

**Mathematics Governor's Institute 2003
Problem-in-a-Bag Template**

Title of Project:

Grandma's Birthday Gift

Team Members:

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Grade Level and/or Course:

Pre Algebra Grades 6 - 8

Concept(s) used:

Problem Solving, Graphing, Basic Operations, Writing, Reasoning, Algebraic Equation Solving, Patterning

PA Standard(s) Addressed:

- **2.1.8 G - Numbers, Number Systems and Number Relationships**
- **2.2.8 A, B, F – Computation and Estimation**
- **2.4.8 A – Mathematical Reasoning and Connections**
- **2.5.8 A, B, C, D – Mathematical Problem Solving and Communication**
- **2.6.8 F – Statistics and Data Analysis**
- **2.7.8 B – Probability and Predictions**
- **2.8.8 C, F, G, H, I – Algebra and Functions**
- **2.11.8 C – Concepts of Calculus**

NCTM Standard(s) Addressed:

- **Numbers & Operations**
- **Algebra**
- **Data Analysis & Probability**
- **Problem Solving**
- **Reasoning and Proof**
- **Communications**
- **Connections**
- **Representation**

Introduction / applications:

For your birthday, Grandma has offered you a choice of either a \$100 gift card to a movie theater or to a local video store. The gift card is valid for packages only, not individual items. The contents of each movie package are listed below. All applicable sales tax has been included in the prices.

<u>Video store package</u>	<u>Movie theater package</u>
Rental \$4.23	Ticket \$ 7.50
Soda \$1.16	Medium Soda \$3.75
Popcorn bucket \$ 1.69	Medium Popcorn \$ 4.25
Candy bar \$1.49	
Membership fee \$10.00 (one time only)	

Question:

(Be sure to show all work for the entire project.)

1. Given the pricing information which card would give you the most movie packages?
2. Between the two choices what is the difference in the number of movie packages you get?
3. Find the balance left on your gift card after you have spent the greatest amount possible.
4. Would your choice be different if you could attend all matinee packages where all prices are the same except the admission ticket is reduced to \$5.25? Why or why not?
5. Using the number of packages as your x value and cost as your y value, graph the relationship for each type of gift card (using matinee prices).
6. Using the graph from question 5, do the lines intersect? If so, at what point do they intersect and what does that point represent?

Model:

Goal 1: To find the gift card I would choose to get the most movie packages for \$100.

Supporting Details: See the information given in the introduction

Using arithmetic:

Find the total cost for a movie theater package:

$$7.50 + 3.75 + 4.25 = 15.50$$

Find the total cost for a video store package:

$$4.23 + 1.16 + 1.69 + 1.49 = 8.57$$

Find the number of movie packages I can get at the movie theater for \$100.

$$100 \div 15.50 \approx 6.45$$

With this gift card I could buy six movie packages at the movie theater.

Find the number of movie packages I can get at the video store for \$100.

$$100 - 10 = 90 \text{ (the amount left after the one-time membership fee)}$$

$$90 \div 8.57 \approx 10.50$$

With this gift card I could buy ten movie packages at the video store.

Therefore, I would choose the gift card from the video store because I can see more movies if I rent them.

Using algebra:

Find the total cost for the movie theater package:

$$7.50 + 3.75 + 4.25 = 15.50$$

Find the total cost for the video store package:

$$4.23 + 1.16 + 1.69 + 1.49 = 8.57$$

Let x = number of movie packages

$15.50x$ = total cost of movie packages at the movie theater

$8.57x + 10 =$ total cost of movie packages at the video store

Solve for x to find the number of movie packages for each gift card choice.

$15.50x = 100$ Divide both sides by 15.50 to isolate x .

$$x \approx 6.45$$

With this gift card I could buy six movie packages at the movie theater.

$8.57x + 10 = 100$ Subtract 10 from both sides

$$8.57x = 90$$

$$x \approx 10.50$$

With this gift card I could buy ten movie packages at the video store.

Therefore, I would choose the gift card from the video store because I can see more movies if I rent them.

Model using chart:

Number of Movie Packages	Total cost at the movie theater	Total cost at the video store
1	\$15.50	\$18.57
2	\$31.00	\$27.14
3	\$46.50	\$35.71
4	\$62.00	\$44.28
5	\$77.50	\$52.85
6	\$93.00	\$61.42
7	\$108.50	\$69.99
8	\$124.00	\$78.56
9	\$139.50	\$87.13
10	\$155.00	\$95.70
11	\$170.50	\$104.27

Therefore, from the chart, I can buy at most 6 packages at the movie theater with my gift card or 10 packages at the video store. As a result, I would choose the gift card from the video store because I can see more movies if I rent them.

Goal 2: To find the difference in the number of movie packages between the two choices.

Supporting Details:

Number of video store packages = 10

Number of movie theater packages = 6

Using arithmetic:

$$10 - 6 = 4$$

Therefore, the difference in the number of movie packages is four.

Goal 3: To find the balance on my gift card after I have spent the greatest amount possible.

Supporting Details:

Gift card value = \$100

Total cost for the most movie packages = \$95.70 (taken from chart)

Using arithmetic:

$$100 - 95.70 = \$4.30$$

Therefore, the balance on my gift card is \$4.30 after I have greatest amount possible.

Using algebra:

Find the total cost for the most movies possible.

Substitute 10 for x in the expression $8.57x + 10$ and simplify the expression using order of operations.

$$8.57x + 10 =$$

$$8.57(10) + 10 =$$

$$95.70$$

Find the balance.

$$100 - 95.70 = \$4.30$$

Therefore, the balance on my gift card is \$4.30 after I have spent the greatest amount possible.

Goal 4: To find the gift card I would choose to get the most movie packages for \$100 using the matinee movie price.

Supporting Details: See the information given in the introduction and question

Using arithmetic:

Find the total cost for the movie theater package:

$$5.25 + 3.75 + 4.25 = 13.25$$

Find the total cost for the video store package:

$$4.23 + 1.16 + 1.69 + 1.49 = 8.57$$

Find the number of movie packages I can get at the movie theater for \$100.

$$100 \div 13.25 \approx 7.55$$

With this gift card I could buy seven movie packages at the movie theater.

Find the number of movie packages I can get at the video store for \$100.

$$100 - 10 = 90 \text{ (the amount left after the one-time membership fee)}$$

$$90 \div 8.57 \approx 10.50$$

With this gift card I could buy ten movie packages at the video store.

Therefore, I would still choose the gift card from the video store because I can still see more movies if I rent them.

Using algebra:

Find the total cost for the movie theater package:

$$5.25 + 3.75 + 4.25 = 13.25$$

Find the total cost for the video store package:

$$4.23 + 1.16 + 1.69 + 1.49 = 8.57$$

Let x = number of movie packages

$13.25x$ = total cost of movie packages at the movie theater

$8.57x + 10$ = total cost of movie packages at the video store

Solve for x to find the number of movie packages for each gift card choice.

$13.25x = 100$ Divide both sides by 13.25 to isolate x .

$$x \approx 7.55$$

With this gift card I could buy seven movie packages at the movie theater.

$8.57x + 10 = 100$ Subtract 10 from both sides

$$8.57x = 90$$

$$x \approx 10.50$$

With this gift card I could buy ten movie packages at the video store.

Therefore, I would still choose the gift card from the video store because I can still see more movies if I rent them.

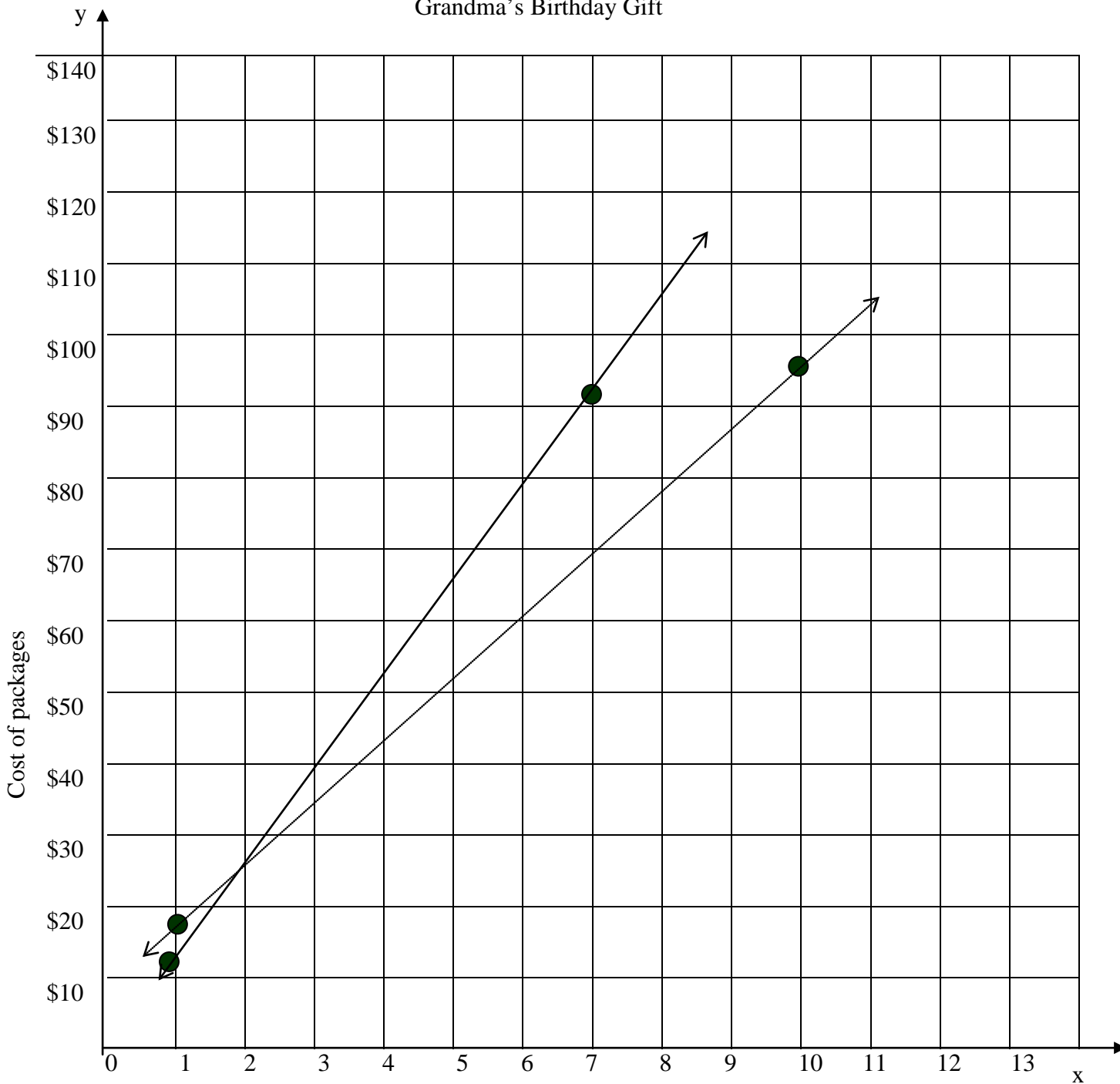
Model using chart:

Number of Movie Packages	Total cost at the movie theater	Total cost at the video store
1	\$13.25	\$18.57
2	\$26.50	\$27.14
3	\$39.75	\$35.71
4	\$53.00	\$44.28
5	\$66.25	\$52.85
6	\$79.50	\$61.42
7	\$92.75	\$69.99
8	\$106.00	\$78.56
9	\$119.25	\$87.13
10	\$132.50	\$95.70
11	\$145.75	\$104.27

Therefore, from the chart, I can buy at most 7 packages at the movie theater with my gift card or 10 packages at the video store. As a result, I would still choose the gift card from the video store because I can still see more movies if I rent them.

Goal 5: Graph the relationship of packages to cost for both the movie theatre and the video store.

Grandma's Birthday Gift



Number of Movie Packages

Video store \longleftrightarrow

Movie theatre \longleftrightarrow

Goal 6: To find if the lines intersect and if so, at which point. To find what that intersection represents.

Supporting details: See graph

The lines do intersect at about two packages and about twenty-seven dollars according to the graph of the lines. This point of intersection can also be seen on the previous chart where at two packages the costs become very close to being the same. The point of intersection represents the amount of packages it would take for the two gift cards to allow me to watch the same number of movies.

Resources and Materials (estimated cost):

- Class set of “Birthday Cards” (\$3.00)
- Class set of sample “gift cards”
- Movie display supplies (\$5.00)
- Copies of worksheet and questions
- Graph paper
- Rulers
- Pencils/Colored Pencils

Procedures & Activities:

- Give each student a birthday card from “Grandma” with the offer of a \$100 gift card to either the movie theater or the video store.
- Place a display of the items they might buy with price tags.
- Give each student a chart to fill out for the movie packages. Also a worksheet with all the questions needing to be answered.
- Hand out graph paper for students to graph their answers.
- After the project is completed celebrate with a movie, popcorn and soda.

Answers / Rubric:

CRITERIA	POINTS POSSIBLE	POINTS EARNED
Original package conclusions (# packages, difference, balances)	5	
Matinee package conclusions (# packages, difference, balances)	5	
Work shown	5	
Graphing	3	
Point of intersection (given to the nearest whole number)	3	
Written explanations (original choice, matinee choice, point of intersection)	6	
Neatness/Clarity	3	
TOTALS	30	

Accommodations/Adaptations

Special Ed:

- ◆ Complete in pairs with guided teacher support.
- ◆ Give a template for the graph.
- ◆ Give questions in “chunks”.

Enrichment:

- ✓ You rent 5 movies and view each only once; you can view the movies in any order you wish. How many possible ways are there?
- ✓ You have 7 different candy bars to choose from. You want to buy 3 different ones. How many different combinations of candy could you buy?
- ✓ If you rent 5 movies, buy 2 kinds of soda and 3 kinds of candy bars, how many different combinations consisting of 1 movie, 1 soda and 1 candy bar could you have?