EXPLORATIONS

Activity 4

Picnic Challenge

Teacher Notes

Concept

- Finding Patterns

Skill

- Finding and extending patterns
- Exploring functions
- Graphing linear functions on the coordinate plane

Applicable Calculator Functions

- STO▶, [RCL]

Materials

- Student Activity Sheets (page 31)
- Graph paper
- Straight edges
- TI-30X IIS/TI-34 II calculator

Objective

- Students will find patterns to solve a problem

Prerequisites

Before attempting this activity, students may need to solve a similar, simpler problem. For example, you might pose the following question:

> *Suppose each blank audio cassette tape costs $3 and each blank video tape costs $7. If you can spend only whole dollar amounts, what is the largest total you cannot spend? Explain why you are sure you are correct.*

Students often struggle with this kind of problem at first because they fail to have an organized strategy for attacking it. You may want to let them struggle for a while and then suggest they list the counting numbers with any ways they find to obtain each amount next to it.

Example:

1.		**5.**		**9.**	3,3,3	**13.**	3,3,7
2.		**6.**	3,3	**10.**	3,7	**14.**	7,7
3.	3	**7.**	7	**11.**		**15.**	3,3,3,3,3
4.		**8.**		**12.**	3,3,3,3	**16.**	3,3,3,7

Eventually, students should recognize that there are three patterns that repeat in a cycle so that any dollar amount greater than $11 can be spent. A student might explain these three patterns as follows:

Pattern Rule	Amounts That Can Be Spent
1. Buying only audio cassettes	$3, 6, 9, 12, 15, 18...
2. Buying audio cassettes and one video cassette	$10, 13, 16, 19...
3. Buying audio cassettes and two video cassettes	$14, 17, 20...

Since each rule produces a new value for each interval of three counting numbers, every whole number value above $11 could be spent.

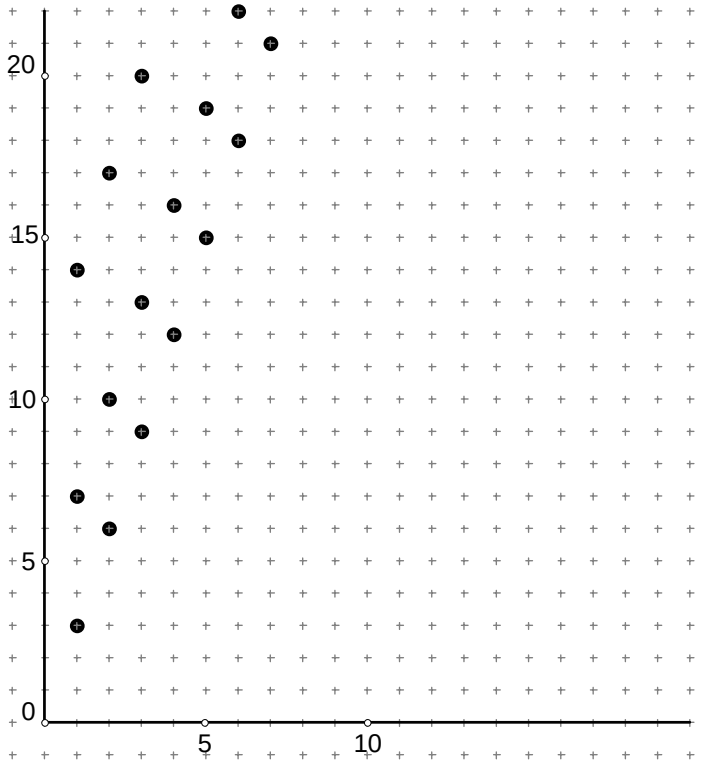
Another student might express the solution using the following function rules:

Function #1 = 3x

Function #2 = 3x + 7

Function #3 = 3x + 14

A graph of these three functions, as shown below, displays that every value above 11 is possible.



Function #1 = 3x

Function #2 = 3x + 7

Function #3 = 3x +14

This experience should help students solve the Picnic Challenge problem, although some groups would benefit from solving another similar problem using $4 and $9 items before tackling this one. (For this problem the function rules are 4x, 4x +9, 4x + 18, and 4x + 27 so that every value above 23 is possible.)

Problem

The Pinchpenny family decided to take McCluck's Chicken Chunks to the neighborhood picnic. Chicken Chunks are sold only in packs of 6, 9, or 20 pieces. The family knew they would need at least 50 pieces and wondered whether they could choose to buy any number of Chicken Chunks using only combinations of 6, 9 and 20 pieces packs. Solve this problem, making sure you could convince the Pinchpenny family you are correct.

Activity

Have students work in pairs to solve the problem. Even with prior experience such as those outlined above, most middle schoolers will find the Chicken Chunks problem to be a challenge. With perseverance, however, students will find the solution (yes, they could choose any number of chicken chunks > 50 since 43 is the largest impossible value). They might use one of the following explanations or another, equivalent version:

44 = 20 + a multiple of 6 (4•6)	Thus, 50 = 20+ 5•6
45 = 9+ a multiple of 6 (6•6)	51 = 9 + 7•6
46 = 2•20 + a multiple of 6 (1•6)	52 = 2•20 + 2•6
47 = 20 + 9 + a multiple of 6 (3•6)	53 = 20 + 9 + 4•6
48 = a multiple of 6 (8•6)	54 = 9•6
49 = (2•20) + 9 + a multiple of 6 (0•6)	55 = 2•20 + 9 + 1•6 etc.

or

Y1 = 6x	0, 6, 12, 18, 24, ... 48, 54....}
Y2 = 6x + 9	{9, 15, 21, 27,... 45, 51,....}
Y3 = 6x +20	{20, 26, 32,... 44, 50, }
Y4 = 6x+ 9 + 20	{29, 35, 41,... 47, 53,....}
Y5 = 6x + 40	{40, 46, 52, ... 46, 52,....}
Y6 = 6x + 9 + 40	{49, 55, 61, ... 49, 55,....} etc.

Wrap-Up

Have students write the final paragraph about what they learned in this activity. You may choose to have some students read their paragraphs aloud or you can choose portions to share the next day in class.

Assessment

The class discussion and completed paragraphs can serve as an assessment tool. It is also appropriate to give a similar follow-up problem for students to solve individually.

Extensions

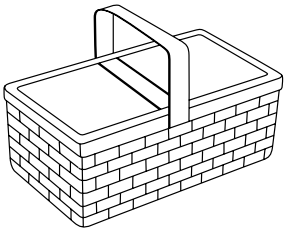
- Have students make up their own problems similar to this one.
- Have students find generalizations related to this and other similar problems; for example, for any two even numbers, there is no solution.

Student Activity

Name _____

Date _____

Activity 4



Picnic Challenge

Objective: *You will find patterns to solve a problem.*

Problem: *The Pinchpenny family decided to take McCluck's Chicken Chunks to the neighborhood picnic. Chicken Chunks are sold only in packs of 6, 9, or 20 pieces. The family knew they would need at least 50 pieces and wondered whether they could choose to buy any number of Chicken Chunks using only combinations of 6, 9, and 20 piece packs. Solve this problem, making sure you could convince the Pinchpenny family you are correct.*

1. Show your solution. (Include patterns that convince you that you are correct.)

2. Write the following paragraphs about this activity:

a. What we found:

b. What I learned:

Picnic Challenge
Keystrokes for the TI-34 II

Example: *Evaluate 6x + 9 for x = 1, 2, 3, ...*

PRESS	DISPLAY
[2nd] [▸OP1]	OP1 = (press [CLEAR] if needed)
[+] 6 [ENTER]	OP1 = + 6
9 [OP1]	9 + 6 1 15 Note: 6x + 9 = 15 when x = 1
[OP1]	15 + 6 2 21
[OP1]	The calculator will continue to evaluate 6x + 9 for each x value displayed on the left.

Note: You must evaluate 6x + 9 when x = 0

Example: *Evaluate 6x + 20 for x = 0, 1, 2, 3, 4, and 5.*

0 [STO▸]	A B C D E (use arrow key, if needed, to underline A)
[ENTER]	0 → A 0
1 [STO▸]	A B C D E
[ENTER]	1 → B 1

Note: Use similar keystrokes to store 2→C, 3→D, and 4→E.

PRESS	DISPLAY
20 + 6	20 + 6
MEMVAR	A B C D E 0
ENTER	20 + 6A
ENTER	20 + 6A 20 Note: 20+6A = 20 when A = 0
▲ ▶ ▶ ▶ ▶ (to place the cursor on A)	20 + 6A
MEMVAR ▶	A B C D E 1
ENTER	20 + 6B
ENTER	20 + 6B 26 Note: 20+6B = 26 when B = 1

Note: You may use similar keystrokes to evaluate 20 + 6C, 20 + 6D, and 20 + 6E.

Picnic Challenge
Keystrokes for the TI-30X IIS

Example: *Evaluate 6x + 9 for x = 1, 2, 3, ...*

PRESS	DISPLAY
[2nd] [K]	K = (press [CLEAR] if needed)
[+] 6 [ENTER]	K = + 6 DEG K
9 [ENTER]	9 + 6 15 DEG K Note: 6x + 9 = 15 when x = 1
[ENTER]	Ans + 6 21 DEG K
[ENTER]	The calculator will continue to evaluate 6x + 9 for each x value displayed on the left.

Note: You must evaluate 6x + 9 when x = 0

You must clear the constant [K] key when you are finished.

Example: *Evaluate 6x + 20 for x = 0, 1, 2, 3, 4, and 5.*

PRESS	DISPLAY
0 STO▶	A B C D E
ENTER	0 → A 0
1 STO▶ ▶	A B C D E
ENTER	1 → B 1

Note: Use similar keystrokes to store 2→C, 3→D, and 4→E.

20 + 6	20 + 6
MEMVAR	A B C D E 0
ENTER	20 + 6A
ENTER	20 + 6A 20 Note: 20+6A = 20 when A = 0
▲ ▶ ▶ ▶ ▶ to place cursor on the A	20 + 6A
MEMVAR	A B C D E 1
ENTER	20 + 6B
ENTER	20 + 6B 26 Note: 20 + 6B = 26 when B = 1

Note: Use similar keystrokes to evaluate 20 + 6C, 20 + 6D, and 20 + 6E.