reasoning. It reflects a **lack of essential understanding** of the underlying mathematical concepts. It may contain a correct numerical answer but the **required work is not provided**.

Score point 0:

The response is **completely incorrect, irrelevant, or incoherent**, or contains a correct response arrived at using an **obviously incorrect procedure**.

NOTES