EXPLORATIONS ™

Unit 15

What's the Plan?

Concepts

- Units of measurement
- Area
- Place value with money
- Estimation of measurement
- Multiplication as repeated addition
- Problem solving

Materials

- TI-10
- Book: *The Ugly Vegetables*
- Grid paper
- Garden Grid
- Plant cutout activity sheets
- Crayons or markers
- Glue
- Scissors
- Playing cards or old business cards
- Play money
- Vegetable price tables

Calculator Connections

- Operations ⊞ ⊟ ⊠ ⊡
- Scrolling ⬡ ⬡
- Problem solving feature ◈
- Place value ▣.
- Constant feature [Opl]
- Memory features [M+] [M−] [MR/MC]
- Fix features [Fix] [0.0l]

Suggested Age/Grade Level

- Ages 7-8
- Second grade

Overview

After discussing any experiences that the students may have had with gardens, read *The Ugly Vegetables* written and illustrated by Grace Lin (Charlesbridge Publishing, 1999). Students explore area with nonstandard and standard units of measure. Afterwards, they work in small groups to plan a unique vegetable garden and calculate the costs of plants for the garden.

Assessment

Assessment should be done through student work samples and teacher observation. The following items should be considered.

Teacher questions have been provided throughout the unit for formative assessment.

Teacher observation and student garden plans should be used as a check for student understanding.

Activity A: Connecting Literature and Mathematics

Begin the activity with a discussion on gardens.

Question to ask:

• What do you know about gardens?

Read *The Ugly Vegetables*.

Questions to ask:

• How was the young girl's and her mother's garden different from their neighbors' gardens?

• What kinds of plants did they grow?

• What kinds of plants might you grow in a garden?

• What kinds of tools did the young girl and her mother use to plant and care for their garden?

• What kinds of tools did their neighbors use?

• Why were different tools used for the different gardens?

• What kinds of tools might you use to plant and care for a garden?

• What might you need to know to plan a garden? (Answers may suggest location of garden, climate, soil type, size of land space, sizes of plants, where to find plants, costs of plants, and purpose of garden.)

• How might you find out the size of a land space?

• What kinds of tools might help find answers?

Activity B: Exploring Area with the TI-10

Tell students that they will look at one way to measure size and ask for a volunteer to stand against a sheet of butcher block paper.

1. Trace around the student.

New Vocabulary:
Area
Chinese vegetable
Plan
Square unit
Venn diagram

Prerequisite Skills:
Students should have an understanding of the concept of length before starting this unit.

Question to ask:

•   What can you say about the space inside the traced outline?

Tell students that sometimes we need to know the size or how much space is inside an outline.

Question to ask:

•   When might you want to know the size or how much space is inside an outline?

Tell students that in this activity, they will be finding out how much space is covered by different objects in the classroom.

2.   Distribute playing cards or old business cards to students.

Direct students to work in pairs to find how many cards cover their desktop.

Tell students that their TI-10 can help them keep track of the number of cards used to cover the desktop.

One student may count on the TI-10 while the other student touches each card.

3.   Press ⓐ to begin.

4.   Press Ⓐ𝖼 to clear anything previously stored in memory.

5.   Press Ⓒˡᵉᵃʳ. The screen is blank (except for the cursor), the memory is clear, and you are ready to get started.

Ask students to look at their cards and explain that they will be adding the cards one at a time.

6.   Press 〔Opl〕.

7.   Press 〔+〕〔1〕 because you will be counting each card one at a time.

8.   Press 〔Opl〕 to let the TI-10 know that you are ready to count.

9.   Press 〔0〕.

10. Press 〔Opl〕 to begin counting.

The TI-10 displays:

```
0 ÷ 1

1            1
```
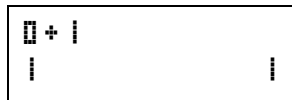
11. Press ⬚Opl⬚ to continue counting.

Questions to ask:

- How many cards covered the desktop?

- How might your cards be arranged to count another way with your TI-10? (rows and columns)

- How many rows of cards might be arranged?

- How many cards are in each row?

For example, if ten cards are in a row:

- Reset the TI-10.

- Press ⬚Opl⬚.

- Press ⬚+⬚ ⬚1⬚ ⬚0⬚ because you will be counting cards by rows of ten.

- Press ⬚Opl⬚ to let the TI-10 know that you are ready to count.

- Press ⬚0⬚ to begin counting at zero.

- Press ⬚Opl⬚ to begin counting.

- Press ⬚Opl⬚ to continue counting.

When you've counted six rows, the TI-10 displays:

```
50 ÷ 10

6            60
```

Tell students that the space inside the outline of the desktop is also called area and it is measured by covering.

Question to ask:

- What might you say about measuring the area of the desktop?

Instruct the pairs of students to record their findings by writing the number and kind of objects used to measure each area.

Teaching Tip:
It is helpful when the same number of cards is in each row.

Resetting the TI-10:
Press ⬚ to wake it up if it has turned off.

Press ⬚AC⬚ if you need to clear the memory.

Press ⬚Clear⬚ to clear the display.

Teaching Tip:
Provide students the opportunity to explore covering the desktop and other small areas in the classroom with the cards. It is best to begin with smaller areas. Make a list of the areas to measure by covering in the room.

Teaching Tip:
While creating the list of areas to measure, it is important to include curves or other areas that are not inside straight outlines. Always include estimates before the measures.

Questions to ask:

*   How would you describe your findings? (Guide students to the idea that the larger the measuring object, the fewer were needed to cover the object.)

*   How is this a useful or not useful way to measure area? (Guide students to the idea that a standard/universal measure is needed.)

Discuss and review with students the usefulness of having standard units of measuring area for communication.

12. Pass out two centimeter grid paper which is located in Appendix A.

Questions to ask:

*   What might you say about the size of the squares on the grid paper? (Answers should suggest that the squares are all the same size.)

*   How might you and your partner find the number of squares to cover the desktop with the grid paper?

*   How might the TI-10 help?

Activity C: Planning a Garden Area

1. Revisit *The Ugly Vegetables*.

Question to ask:

*   How would you use area to help plan a garden?

2. Pass out the Garden Grid, located at the end of the unit, to students and tell them that they will work in pairs to make their garden plan on paper with the following guidelines.

    *   Each small grid square on the plan paper represents one large square in the actual garden plot.

    *   Because there is limited space, the garden plot will be in the shape of a square.

> **Teaching Tip:**
> The Garden Grid is a five by ten grid. Students may discover that they can glue two together to create a ten by ten grid.

- There are ten squares in each row and a total of ten rows. The area of the garden will be 100 squares.

Activity D:
Planning a Garden with the TI-10

Questions to ask:

- Since you have worked with your partner in finding the area of your desktop, how might you make a paper garden grid with the area of one hundred squares?

Remind students that there are ten squares in a row.

1. Reset the TI-10.

2. Press [Opl].

3. Press [+] [1] [0] because you will be counting ten squares in each row.

4. Press [Opl] to let the TI-10 know you are ready to begin counting.

5. Press [0].

6. Press [Opl] to begin counting the number of rows.

7. Press [Opl] to continue counting.

When you have skip counted ten times, the TI-10 displays:

number of rows → [90+10] ← total squares
                   [10   100]

Questions to ask:

- How did you know when to stop counting?

- How many rows will you need?

- How did the TI-10 help?

- Will this make a garden that is in the shape of a square? How do you know?

8. Pass out the Plant Cutout Grids.

> ***Resetting the TI-10:***
> Press (On/off) to wake it up if it has turned off.
>
> Press (AC) if you need to clear the memory.
>
> Press (Clear) to clear the display.

.

Explain that the grids show how many squares (square units) a plant will cover in the garden. Ask them to choose the number and kinds of plants that they intend to use.

Question to ask:

- How might the TI-10 help find the number of squares used?

- How can you find the total area of one pepper plant and two tomato plants?

9. Reset the TI-10.

10. Press ④ ➕ (⑨ ➕ ⑨) ＝ to add the area of the one pepper plant and the two tomato plants.

The TI-10 displays:

```
4+(9+9)=
              22
```

Question to ask:

- How might you find the total area of one pepper plant and two tomato plants and the area remaining for the plants?

11. Reset the TI-10.

12. Press ① ⓪ ⓪ Enter to enter the total number of squares (square units) in the garden plan.

The TI-10 displays:

```
100=        100
```

13. Press M+ to remember the one hundred squares (square units).

14. Press ④ Enter to enter the number of squares needed for the pepper plant.

The TI-10 displays:

```
4=            4
```

15. Press M- to subtract the area of the pepper plant from the total area of the garden.

16. Press ⑨ ⊞ ⑨ [Enter] to enter the number of squares needed for two tomato plant s.

The TI-10 displays:

```
9÷9=           18
```

17. Press [M−] to subtract the area of the two tomato plants from the total area of the garden.

18. Press [MR/MC] to find and recall the area of the garden remaining for other plants.

The TI-10 displays:

```
78
```

You have 78 squares (square units) left for planting. You can press ⓒ to continue to subtract more plants.

Have students cut out the plants they have selected and continue planning their garden in pairs or small groups.

Activity F:
Finding Garden Prices

Once students have determined what plants they will use in their garden, they will need to determine how much the plants will cost.

1. Pass out the Vegetable Price Tables and play money.

Question to ask:

• How might the TI-10 help you find the total cost of your plants?

2. Reset the TI-10.

3. Press [Fix] [0.01] [Enter] to enter your dollars and cents using decimals.

4. Press ⓜ to view the menu screen for division results.

5. Press ⟨⟩ to underline the decimal choice.

Teaching Tip:
The examples in this activity are shown with one pepper plant and two tomato plants. Be sure to substitute the actual amounts selected by students.

Resetting the TI-10:
Press ⓞ to wake it up if it has turned off.

Press ⒶⒸ if you need to clear the memory.

Press ⓒ to clear the display.

The TI-10 displays:

```
 Q R              .
              ÷
```
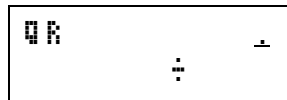
6. Press $\boxed{\text{Enter}}$.

7. Press $\textcircled{\text{Mode}}$ to exit the menu screen.

8. Press $\boxed{1}$ $\boxed{.}$ $\boxed{0}$ $\boxed{0}$ $\boxed{÷}$ $\boxed{4}$ $\boxed{\text{Enter}}$ $\boxed{\text{M+}}$ to add and remember the price of the pepper plant.

The TI-10 displays:

```
1.00÷4=  0.25
```
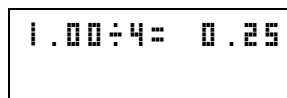
9. Press $\boxed{.}$ $\boxed{5}$ $\boxed{0}$ $\boxed{+}$ $\boxed{.}$ $\boxed{5}$ $\boxed{0}$ $\boxed{\text{Enter}}$ $\boxed{\text{M+}}$ to add and remember the price of the two tomato plants.

The TI-10 displays:

```
.50+.50 =1.00
```
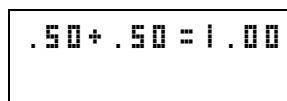
10. Press $\boxed{\text{MR/MC}}$ to find and recall the total cost of your plants.

The TI-10 displays:

```
1.25
```

11. Press $\textcircled{\text{Clear}}$ to continue to add more plants.

Encourage students to work in pairs or small groups with their play money to explore different ways of showing each amount.

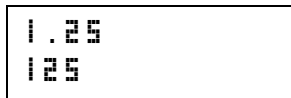Question to ask:

•   How might the TI-10 help show different ways?

12. Reset the TI-10.

13. Press $\diamondsuit$ for problem solving.

14. Press $\textcircled{\text{Auto}}$ to take a shortcut to the manual mode.

15. Press $\boxed{1}$ $\boxed{.}$ $\boxed{2}$ $\boxed{5}$ to show the cost of the plants.

16. Press $\boxed{\blacksquare.}$ to find other ways of showing this amount.
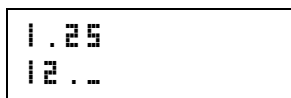
17. Press ⬚0.01⬚ to show how you might pay for the plants with pennies. How many are needed?
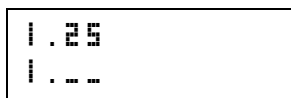
The TI-10 displays:

```
 1.25
125
```

18. Press ⬚0.1⬚ to show how you might pay this amount with dimes. Is this enough money? Why?

The TI-10 displays:

```
 1.25
12._
```

19. Press ⬚1.⬚ to show the whole dollars that make $1.25.

The TI-10 displays:

```
 1.25
 1.__
```

Conclusion

- Give students a budget for their garden. Ask them to plan the number and kinds of plants that would fit in the budget. The total amount of the budget may be entered into memory ⬚M+⬚ and the cost of each plant price subtracted ⬚M−⬚ from the total.

- Provide opportunities for students to use their own plants with estimated areas and prices using the blank price table and grid paper.

Extension

- Students may want to make a large paper garden within the classroom. Gridded butcher block paper may be used for this purpose or students can create their own butcher block grid.

- Some students may be interested in planting a real garden. Plan a trip to a local nursery or farm to explore prices, sizes, and care of plants.

Garden Grid

glue tab

Plant Cutout Grid

Beans	Beans	Beans	Beans	Beans	Beans	Beans

Beet	Beet	Tomato
Pepper	Pepper	
		Potato
Pumpkin		
		Potato
Okra	Okra	Okra	Okra	

Plant Cutout Grid

Beans	Beans	Beans	Beans	Beans	Beans	Beans

Carrot	Carrot	Eggplant
Lettuce	Lettuce	
Corn	Corn	Tomato
Corn	Corn	Zucchini

Okra	Okra	Okra	Okra	
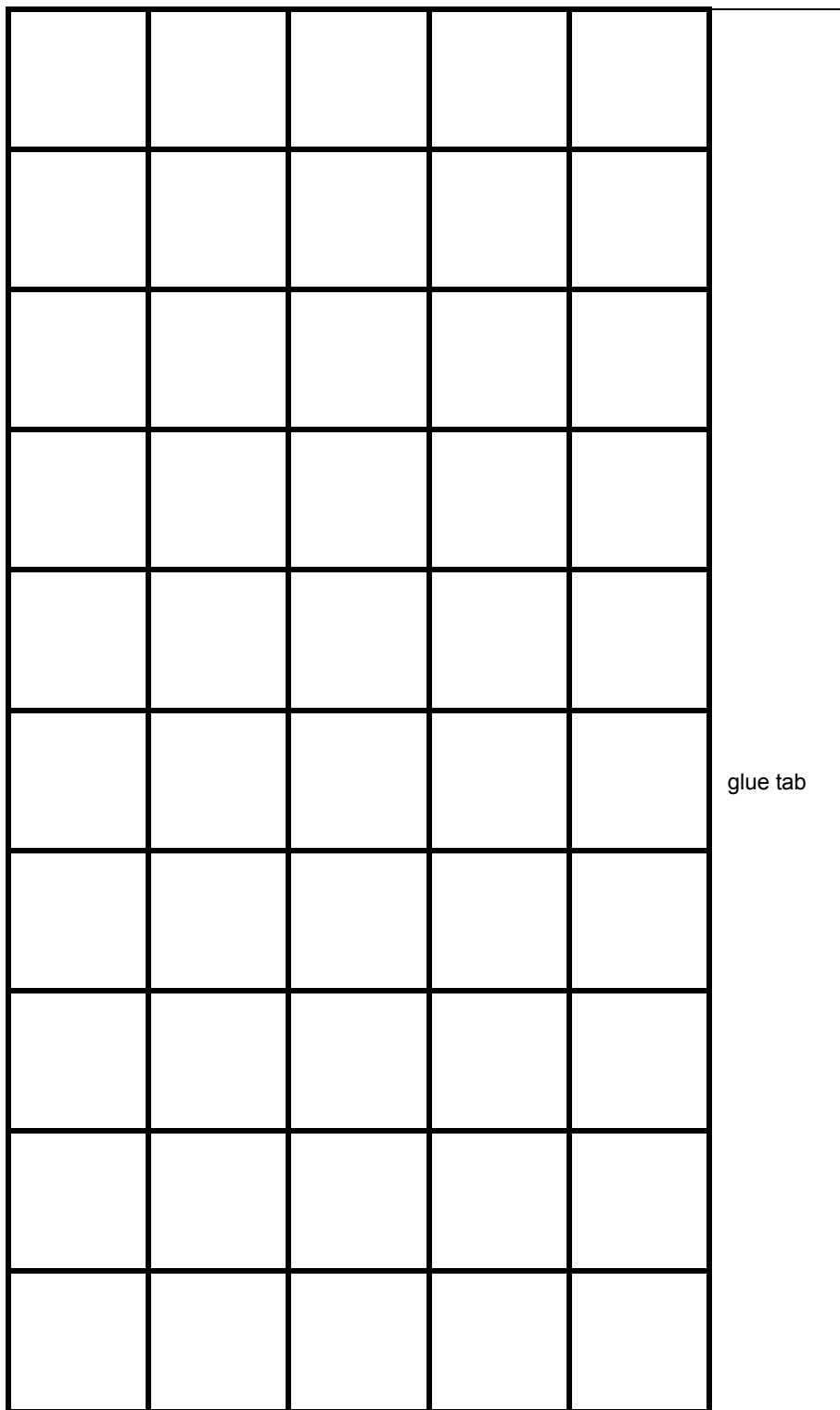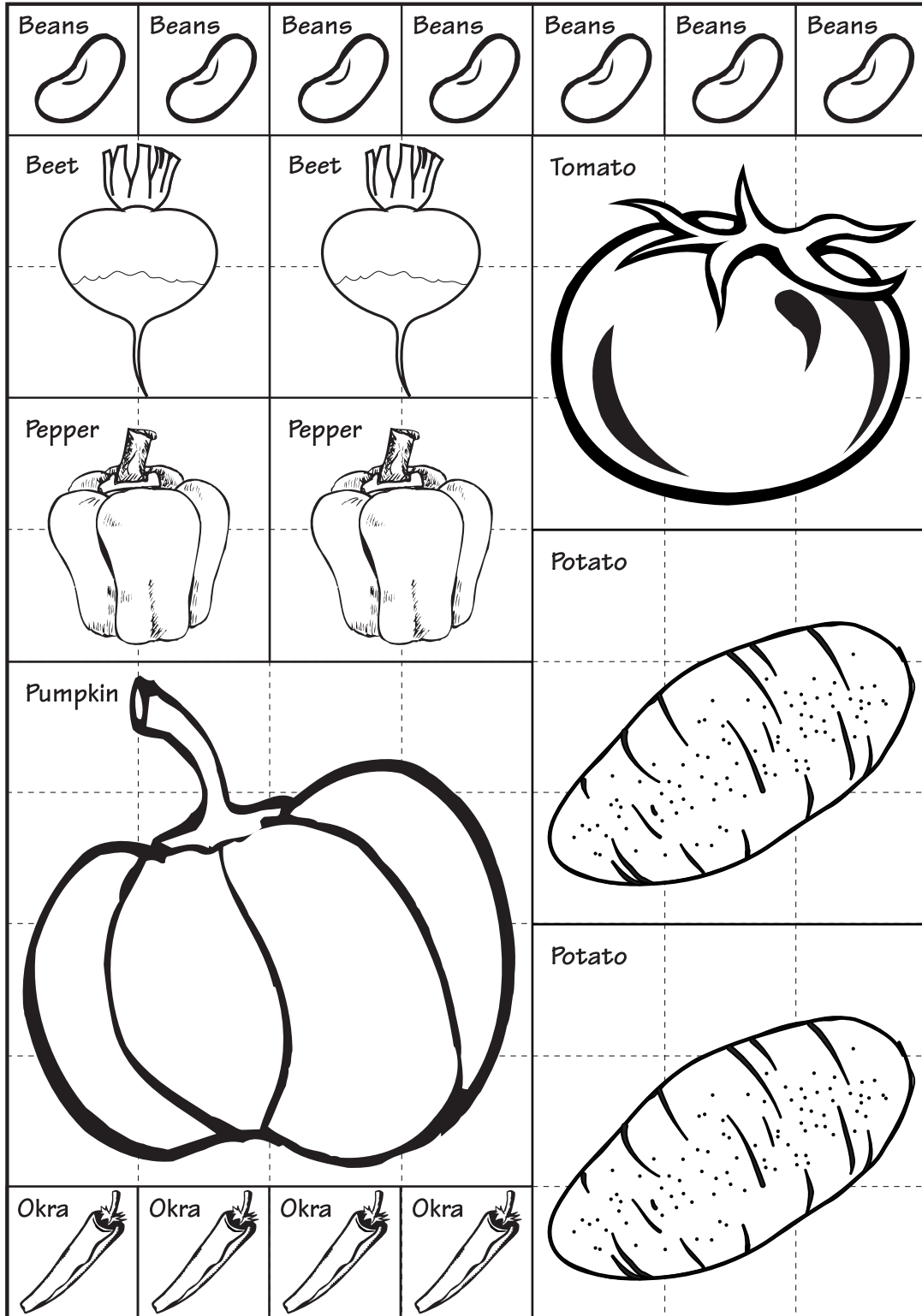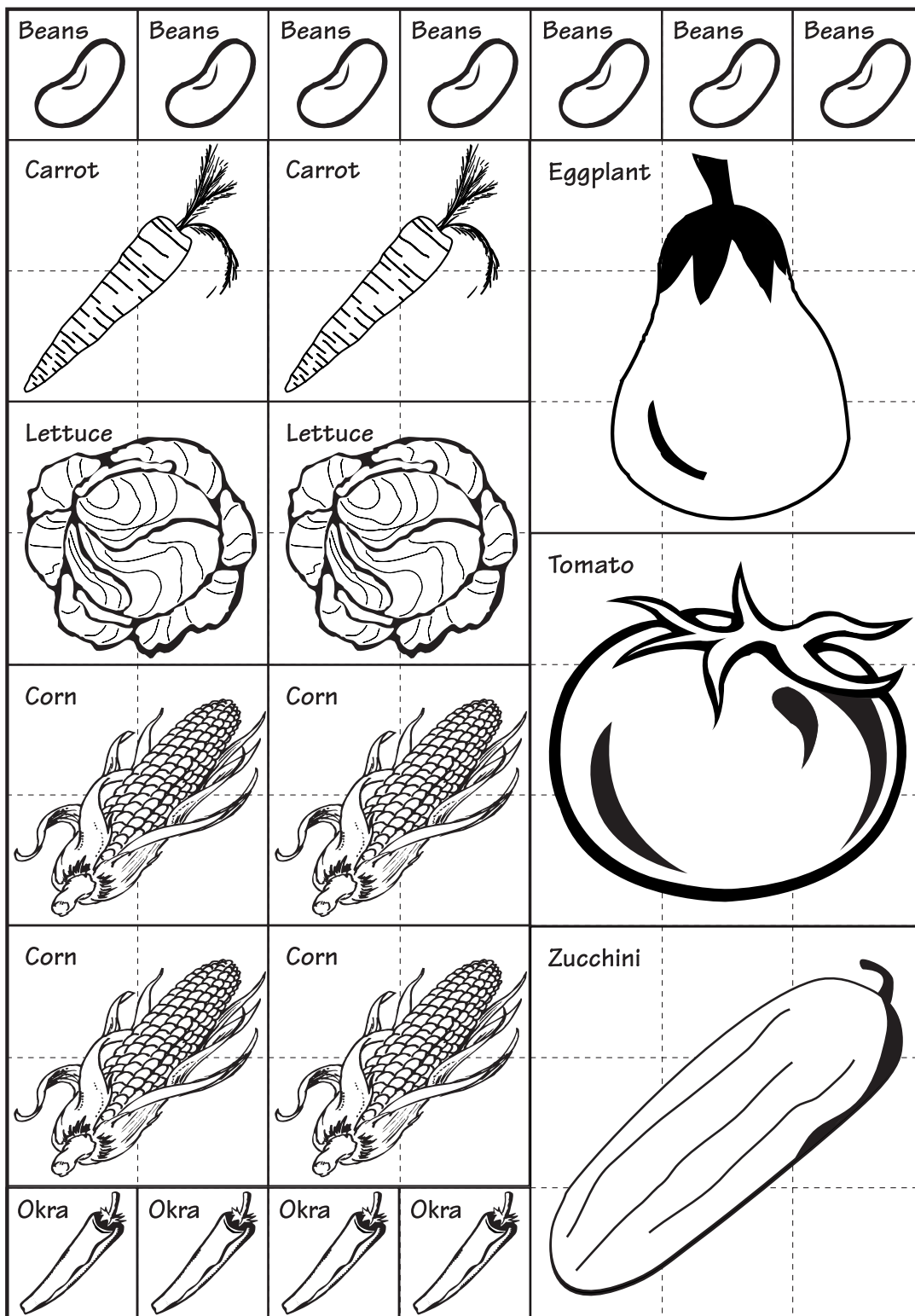
Chinese Plant Cutout Grid

| Jeou Tsay | Jeou Tsay | Jeou Tsay | Jeou Tsay | Jeou Tsay | Jeou Tsay | Jeou Tsay |

Shiann Tsay

Shiann Tsay

Torng Hau

Sheau Hwang Gua

Sheau Hwang Gua

Sy Gua

Fwo Loo Fwo

Kuu Gua

Kong Shin Tsay   Kong Shin Tsay   Kong Shin Tsay   Kong Shin Tsay
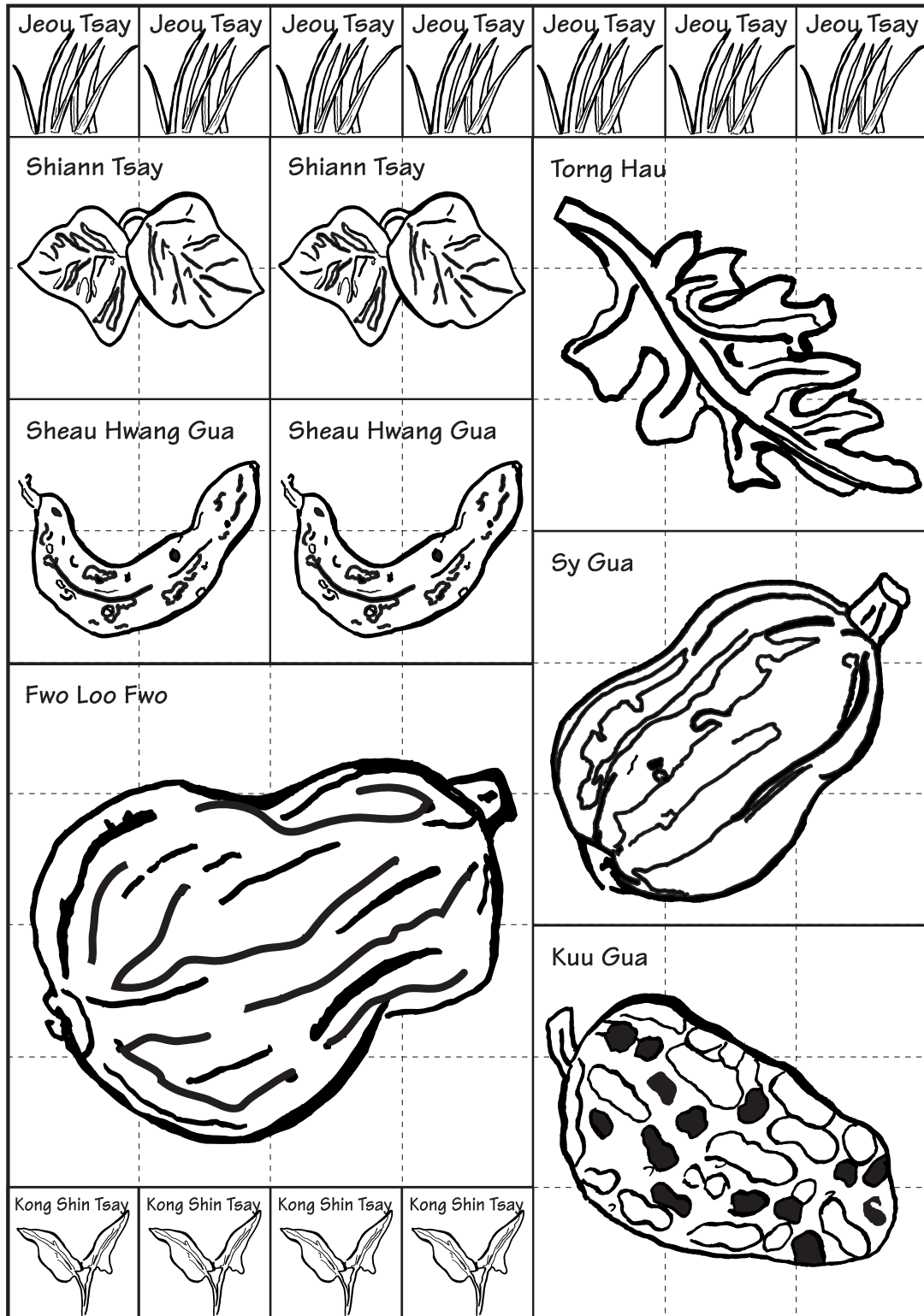
Vegetable Prices

Plant	Area of Each Plant	Price
Beans	1 square unit	4 for $2.00
Beets	4 square units	$1.00 each
Carrots	4 square units	$1.50 each
Corn	4 square units	2 for $1.00
Eggplant	9 square units	$2.00 each
Lettuce	4 square units	5 for $1.00
Okra	1 square unit	10 for $1.00
Pepper	4 square units	4 for $1.00
Potato	9 square units	$1.00 each
Pumpkin	16 square units	2 for $5.00
Tomato	9 square units	$.50 each
Zucchini	9 square units	$2.00 each

Chinese Vegetable Prices

Plant	Area of Each Plant	Price
Fwo loo fwo *Chinese squash*	16 square units	$2.00 each
Jeou tsay *Chinese leeks*	1 square unit	4 for $2.00
Kong shin tsay *Chinese celery*	1 square unit	2 for $1.00
Kuu gua *Chinese melon*	9 square units	$1.50 each
Sheau hwang gua *Chinese cucumber*	4 square units	4 for $1.00
Shiann tsay *Chinese spinach*	4 square units	5 for $1.00
Sy gua *Chinese eggplant*	9 square units	$1.00 each
Torng hau *Chinese lettuce*	9 square units	$ 5.00 each

Vegetable Prices

Plant	Area of Each Plant	Price