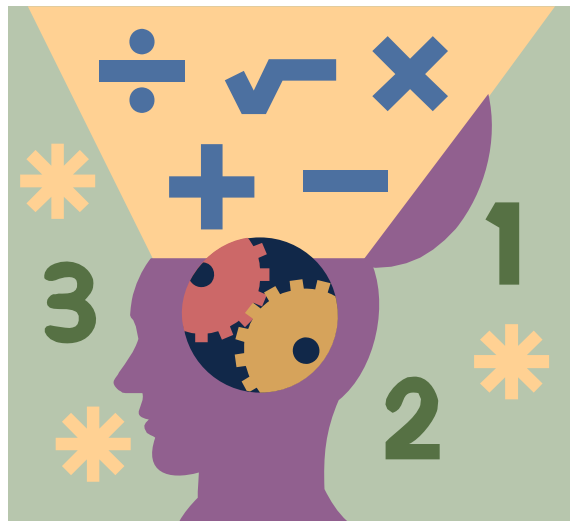


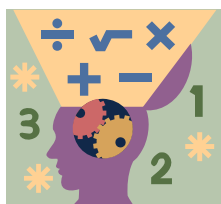
# PATTERNS & FUNCTIONS



**University of Houston Central Campus**

**September 23, 2006**

# Warm-up Activity



Test your knowledge by answering the following questions. No calculations or finger counting allowed. Good luck!

1. A woman gives a beggar 50 cents; the woman is the beggar's sister, but the beggar is not the woman's brother. How come?
2. Why can't a man living in the USA be buried in Canada?
3. How many outs are there in an inning?
4. Is it legal for a man in California to marry his widow's sister? Why?
5. Two men play five games of checkers. Each man wins the same number of games. There are no ties. Explain this.
6. Divide 30 by  $\frac{1}{2}$  and add 10. What is the answer?
7. If there are 3 apples and you take away 2, how many do you have?
8. A doctor gives you three pills telling you to take one every half hour. How long would the pills last?
9. A clerk in the butcher shop is 5'10" tall. What does he weigh?
10. How many two cent stamps are there in a dozen?
11. What was the President's name in 1950?

## Patterns & Functions



### Objectives

The participants will:

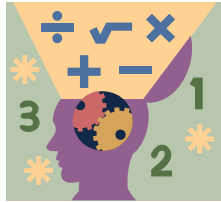
- ✓ identify independent and dependent quantities and express them in functional relationships.
- ✓ identify mathematical domains and ranges and determine reasonable domain and range values for given situations, described by discrete or continuous data.
- ✓ describe a functional relationship for given problem situations, and write equations to answer questions arising from the situations.
- ✓ represent relationships among quantities by building concrete models, completing tables, constructing graphs or diagrams, writing verbal descriptions, and writing equations.
- ✓ look for patterns in finite differences, and write the general expression or equation for a specific problem situation.

## List of Activities



- ✓ **Patterns & Functions**
  - **What Do You See?**
  - **Toothpick Triangles**
  - **Patterns & Sequences**
  - **Number Game**
  - **Vending Machine**
  - **Function or Not A Function**
  - **Real-life Functional Situations**
  - **Correlations**
  - **Elements of a Relation**
  - **Pitcher Perfect**
  
- ✓ **TEKS Related Questions**
  
- ✓ **Questions, Concerns, Evaluation**

## Pattern Activity #1



How many patterns can you find in the chart below?

Input	Output
1	6
2	10
3	14
4	18
5	22
6	26

Patterns observed:

1.

2

3.

4.

5.

## Pattern Activity #2



Examine the toothpick pattern below:



1. Describe the pattern in as many ways as you can.
2. Imagine you keep adding triangles. Complete the following table:

# of Triangles	Toothpicks
1	
2	
3	
4	
5	
10	

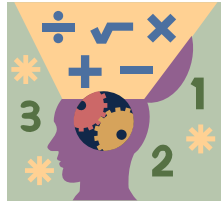
3. If someone tells you the number of triangles, explain how to tell them the number of toothpicks they would need. How do you know your description will always give the right number of toothpicks?

4. Use your explanation in Question #3 to complete the table below:

# of Triangles	Toothpicks
<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>4</b>	
<b>5</b>	
<b>10</b>	
	<b>26</b>
	<b>46</b>
	<b>102</b>

5. How does the table in this problem compare to the table from Pattern Activity #1? Is there more than one way to extend the triangle and toothpick table? Explain.

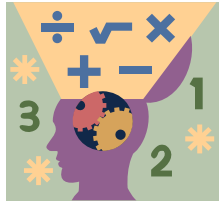
## Patterns & Sequences



- 1. Angel collected 15 rocks her first day at camp. After the first day, she found 12 rocks per day. Write an algebraic expression to determine how many rocks she collected by the  $n$ th day.**
- 2. Chili's charges \$4 to deliver the first dinner to your door. Each additional dinner cost \$8. Seven dinners would cost \$52. Write an algebraic expression to determine how much  $n$  dinners would cost.**
- 3. The Madison Family paid \$53 to have 4 pizzas delivered. 5 pizzas would cost \$65 and 6 pizzas would cost \$77. How much would  $n$  pizzas cost?**
- 4. Kathy is saving her money to buy a new bike. By the fifth week she had saved a total of \$40. The sixth week her total was \$45 and the next week it was \$50. Write an algebraic expression to determine her total on the  $n$ th week if she continues saving at this rate. How much would she have saved on week 32?**



# Number Game



## Problem #1

- Pick a number (that's the input)
- Double it
- Add 2 to the answer
- Divide that answer by 2
- Subtract 7 from what you get
- Multiply the result by 4 (that's the output)

## Problem #2

Undo Problem #1 with a new algorithm by taking the output and changing it back to the original input.

## Problem #3

Does the algorithm in Problem #2 undo the algorithm in Problem #1? That is, if you put a number into algorithm #1 and then put that output into algorithm #2; do you get back to your starting number?

## Problem #4

Use the algorithm in Problem #1 to answer the following:

- If the input is 9, what is the output?
- If the input is  $n$ , what is the output?
- If the output is 28, what is the input?

# Snack Machine



Codes		Salted Popcorn	Kettle Corn	Unsalted Popcorn
1	a			
2	b			
3	c			
		1a	1b	1c
		<b>Movie Theater Butter Popcorn</b> 	<b>Extra Butter Popcorn</b> 	<b>Fat Free Popcorn</b> 
		2a	2b	2c
		<b>Caramel Popcorn</b> 	<b>Cheese Popcorn</b> 	<b>Butter Popcorn</b> 
		3a	3b	3c

## Snack Machine Questions



1. Why would the vending machine company consider the code the independent variable in this situation?
2. Why would the vending machine company consider the drink the dependent variable in this situation?
3. List the elements in the input.
4. List the elements in the output.
- 5.
- 6.

## **Additional Real-life Input-Output Situations**

**1.**

**2.**

**3.**

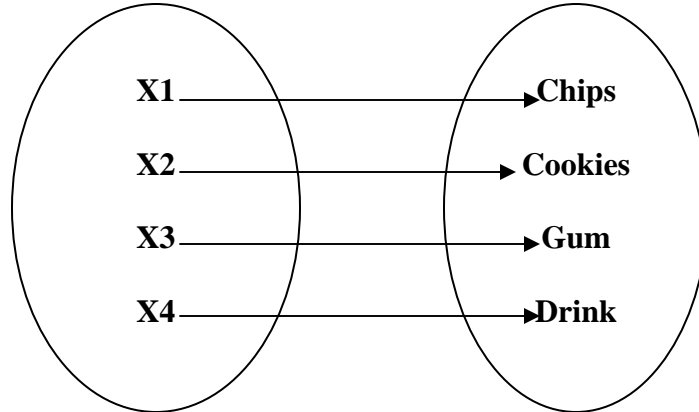
**4.**

**5.**

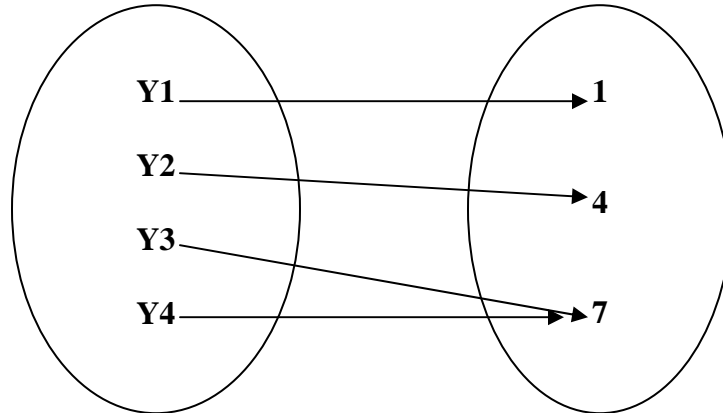
# Function or Not A Function



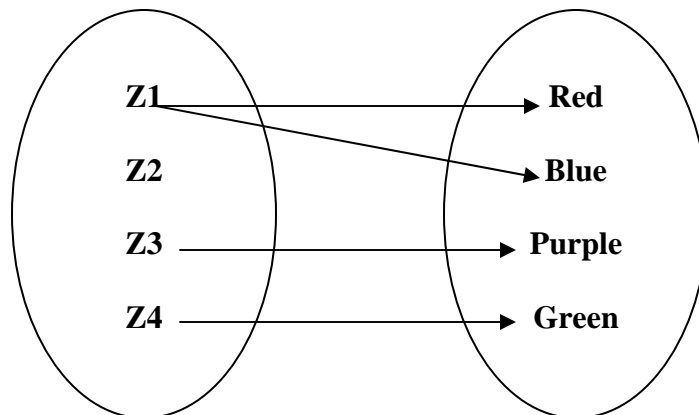
1.



2.



3.



## Independent & Dependent Relationships

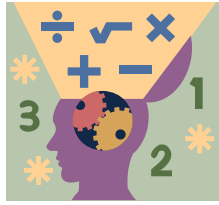


**Identify the independent and dependent variables; state if the relationship has a positive, negative, or no correlation.**

1. The total amount of money earned depends on the number of cars washed at a carwash.
2. The number of miles that we drive in a month determines the number of times we have to fill our car with gas.
3. The number of hours of television we watch affects the number of hours we devote to studying.
4. The number of cavities you get depends on the number of times you floss your teeth.
5. The length at birth versus month of birth.

<b>Independent Variable</b>	<b>Dependent Variable</b>	<b>Correlation</b>
1.		
2.		
3.		
4.		
5.		

## Independent & Dependent Relationships



**Write at least 3 functional relationships; one with a positive correlation, one with a negative correlation, and one with no correlation.**

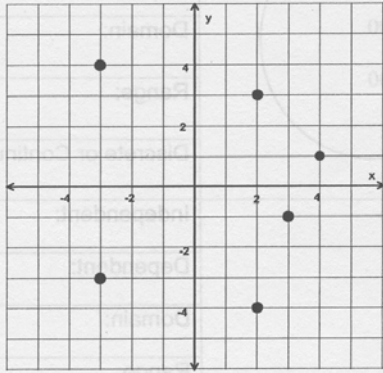
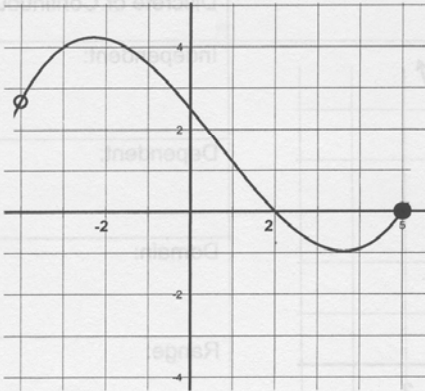
1.

2.

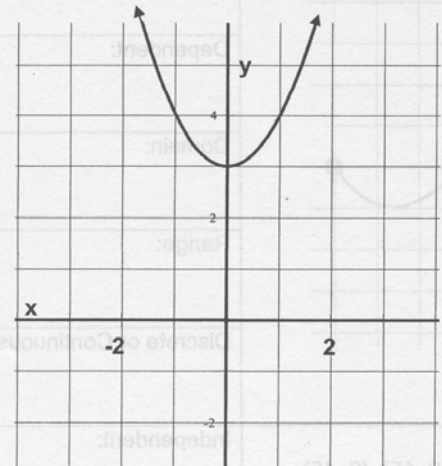
3.

**B14 Elements of a Relation**

Name the domain and range of each relation.

<p>1.</p> 	<p>Independent:</p> <p>Dependent:</p> <p>Domain:</p> <p>Range:</p> <p>Discrete or Continuous:</p>
<p>2.</p> 	<p>Independent:</p> <p>Dependent:</p> <p>Domain:</p> <p>Range:</p> <p>Discrete or Continuous:</p>
<p>3.</p> <p>{Number of shoes, cost of shoes} = { (2, 15), (6, 45), (0, 0), (7, 52.50), (5, 37.50) }</p>	<p>Independent:</p> <p>Dependent:</p> <p>Domain:</p> <p>Range:</p> <p>Discrete or Continuous:</p>



4	<table border="0"> <thead> <tr> <th>Menu item</th> <th>Cost</th> </tr> </thead> <tbody> <tr> <td>Fries</td> <td>\$1.25</td> </tr> <tr> <td>Soda</td> <td>\$3.00</td> </tr> <tr> <td>Hamburger</td> <td>\$2.00</td> </tr> <tr> <td>Hotdog</td> <td></td> </tr> </tbody> </table>	Menu item	Cost	Fries	\$1.25	Soda	\$3.00	Hamburger	\$2.00	Hotdog		Independent: Dependent: Domain: Range: Discrete or Continuous:
Menu item	Cost											
Fries	\$1.25											
Soda	\$3.00											
Hamburger	\$2.00											
Hotdog												
5.	$Y = 2x + 3$	Independent: Dependent: Domain: Range: Discrete or Continuous:										
6.		Independent: Dependent: Domain: Range: Discrete or Continuous:										

## Pitcher Perfect



**A baseball pitcher has just returned to active play after recovering from an injury. The team trainer has limited him to throwing only 15 pitches in each practice session. The pitcher throws curve balls and fast balls, and wants to practice both. The trainer keeps a tally so the pitcher will not go over 15 pitches.**

1. Make a table of all possible pairs of fast balls and curve balls the pitcher can throw.

<b>Fast Balls (f)</b>	<b>Curve Balls (c)</b>

## Pitcher Perfect Cont...



2. Represent the information in your table graphically using the large graph paper. It is customary to put the dependent variable in a relationship on the vertical axis and the independent variable on the horizontal axis. Discuss with your group whether one variable is dependent on the other or if they are interchangeable. Decide on a scale for your graph and label the axes.
3. What happens to the number of curve balls as the number of fast balls increases? Do you think it is easier to determine this relationship from the table or the graph?
4. What do you notice about the pattern of dots on your graph?
5. Write an equation using “c” and “f” that says that the sum of curve balls and fast balls is always equal to 15.
6. Write an equation using “c” and “f” that shows what the number of curve balls equals. Substitute a few pairs of numbers into the equation to show that your equation works.
7. Would it have made sense to draw a line through the points on your graph of “f” and “c”? Why or why not?

## Pitcher Perfect Graphing Calculator Activity



Using the “List” function of the graphing calculator, input the information from the Pitcher Perfect table in Question #1 into the calculator in order to create a scatterplot.

## TEKS Related Problems

1. The table below shows the relationship between the amount of hours Billy works and the amount of his paycheck. Identify the independent and dependent quantities and justify your answer.

Hours	10	15	20	25
Amount	70	105	140	175

2. City workers are building circular flower gardens inside of existing square gardens that each has a perimeter of 32 feet. The largest possible circular garden could touch all four sides of the square garden and the smallest circular garden may have a radius of 1 foot. What is the range of the areas of the possible circular gardens rounded to the nearest tenth of a square foot? Justify your answer.

3. Several friends are splitting the cost of a 6-foot submarine sandwich for a party. The sandwich will cost \$35. The table below represents the relationship between the number of people and the amount each person will need to contribute. Complete the table and write a function rule that represents this relationship. Justify your answer.

Number of People	Amount Contributed
1	\$35.00
2	\$17.50
3	\$11.67
4	\$8.75
5	
6	

## Resources Used

Houston Independent School District. (2004). CLEAR Curriculum. Houston, TX: Curriculum & Instruction Department.

Region IV Education Service Center. (2003). TAKS Mathematics Preparation Guide. Houston, TX: Region IV ESC.

[www.learner.org](http://www.learner.org)

[www.mathbenchmarks.org](http://www.mathbenchmarks.org)