

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Student Booklet

Task Title: **Who Must Be Canned?**

Student's Name: _____

GRADES 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: Who Must Be Canned?

MATERIALS:

Calculator
Paper
Tape
Scissors
Ruler

FORMULAS:

$$V = \pi r^2 h$$

$$C = 2\pi r$$

$$A = \pi r^2$$

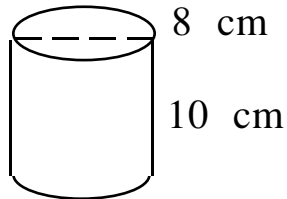
PROBLEM:

Your boss, the CEO of “Super Soup,” has decided to sell twice as much soup for the original price. Two employees approach you, the vice president in charge of packaging, with can designs. Charlie claims that he has doubled the volume of the soup can by doubling its height. Alexis claims that she has doubled the volume by doubling the radius of the lid. You must determine which (if either) of the two designs will be used. Your decision and the defense of your decision is especially crucial, for the CEO tends to fire ineffective employees. Thus, the jobs of three people are at stake!

INSTRUCTIONS:

1. Write an explanation to the CEO demonstrating the effect of both Charlie’s & Alexis’s approaches to doubling the volume. Include all details clarifying your reasoning, including necessary formulas and calculations. Finally, state which of the two designs you would recommend and why.

2. A month later, a representative from market research brings to your attention the public's demand for a larger can of squirrel stew. The original stew can is shown below.



Grocers refuse to alter the shelf height, so you may only change the diameter of the can. Describe how you would determine the diameter to double the volume. If equations are used, be sure to show all steps.

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Teacher Booklet

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GRADES 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: Who Must Be Canned?

CURRICULUM STANDARD ASSESSED:

Problem Solving:

- 1.3 The student understands and applies concepts and procedures from geometric sense.
- 2 The student uses mathematics to define and solve problems.

Communication:

- 4 The student communicates knowledge and understanding in both everyday and mathematical language.

ASSESSMENT PROTOCOL:

1. Materials must be provided for students in case they choose to use them.
2. Assessment is to be completed individually.

MATERIALS:

Calculator
Paper
Tape
Scissors
Ruler

FORMULAS:

$$V = \pi r^2 h$$
$$C = 2\pi r$$
$$A = \pi r^2$$

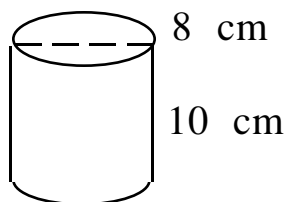
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GRADE 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

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Rubric (in addition to the problem solving rubric)

- 4 Answers are correct and explanation is detailed and clear. In question 1, the student explains that doubling this height will double the volume, when doubling the radius will actually quadruple the volume. $V = \pi r^2$ must be used somewhere in this explanation.
In question 2 the student must fully explain a way that the diameter can be altered to double the volume. The correct new radius is $4\sqrt{2}$. The correct new diameter is $8\sqrt{2}$.
- 3 The correct answers, (as detailed above) are given but lacking detail in computation or explanation.
or
Question 1 is correctly answered with a full explanation but there are minor errors in question 2.
- 2 The student uses the correct formula and logic, but computational errors are made so the final figures are incorrect.
- 1 The student uses the wrong formula but the reasoning is logical.
or
The student uses the correct formula, but uses it incorrectly.

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Anchor Paper Commentaries

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GRADE 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: Who Must Be Canned?

ANCHOR PAPER 4

Problem Solving:

The student used the correct formula for the volume of a cylinder. He demonstrated that doubling the radius actually quadruples the volume, while doubling the height doubles the volume. In the second part, he correctly derived the square root of 32 as the radius of the requested can.

Communication:

For communication, this paper receives a 4. The explanation is extremely organized and systematic. It is also logical and easy to follow. The mathematical concepts are presented in a step-by-step format.

ANCHOR PAPER 3

Problem Solving:

The student used the correct formula for the volume of a cylinder. He/she reached the conclusion that, if the radius is doubled, the volume of the new can will be 4 times the volume of the original. By plugging in numbers, the student also determined that the volume of the can whose height was doubled was two times the volume of the original can. The second part of the student's answer uses effective logic but contains computational errors.

Communication:

The communication score for this paper would be a three. The presentation is clear and organized, but could be more systematic in order to be effective.

ANCHOR PAPER 2

Problem Solving:

The student uses the correct formula but makes computational errors in both parts of the problem. Applicable mathematical processes are used, but reasoning is somewhat flawed.

Communication:

For communication this paper would receive a 2. The presentation was understandable but could have been better organized. Question 2, in particular, lacked clarity.

ANCHOR PAPER 1

Problem Solving:

The student used the wrong formula, but reasoning was logical. He/she attempted to investigate the situation. The analysis of the data for the task was inappropriate.

Communication:

For communication, this paper would receive a 2. The student communicates understanding of the situation in an understandable manner. The format of presentation is acceptable to the task.

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Student Booklet

Task Title: **Never Give a Sucker an Even Break**

Student's Name: _____

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Teacher Booklet

Task Title: **Never Give a Sucker an Even Break**

GRADES 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: Never Give a Sucker an Even Break

CURRICULUM STANDARD ASSESSED:

Problem Solving:

- 1.4 The student understands and applies concepts and procedures from probability and statistics.
- 2 The student uses mathematics to define and solve problems.
- 3.2 The student predicts results and makes inferences.

Communication:

- 4 The student communicates knowledge and understanding in both everyday and mathematical language.

ASSESSMENT PROTOCOL:

1. Materials must be provided for students in case they choose to use them.
2. Not all materials are required to be used for the solution.
3. Assessment is to be completed individually.

MATERIALS:

Calculator	Tally Sheet
Die	Spinner (optional)

PROBLEM:

You and your friend are at a carnival. You pass a carnival game in which a person can win \$8 if he/she can guess the number that will turn up when a fair die is rolled or lose \$2 if the number is different. Your friend thinks that this game is a good deal. You think otherwise. Convince your friend that, over the long run, a person who plays this game will lose money.

INSTRUCTIONS:

- 1 Using a die, spinner, tally sheet, algebra, or other means, justify, in detail, your argument that a person playing the game will lose money in the long run.
- 2 Rewrite the rules of the game so that the game is fair. Explain in detail.

GRADE 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: Never Give a Sucker an Even Break

Rubric (in addition to the problem solving rubric)

- 4 The student must explain in detail that there is only a one in six chance of winning; therefore, out of six rolls he would lose \$2.00 (\$8.00-\$10.00) on the average.
- 3 Same as above but doesn't explain question 2 in detail.
or
The student answers question 1 correctly. Addresses the fairness issue, but misses the monetary part of the "fairness" in question 2.
- 2 Question 1 is answered correctly and question 2 is wrong.
- 1 Experimental probability or $1/6$ concept but not much else.

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Anchor Paper Commentaries

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GRADE 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: Never Give a Sucker an Even Break

ANCHOR PAPER 4

Problem Solving:

The student gave an accurate probability of winning the game. He/she also described the monetary effects of losing \$2.00 in 6 rolls of the dice over the long run. In part 2 the student successfully rewrote the rules to create a fair game that took into account both probability and pay outs.

Communication:

This paper would receive a 4 in communication. The student presented the possible outcomes in a clear and systematic manner using audience appropriate language.

ANCHOR PAPER 3A

Problem Solving:

The student gave an accurate probability of winning the game. He/she also described that you would lose \$10 for every \$8 you won. While giving correct modified pay outs to make the game fair, the student did not explain how he/she arrived at this answer.

Communication:

This paper would receive a 2 for communication. The student's responses are understandable, but not clear and organized.

ANCHOR PAPER 3B

Problem Solving:

The student gave an accurate probability of winning and also mentioned that in the long run \$2 would be lost for every 6 rolls. To make the game fair, the student balanced the mathematical probability but neglected to mention the financial effect.

Communication:

This paper would receive a 3 for communication. The reasoning is clearly delineated.

ANCHOR PAPER 2

Problem Solving:

The student gave the correct probability of winning the game. To make the game fair, the student balanced the mathematical probability. In the first part, the student neglected to mention the financial aspect, and gave an incorrect financial assessment in the second part.

Communication:

In communication, this paper would receive a 3. The student presented the answer clearly and in an organized manner.

ANCHOR PAPER 1

Problem Solving:

The student arrived at the correct probability but didn't demonstrate an understanding of the meaning of the probability. The financial aspect was omitted in the first part and incorrectly interpreted in the second part.

Communication:

For communication, this paper would receive a 1. The student gathered a little information but presented it in a disorganized manner that was difficult to understand.

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Student Booklet

Task Title: **The Career Conflict**

Student's Name: _____

GRADES 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: The Career Conflict

MATERIALS:

- Calculator
- Paper
- Pencil

PROBLEM:

Your best friend has received 2 different job offers, one in Washington, one in Oregon. Your friend comes to you for help in deciding which offer to accept. In considering the offers, keep in mind that your friend has decided to live and work in the same state. To help with the decision, you made a list of financial considerations for each job, shown in the following table.

	WA Job	OR Job
Salary	\$27,000/yr	\$30,000/yr
Federal Income Tax on Salary	25%	25%
State Income Tax on Salary	none	8%
Housing (apt.)	\$550/month	\$600/month
Food	\$175/month	\$175/month
Additional Living Expenses	\$200/month +7.8% sales tax	\$250/month +no sales tax
Car Licensing	\$350/year	\$20/year

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Teacher Booklet

Task Title: **The Career Conflict**

GRADES 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: The Career Conflict

CURRICULUM STANDARD ASSESSED:

Problem Solving:

- 1.1 The student understands and applies concepts and procedures from number sense.
- 2 The student uses mathematics to define and solve problems.
- 5.3 The student relates mathematical concepts and procedures to real-life situations.

Communication:

- 4 The student communicates knowledge and understanding in both everyday and mathematical language.

ASSESSMENT PROTOCOL:

1. Materials must be provided for students in case they choose to use them.
2. Assessment is to be completed individually.
3. Keep to the parameters of the problem: don't add complexity to disposable income.

MATERIALS:

Calculator
Paper
Pencil

PROBLEM:

Your best friend has received 2 different job offers, one in Washington, one in Oregon. Your friend comes to you for help in deciding which offer to accept. To help with the decision, you made a list of financial considerations for each job, shown in the following table.

	WA Job	OR Job
Salary	\$27,000/yr	\$30,000/yr
Federal Income Tax on Salary	25%	25%
State Income Tax on Salary	none	8%
Housing (apt.)	\$550/month	\$600/month
Food	\$175/month	\$175/month
Additional Living Expenses	\$200/month +7.8% sales tax	\$250/month +no sales tax
Car Licensing	\$350/year	\$20/year

INSTRUCTIONS:

1. Based on the figures in the previous table, which of the 2 jobs would you recommend that your friend accept? Explain, in detail, how you arrived at this conclusion.
2. How much more would your friend have to make in either Washington or Oregon to make the two jobs equally attractive from a financial viewpoint? Completely explain your answer.

GRADE 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: The Career Conflict

- 4 Correct figures for WA and OR disposable income (WA: \$8,612.80/yr or \$717.73/month; OR: \$7,780/yr or \$648.33/month) **or** Correct difference between the two disposable incomes (\$832.80 more yearly in WA; \$69.40 more monthly in WA) **and** On Question 1: Correct Job Choice (Washington). Fully explain methodology in arriving at the conclusion. Correct figure for Question 2 with explanation (\$1243/year more in OR)
- 3 Same as above except #2 attempted but incorrect.
or
Correct job choice with minor calculation errors on #1, but logical explanation and #2 within 5% of correct answer.
- 2 Question #1 has correct Job Choice and some explanation, although minor calculation errors prevent correct numerical solution.
or
Incorrect job choice due to minor calculation errors but a good job explaining the reasoning.
- 1 Some mathematical attempt to find correct disposable incomes but numerous calculation errors. Incorrect job choice.
- 0 Superficial reasons for job choice with little or no mathematical reasoning.

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Anchor Paper Commentaries

Task Title: **The Career Conflict**

GRADE 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: The Career Conflict

ANCHOR PAPER 4

Problem Solving:

The student gave correct procedures and figures for problems 1 and 2.

Communication:

This paper would receive a 3 in communication. The details of how the answers were obtained needed to be searched for.

ANCHOR PAPER 3A

Problem Solving:

Correct figures and choice of job were given for problem 1. The procedure was explained well. Problem two was attempted but incorrect. The answer in problem two was guessed or estimated.

Communication:

This paper would receive a 4 for communication. The student's responses are understandable, well-written and organized.

ANCHOR PAPER 3B

Problem Solving:

The student has the correct job choice for problem 1, using logical reasoning. The details are not fully developed. Incorrect figures were given for disposable income. Problem 2 was attempted and the answer was within 2% of the correct figure.

Communication:

This paper would receive a 2 for communication. The reasoning is not clearly delineated but shows a logical thought process.

ANCHOR PAPER 2A

Problem Solving:

Correct job choice, but minor errors in calculation for problem 1. (Intermixed yearly and monthly expenses.) Problem 2 was attempted but the student calculated that the Oregon job would not provide enough to cover expenses.

Communication:

In communication, this paper would receive a 3. The student presented the answer clearly and in an organized manner, although the conclusion was based on erroneous information.

ANCHOR PAPER 2B

Problem Solving:

The student made the incorrect job choice based on numerous mistakes. (Intermixed yearly and monthly expenses, numerical mistakes.) Disregarding errors in arithmetic, the figures seem logical.

Communication:

For communication the student would receive a 2. There is some attempt at an explanation, but it is hard to follow.

ANCHOR PAPER 1

Problem Solving:

The student made the incorrect job choice based on numerous mistakes. (Intermixed yearly and monthly expenses, numerous errors in calculation on the WA figures.) No attempt was made at problem 2.

Communication:

For communication, this paper would receive a 2. The student labeled the work, but gave no written explanation of choice or arithmetic.

ANCHOR PAPER 0

Self-explanatory.

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Student Booklet

Task Title: **Working for Scale!**

Student's Name: _____

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Teacher Booklet

Task Title: **Working for Scale!**

GRADE 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: Working for Scale!

CURRICULUM STANDARD ASSESSED:

Problem Solving:

- 1.2 The student will measure objects and events directly or use indirect methods *such as finding the volume of a cone given its height and diameter.*
- 1.3 The student constructs geometric models and scale drawings using tools as appropriate, *for example, designing a house plan or building a model of a bridge.*
- 2 The student uses mathematics to define and solve problems.
- 5.3 The student relates mathematical concepts and procedures to real-life situations.

Communication:

- 4 The student communicates knowledge and understanding in both everyday and mathematical language.

ASSESSMENT PROTOCOL:

1. A variety of materials must be provided for students for construction of the model.
2. Not all materials are required to be used for the solution.
3. Assessment is to be completed individually.
4. This task may take 120-180 min.
5. Make graph paper available in case students would like to make a scale drawing before building the model.
6. As an extension, catalogues from retailers of windows may be made available so students can use standard window sizes in their models.

MATERIALS:

Cardboard/tagboard

Calculator

Tape/glue

Pencil

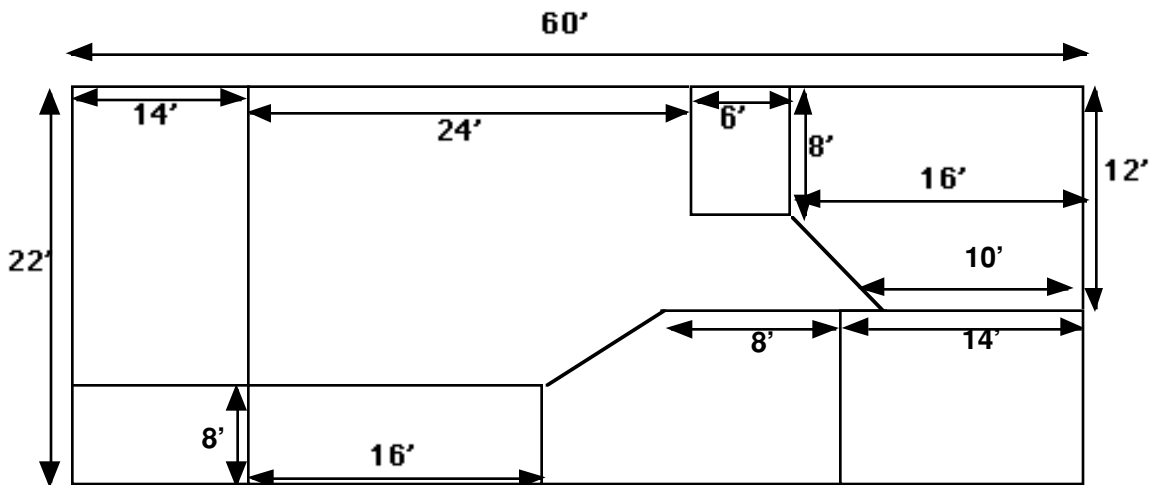
Scissors/craft knives

Paper

Graph paper

PROBLEM:

You are an architect. A married couple has approached you with a sample floor plan for the house of their dreams. The clients already own the land on which the house will be constructed. You explain to your clients that construction costs for this type of home are \$125 per square foot. The clients then ask you to determine the total cost of the house including 7.5% sales tax.



Note: Drawing is not to scale!

INSTRUCTIONS:

1. Find the cost of the house. Show all the calculations and explain your reasoning in detail.
2. You explain to your clients that the general rule of thumb is that homeowners can afford to buy a home costing two and a half times their annual income. The clients' combined annual income is \$72,000. Your clients ask you to determine whether or not they can afford to build this house. They request you to show them all the calculations and explain your reasoning in detail.
3. In order to win the bid for constructing this house, your primary task is to provide them with a scale model with interior walls, but no roof. Develop a feasible scale for your model. Write your scale here:
4. Using this scale, along with the floor plan given above, build your model. Disregard the thickness of the interior and exterior walls. When designing your model, be sure to include doors and windows as you see fit. There must be at least one exterior door and an exit for each room. Standard doors are 6.5' high and 3' wide. The interior walls are 8' high.

GRADE 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: Working for Scale!

RUBRIC

- 4 Question 1 has the correct final figure (\$177,375) with work shown.
Question 2 has correct answer and reasoning (Yes since $2.5(72,000) > 177,375$)
Question 3 a feasible scale was given
Question 4 had the scale followed (with 90% accuracy) in the model.
- 3 Question 1 has the correct final figure (\$177,375) with work shown.
Question 2 has correct answer and reasoning (Yes since $2.5(72,000) > 177,375$)
Question 3 a feasible scale was given
Question 4 had the scale followed (with 75% accuracy) in the model.

or

- 3 Question 1 is incorrect.
Question 2 is incorrect.
Question 3 a feasible scale was given
Question 4 had the scale followed (with 90% accuracy) in the model.
- 2 Question 1 has the correct final figure (\$177,375)with work shown.
Question 2 has correct answer and reasoning (Yes since $2.5(72,000) > 177,375$)
Question 3 a feasible scale was given
Question 4 had the scale followed (with 50% accuracy) in the model.

or

- 2 Question 1 is incorrect.
Question 2 is incorrect.
Question 3 a feasible scale was given
Question 4 had the scale followed (with 75% accuracy) in the model.
- 1 Question 1 is incorrect.
Question 2 is incorrect.
Question 3 a feasible scale was given
Question 4 had the scale followed on the model's outside dimensions.
- 0 None of the above.

GRADE 9/10
PERFORMANCE ASSESSMENT

MATHEMATICS

Anchor Paper Commentaries

Task Title: **Working for Scale!**

GRADE 9/10 - PERFORMANCE ASSESSMENT

MATHEMATICS

TASK: Working for Scale!

Problem Solving/Communication:

Note: In the original piloted task, an explanation was NOT required for Problem 1. When scoring future tasks, this should be considered.

- 4 The correct figure \$177,375 was obtained for the cost of the house (Problem 1) and a correct answer (yes) was given for problem 2. The scale given was 1ft:1/4 in, which was accurately followed in the scale model.

See picture of model with student paper.

- 3A Correct answers given for Problem 1 and 2. The scale of 1ft:1/4 in was given and mostly followed. Doors were not to scale, nor were some of the walls.

See picture of model with student paper.

- 3B The answer to Problem 1 was incorrect, although the student obtained the correct answer to Problem 2. A scale of 1 ft:1 cm was followed with 90% accuracy.

See picture of model with student paper.

- 2 The correct answer was given on Problem 1. The student concluded that the homeowners could afford the house but didn't justify this. The width of the house is not to scale, nor are the doors. If the correct scale was used, the doors would be 4.5 feet tall.

See picture of model with student paper.

- 1 Correct answers given for Problem 1 and 2. The house is not well constructed and only about 50% complete. Outer walls and existing rooms are to scale.

See picture of model with student paper.

- 0 Accompanying test paper was not submitted. Exterior walls not complete, and completed walls are not to scale.

See picture of model at end of student papers.