



# Mathematics, Science & Technology

## PART III.2

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**NOTE: This document is a work in progress. Parts II and III, in particular, are in need of further development, and we invite the submission of additional learning experiences and local performance tasks for these sections. Inquiries regarding submission of materials should be directed to: The Mathematics, Science, and Technology Resource Guide, Room 681 EBA, New York State Education Department, Albany, NY 12234 (tel. 518-474-5922).**



MST

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ELEMENTARY  
INTERMEDIATE  
COMMENCEMENT

# Sample Questions from New York State Pilot Math Assessments

*Questions from fourth-grade, eighth-grade and commencement level pilots provide examples of the sorts of thinking expected of students in new assessments.*

Assessment

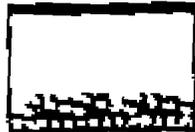
**4<sup>th</sup>**  
grade

## Fourth-grade:

1. Using the digits 3, 4, 5, place each digit in a box in order to get the largest possible answer (product). No digit may be used more than once.

<input type="text"/>	<input type="text"/>
<input type="text"/>	×

2. Jerry has gumballs in a plastic box. Right now there are 58 gumballs in the box shown below:



Estimate how many gumballs will be in the box if Jerry fills it up to the lid.

Explain how you got your estimate.

**8<sup>th</sup>**  
grade

## Eighth-grade:

1. Jason went to the grocery store and bought a package of 10 hot dogs and a package of 8 rolls. Jason noticed he would have two hot dogs without rolls. He wondered, "What is the least number of packages of hot dogs and rolls I would have to buy in order to have hot dogs and rolls come out even?"  
Solve Jason's problem. Show your work.
2. Melita has an average of 87 on the four tests she has taken in English class so far this marking period. She could make the honor roll if she gets her average up to 90. There will be only one more test before the end of the marking period.

What score will Melita need on the last test to give her an average of 90 for the marking period? Show your work.

## Extended Task

The following task assesses your ability to integrate and use your mathematical understanding to gather data and communicate your conclusions.

The Acme Bubble Gum Company is introducing a new series of Olympic Star Trading Cards. The collection includes pictures of six gold-medal winners. There is one card in each pack of gum. The probability of getting any one of the stars is equal.

In order to answer this problem, you will work in groups to simulate the purchase of gum packs in different ways.

Before you begin these experiments, answer the following questions to predict what the actual outcomes will be:

1. What do you think would be a reasonable number of packs of gum that you would need to purchase to collect all six stars?
2. Is it possible to get all six stars by purchasing only six packs of gum?
3. Is it possible **not** to get all six stars if you purchased 100 packs of gum?

## Group Data Collection

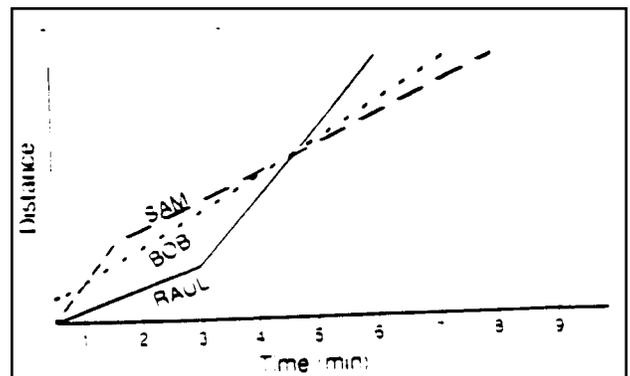
Each group will simulate the purchase of gum packs in three different ways.

1. Use a spinner divided into six equal regions, with the regions numbered 1, 2, 3, 4, 5, and 6. Each spin will represent the purchase of a pack of gum. Spin and record your results and the number of spins until you have landed on each number at least once.
2. Using a cube numbered from one to six, perform a similar experiment. Keep track of your rolls until you have rolled each number at least once.
3. Place six chips numbered from 1 to 6 into a container. Remove one chip and record your pick each time. [Remember to replace the chip drawn each time before drawing again.] Continue to draw until each number has been drawn at least once.

When your group has completed the three simulations, record your results on the class chart as directed by your teacher.

## COMMENCEMENT:

1. Three notebooks and two pens cost \$6.90. At the same time, two notebooks and one pen cost \$4.35. Find the cost of a notebook and the cost of a pen.
2. The graph below shows the relative positions of three runners in a race. Write a paragraph describing the entire race.



# Harvest Halloween

## Context

First-grade students are asked to work with a partner to solve a problem about buying pumpkins. The problem could be made easier or more difficult by changing the total amount of money the pumpkins cost, or by asking each pair or group of students to find as many solutions as possible.

### THE PUMPKIN PROBLEM

ANN WENT TO THE PUMPKIN FARM.  
SHE HAD \$5 TO SPEND. WHAT  
KINDS OF PUMPKINS COULD SHE  
BUY?



BIG PUMPKINS \$2



MEDIUM PUMPKINS \$1



SMALL PUMPKINS 2 FOR \$1



## Objectives

1. to solve a "real" problem that is connected to students' interests (and is integrated with other curriculum areas, i.e., science, social studies, health)
2. to relate mathematics to things students do outside of school (with their families) and thus to see that mathematics is present and useful (both inside and outside the classroom)
3. to see that a problem can have more than one solution
4. to develop students' ability to communicate mathematically through writing and/or drawing and to share their thinking (with others) through class discussion
5. (to foster curiosity about mathematics) and to make connections between mathematics and other subject areas.

## Materials needed

1. at least 4 pumpkins—1 large, 1 medium, and 2 small (if real pumpkins are not available, you could use paper cut-outs of pumpkins)
2. a variety of mathematic manipulatives and collections for the students to use to "stand for" the pumpkins as they work out their solution(s)
3. paper (white & orange), pencils, crayons/markers
4. large chart paper to record the brainstorming and the multiple solutions during the class discussion.

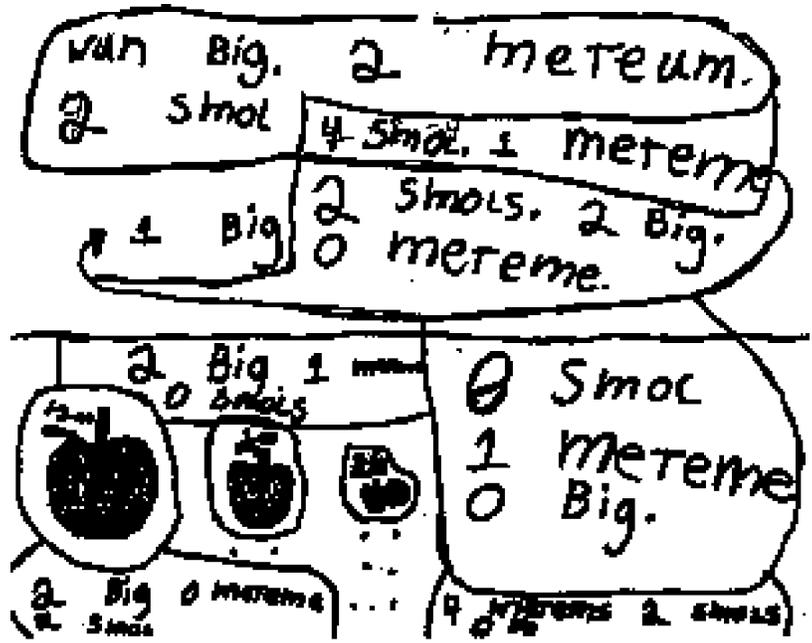
Adapted from: Caren, Ann, Beverly J. Martin School, Ithaca City Schools.

## Procedures

1. Present the following problem to the students:

I went to the pumpkin farm with \$5.00 to spend. Big pumpkins were \$2.00. Medium pumpkins were \$1.00. Small pumpkins were 2 for \$1.00. I spent all of my money. What kind of pumpkins could I buy?

2. Place the pumpkins on a table with a sign showing the prices of each kind of pumpkin. Refer to them as you describe the problem.
3. Explain that students may use any materials in the room, or draw, to help them solve this problem. Brainstorm a list of mathematic manipulatives that they use to stand for the pumpkins as they work on solving this problem.
4. After students have solved the problem, they should write and/or draw to explain how they solved it. Give them an opportunity to share their solution(s) with the class.
5. The students then work in pairs or small groups. The teacher should circulate throughout the room to observe them and to conference where needed.
6. As students finish, they should share their solutions. The teacher should record the various solutions on chart paper so that they can see the multiple solutions and check to see if their solution has been mentioned.



## Assessment Techniques

1. Observe and record student participation in class discussion by audio-taping and making written notes during and/or after the lesson regarding:
  - ability to explain reasoning
  - willingness to take risks
  - level of involvement and interest in the assignment
  - inventiveness in thinking about how to solve the problem.
2. Observe and record information about the student's work with a partner by taking brief notes during the work session and talking to groups as they work through the problems regarding:
  - grasp of numerical relationships
  - ability to represent numerical relationships with words and symbols
  - process of working with others
  - choice of materials and how they were used to solve the problem
  - level of involvement in the process.
3. Review the written work done by the students, making notes on the information gained and using the process of analyzing the work to plan the next steps in the instructional process, in terms of individual students and of the class as a whole.

Assessment

# Creating Data Bases: Computer Class Assessment

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## Context:

Students have been working on creating database files from papers which have everything labeled for them.

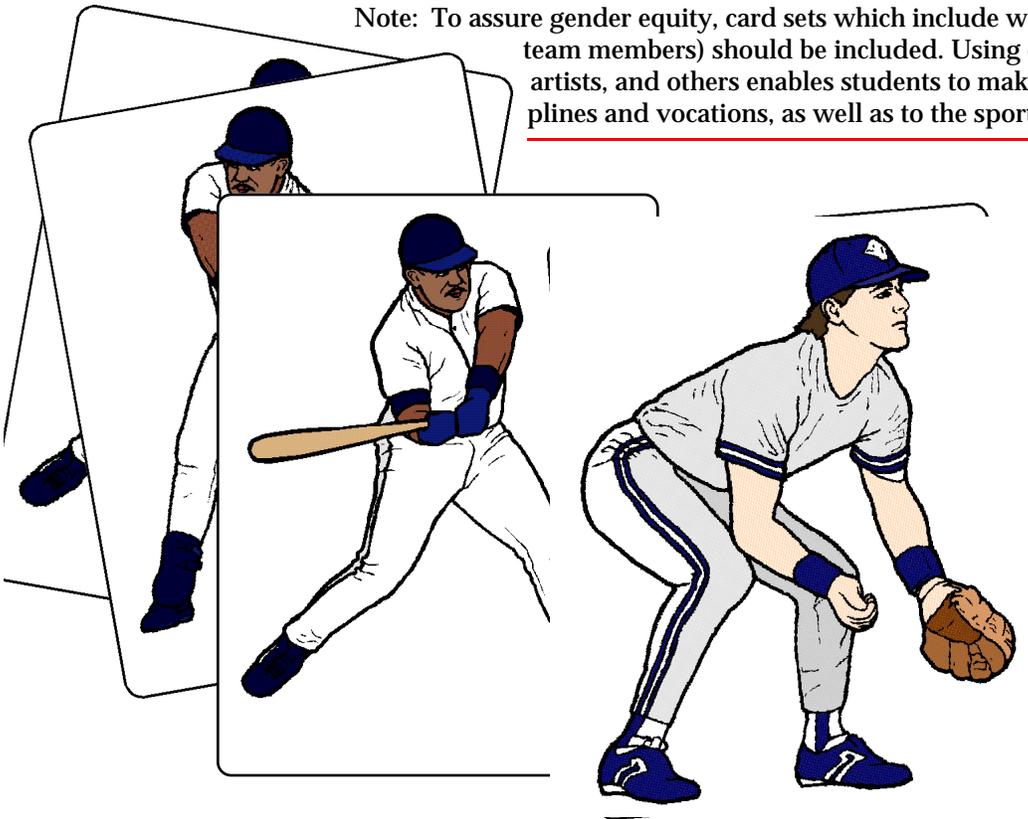
For this assessment, each student will be given a series of fifteen baseball cards. From these cards they will have to decide which categories are the most important, type in field names, decide what length would be appropriate for each line, and gather the correct information from the back of each of the baseball cards.

After all the information is filed, each student will choose any one of the players and prepare a one-page composition about the player, based on information contained in the database. They will use any computerized word processing programs with which they feel comfortable.

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Note: To assure gender equity, card sets which include women athletes (e.g., Olympic team members) should be included. Using cards that portray authors, artists, and others enables students to make connections to other disciplines and vocations, as well as to the sports field.

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Source: Lewis, Shiela and Guski, Patricia. Eighth-grade computer teachers, Emerson Junior High, Yonkers City Schools.

# Jungle Explorer Assessment

## Context

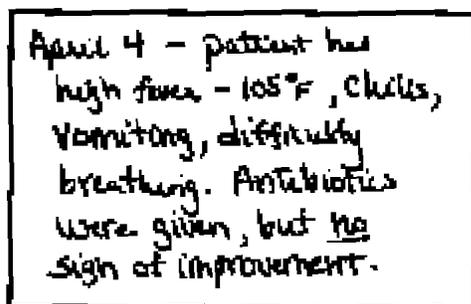
The following assessment was designed to be given after studying units on bacteria, viruses, and on the immune system. Students are expected to finish the task in a 43 minute class period, without notes. Their answers may be fictional, but must be supported by facts/content discussed in class.

## Directions

Read all of the following information **and** the questions before you begin to write your essay. Answer the problem as **completely** as you can; you must use at least **fifteen** vocabulary words from these last two units.

You are a staff member of the Center for Disease Control in Atlanta, Georgia. You have just been flown into Zaire, Africa to investigate a newly found outbreak of a disease. You have to move as quickly as possible because thousands of people are dying from an unknown disease, and you must stop it before it spreads to the city 75 miles away. Your only sources of information are local doctors, the dead bodies, family members, and the homes of the dying or the dead.

The following notes are from a diary of a doctor who treated the first victims. He is now also deceased.



April 4 - patient has high fever - 105°F, chills, vomiting, difficulty breathing. Antibiotics were given, but no sign of improvement.

1. How would you proceed? What would you do to get started?
2. What information would you want to look for?
3. How could you tell if this disease is caused by a virus or bacterium? (at least 3 ways)
4. Draw a picture of the microorganism as it looks under the microscope and label its parts.
5. Name the organism.
6. Describe what is happening to the victims' bodies.
7. Why can't the victims fight off this disease?
8. What precautions need to be taken so that you do not catch this disease?
9. How do we keep this disease from spreading? (at least 2 ways)

Source: Wood, Lisa, Seventh-grade life science teacher, Bethlehem Central Middle School, Bethlehem Central Schools.

# River Watch Program

## Context

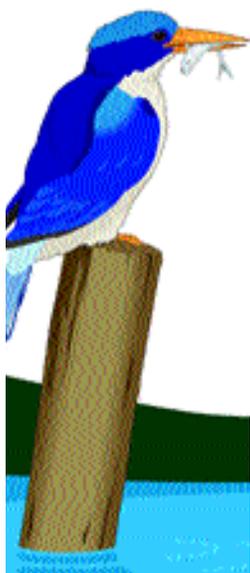
Glens Falls High School students monitor the water quality of the Hudson River with teachers and others to investigate the health of local aquatic systems in their communities. Using laboratory equipment, they measure:

- nitrate concentration
- phosphate concentration
- alkalinity
- pH
- water temperature.

Data is then evaluated to:

- detect potential pollution problems
- determine river's fitness for swimming, fishing, and other public uses
- devise cleanup strategies in event of pollution.

River Watch is a demonstration of applied science in education, for students are required to use their knowledge of chemistry, biology Earth science, mathematics, and English through hands-on science. They collect and analyze data which is computerized and processed in a regional data bank. Students also present their findings publicly at a full day session of the regional student-sponsored Clean Water Congress held in November. These science students are both enlightened and excited by the River Watch exercise. They have a vested interest in the results of their work because the Hudson River is their own local waterway, and data they collect is accurate, reliable, and can be used by decision-makers to address local concerns.



### RIVER WATCH ESSAY SCORING RUBRIC

#### 1. DEVELOPS BASELINE STUDY

Full development of ideas .....	1
Articulate; concise .....	1
Appropriate terminology used .....	1
Specific chemical concepts addressed.....	2

Four parameters identified.....	4
Three parameters identified.....	3
Two parameters identified .....	2
One parameter identified.....	1
No parameters identified .....	0

Excellent selection of sample sites.....	1
Poor selection of sample sites.....	0

#### 2. SEWAGE TREATMENT

Full development of ideas .....	1
Articulate; concise .....	1
Appropriate terminology used .....	1
Specific chemical concepts addressed.....	2

#### 3. DEVELOPMENT

Full development of ideas .....	1
Articulate; concise .....	1
Appropriate terminology used .....	1
Specific chemical concepts addressed.....	2

#### 4. FARMERS

Full development of ideas .....	1
Articulate; concise .....	1
Appropriate terminology used .....	1
Specific chemical concepts addressed.....	2

Source: Danna, Steve and Pamela Parrott, Glens Falls High School, Glens Falls City Schools.

# Applied Biology: Portfolios and Self-Assessment

MST

4

COMMENCEMENT

## Context

Teachers from Glens Falls and Brighton High Schools developed this Applied Biology Portfolio Project as a self-assessment that commencement level students could use to assess their proficiency at Standard 4.

Artists, business people, scientists, and others use portfolios when seeking jobs to demonstrate their skills and accomplishments. A portfolio is a collection of a person's best work. In June, you will prepare a portfolio of your ten best pieces of work done in this class. During the year, you will keep a work folder which will be checked at the end of each quarter. In January and June, you will place your best work with a written evaluation of each item in the portfolio for review by you, your parents, peers, and teacher.

1. Purchase two folders or portfolios (one for the work folder, and one for the official portfolio)
2. Decorate your folders—especially the portfolio (show your creativity)
3. In June, your portfolio must contain:
  - a. table of contents
  - b. a description and self evaluation of each item
  - c. use of computer graphics (ex. graphs, charts)
  - d. use of artwork (ex. sketches of cells)
  - e. Ten works including:
    - two-written lab reports (one from September and one from later in the year to illustrate progress in scientific writing)
    - one-short report and the assessment sheet for a major project (River Watch, Mentorship, Exploravision)
    - two-concept maps
    - one-personal contribution to a cooperative learning activity
    - one-piece that shows the interdisciplinary use of science in another subject taken at Glens Falls High School
    - one-journal article analysis or critique that covers a controversial issue (ex. bioengineering, laboratory animals, acid rain)
    - two-works of your choice done during the year.

Your portfolio will change through the year as you complete new work and develop better skills. Upon completion of this class, you will keep your portfolio to use someday at a college or job interview. Remember, the portfolio represents your finest work in this applied program.

### Portfolio Element Self-Evaluation Criteria

Following is a list of criteria to use in evaluating your portfolio:

- 1) selection of a topic that is of interest;
- 2) ability to describe the strengths of the portfolio element;
- 3) ability to describe ways in which the portfolio element could be improved;
- 4) ability to select important ideas from independent learning;
- 5) ability to seek constructive suggestions regarding improvement of work.

You will receive one point for each portfolio evaluation form which shows the five criteria. Since there are ten portfolio evaluation forms, you may earn a total of ten points for your portfolio self-evaluations.

Adapted from: Giglio, Kathy, McKain, Mike, and Nicandri, Steve. Brighton High School, Brighton Central Schools. With Danna, Steve and Parrott, Pamela. Glens Falls High School, Glens Falls City Schools.

# Self-Evaluation of Portfolio Element

Name \_\_\_\_\_

Type of portfolio element \_\_\_\_\_

Title/Subject \_\_\_\_\_

Why did you select this portfolio element?

What did you like most about doing this portfolio element?

What did you like least about doing this portfolio element?

What is good about the work that you have done for this portfolio element?

What could be improved in the work that you have done for this portfolio element?

What are the ten most important things you learned about biology from doing this portfolio element?

Share your work with two of your classmates. What did they like about your portfolio element?

Share your work with two of your classmates. What suggestions did they have for improving your portfolio element?

What advice should your teacher give to future students who might select a portfolio element similar to this one?



# Checklist: Writing Skills for Laboratory Reports

MST

1 2 3 4  
5 6 7

COMMENCEMENT

## Context

The writing that students do in science class is different from the writing they complete in their English language arts classes. The following chart suggests skills and techniques that students will need to master to write effectively in the science classes.

	<i>Acceptable</i>	<i>Not acceptable</i>	<i>Does Not Apply</i>
<b>WRITING SKILLS</b>			
<b>I. Mechanical Skills</b>			
1. spells correctly			
2. punctuates correctly			
3. capitalizes correctly			
4. writes legibly			
<b>II. Word Choice</b>			
1. uses words correctly			
2. uses appropriate vocabulary			
3. uses clear, concrete language (without slang)			
<b>III. Sentence Structure and Syntax</b>			
1. varies sentence structure			
2. uses complete sentences (without fragments or run-ons)			
3. keeps subject/verb in agreement			
4. appropriately uses conjunctions			
<b>IV. Graphic Techniques (for Diagrams, Tables, Charts and Graphs)</b>			
1. draws accurately			
2. adapts constructions to fit conventions			
3. labels correctly			
4. presents visually effective data			
5. matches captions to data			
<b>V. Organization of the Lab Report</b>			
1. composes internally consistent paragraphs			
2. reorganizes paragraphs into sections			
3. forms transitions between ideas			
4. summarizes and concludes major ideas			
5. articulates and coordinates a coherent model			
<b>VI. Communicating the Lab Activity</b>			
1. follows format directions			
2. focuses upon topic			
3. excludes irrelevant material			
4. supports generalizations with appropriate examples and details			
5. demonstrates understanding of the objective			

Adapted from: *Reflections on Writing in Science*, New York State Education Department, 1984.



# Checklist: Inquiry and Writing Skills for Revision and Evaluation of the Written Report

## Context

The writing that students do in science class is different from the writing they complete in their English language arts classes. The following chart suggests skills and techniques that students will need to master to write effectively in the science classes.

	<i>Acceptable</i>	<i>Not acceptable</i>	<i>Does Not Apply</i>
<b>INQUIRY SKILLS</b>			
<b>I. Planning</b>			
1. identifies a problem or question to investigate			
2. formulates hypothesis			
3. explains or refers to experimental design			
4. plans appropriate controls			
<b>II. Performance</b>			
1. demonstrates knowledge of technique			
2. describes and observes accurately and completely			
3. demonstrates quantitative measurement			
4. identifies dependent and independent variables			
<b>III. Analysis and Interpretation</b>			
1. appropriately transforms raw data			
2. correctly interprets observed data			
3. shows qualitative relationships			
4. shows quantitative relationships			
5. analyzes accuracy of data			
6. suggests limitations or assumptions affecting data			
7. proposes a generalization or model			
8. draws conclusions			
<b>IV. Application</b>			
1. integrates prior knowledge			
2. suggests original hypothesis			
3. suggests contemporary application			

Adapted from: *Reflections on Writing in Science*, New York State Education Department, 1984.