

Teacher Package

Mathematics Exemplar Task Grade 8 – Data Management and Probability, and Number Sense and Numeration

Teacher Package

Title: Rolling in Sales

Time requirement: 165 minutes (total)

- 45 minutes for pre-task 1
- 30 minutes for pre-task 2
- two periods of 45 minutes each for the exemplar task

Description of the Task

This task requires each student to determine the lowest possible percentage discount and the highest possible percentage discount resulting from their rolling two numbered cubes (dice) and adding the numbers shown on the numbered cubes. Students must state which percentage discount is most likely to occur and why; the probability of getting a percentage discount greater than 10 percent; and which they would choose, and why, between a 10 percent discount and rolling the numbered cubes. Finally, students will be asked to invent a probability game that uses percent.

Expectations Addressed in the Exemplar Task

Note that the codes that follow the expectations are from the Ministry of Education's *Curriculum Unit Planner* (CD-ROM).

Students will:

1. solve and explain multi-step problems involving fractions, decimals, integers, percents, and rational numbers (8m8);
2. use mathematical language to explain the process used and the conclusions reached in problem solving (8m9);
3. ask "What if" questions; pose problems involving fractions, decimals, integers, percents, and rational numbers and investigate solutions (8m30);
4. explain the process used and any conclusions reached in problem solving and investigations (8m31);

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5. apply percents in solving problems involving discounts, sales tax, commission, and simple interest (8m34);
6. identify probability situations and apply knowledge of probability (8m95);
7. list the possible outcomes of simple experiments by using tree diagrams, modelling, and lists (8m118);
8. identify the favourable outcomes among the total number of possible outcomes and state the associated probability (e.g., of getting closer in a random draw) (8m119).

Teacher Instructions

Prior Knowledge and Skills Required

Before attempting the task, students should have some knowledge or skills related to the following:

- addition and multiplication of integers
- solving multi-step problems involving simple fractions, decimals, and percents
- intuitive concepts of probability and how probability can relate to chance
- listing the possible outcomes of simple experiments by using tree diagrams or matrices

The Rubric*

The rubric provided with this exemplar task is to be used to assess students' work. The rubric is based on the achievement chart given on page 9 of *The Ontario Curriculum, Grades 1–8: Mathematics, 1997*.

Before asking students to do the task outlined in this package, review with them the concept of a rubric.

Accommodations

Accommodations that are normally provided in the regular classroom for students with special needs should be provided in the administration of the exemplar task.

Materials and Resources Required

Before students attempt a particular task, provide them with the appropriate materials from among the following:

- a copy of the Student Package (see Appendices 1 and 2) for each student
- 3 cups
- 1 "prize" that will fit under a turned-over cup
- 2 numbered cubes per student
- grid paper for the matrix
- calculators
- math dictionaries (optional)

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*The rubric is reproduced on pages 105–106 of this document.

Task Instructions

Introductory Activities

The pre-tasks are designed to review and reinforce the skills and concepts that students will be using in the exemplar task and to model strategies useful in completing the task.

Pre-task 1: The Integer Spinner Game

Have students, working in pairs, use a spinner to determine two integers. (See Appendix 1, which includes one example of a spinner that you can make.) Ask one student in each pair to find the sum of the two integers and the other to find their product. The player with the greater number wins one point. Have students play several rounds and then analyse the game to determine if it is fair. If students determine that the game is not fair, ask them how could they make it fair.

Pre-task 2: The Three Cups Game

Place three cups upside down with a “prize” underneath one of them. Ask students to predict the probability of selecting the cup concealing the prize. (The answer is 33% or 0.33 or $\frac{1}{3}$.)

Turn over one of the cups that does not conceal the prize. Have students debate whether this new information changes their prediction.

Exemplar Task

1. Distribute a copy of the Student Package to each student.
2. Tell students that they will be working individually and independently to complete the assigned task.
3. Remind students about the rubric and make sure that each student has a copy of it.
4. The problem that the students will solve independently is provided in the worksheets in Appendix 2.

You may find the following analyses of the assigned tasks useful.

Question 1

- The cubes are rolled and the numbers shown on each cube are added together. The sum of the numbers is your percentage discount.
- The current price of one outfit is \$110.
- What is the least you could pay?
[$6+6$ (maximum numbered cube sum) = $12\% \times 110 = \$13.20$ reduction thus \$96.80]
- What is the most you could pay?
[$1+1$ (minimum numbered cube sum) = $2\% \times 110 = \$2.20$ reduction thus \$107.80]

Students may find it useful to create a matrix that shows the possible outcomes:

+	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Question 2

- What percentage discount is most likely to occur? How do you know?
[7% because it has a probability of 6 out of 36 (or 1 out of 6 or 16.6%)]

Question 3

- What is the probability of getting a percentage discount greater than 10%?
[The probability is $\frac{3}{36}$ or $\frac{1}{12}$ or 8.3%.]

Question 4

- If you were offered a choice between a 10% discount and rolling the numbered cubes, which would you choose? Justify your choice.
[Answers may vary. The probability of getting a roll of 10 is 3 out of 36 (1 out of 12), 11 is 2 out of 36 (1 out of 18), and 12 is 1 out of 36. So there are 3 chances in 36 or 1 in 12 of getting higher than a 10% discount and a 30 out of 36 chance (5 out of 6) of getting less than a 10% discount. This means you have a better chance for a higher discount if you choose the 10% discount than if you rolled the numbered cubes.]

Question 5

- As the store manager, you are prepared to offer a discount of 15%. Invent another game that will produce this result. Determine the probability of a customer getting a 15% discount.
[Answers may vary as students may use other types of numbered cubes in their game.]

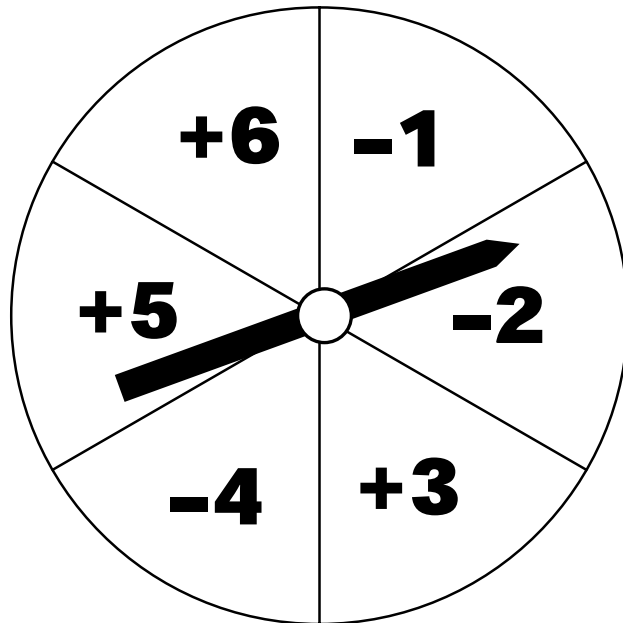
Appendix 1

The Integer Spinner Game

Work with a partner, alternating turns as the spinner.

For each turn, the player spins twice, noting the two numbers arrived at (one for each spin). Player A *adds* the two numbers. Player B *multiplies* the two numbers. The player with the greater result wins a point.

Play several rounds of the game.



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Analyse the game and state whether it is fair or unfair. Discuss your answer. If the game is unfair, how could you make it fair?

Suppose the game were changed so that player A subtracts the smaller number from the larger and Player B *divides* the larger number by the smaller. How would this affect the results of the game?

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Appendix 2: Student Worksheets

Rolling In Sales

A local clothing store decides to offer a unique sales promotion based on the sum of two standard numbered cubes.

The cubes are rolled and the numbers shown on each cube are added together. The sum of the numbers is your percentage discount.

The current price of one outfit is \$110.00.

1. a) Explain how you would determine the lowest percentage discount and the highest percentage discount.

b) Calculate the least you could pay and the most you could pay.

2. What percentage discount is most likely to occur? How do you know?

**3. What is the probability of getting a percentage discount greater than 10%?
Show your work.**

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**4. If you were offered a choice between a 10% discount and rolling the
numbered cubes, which would you choose? Justify your choice.**

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5. As the store manager, you are prepared to offer a discount of 15%. Invent another game that will produce this result. Determine the probability of a customer getting a 15% discount.

6. What discount is most likely to occur? How do you know?