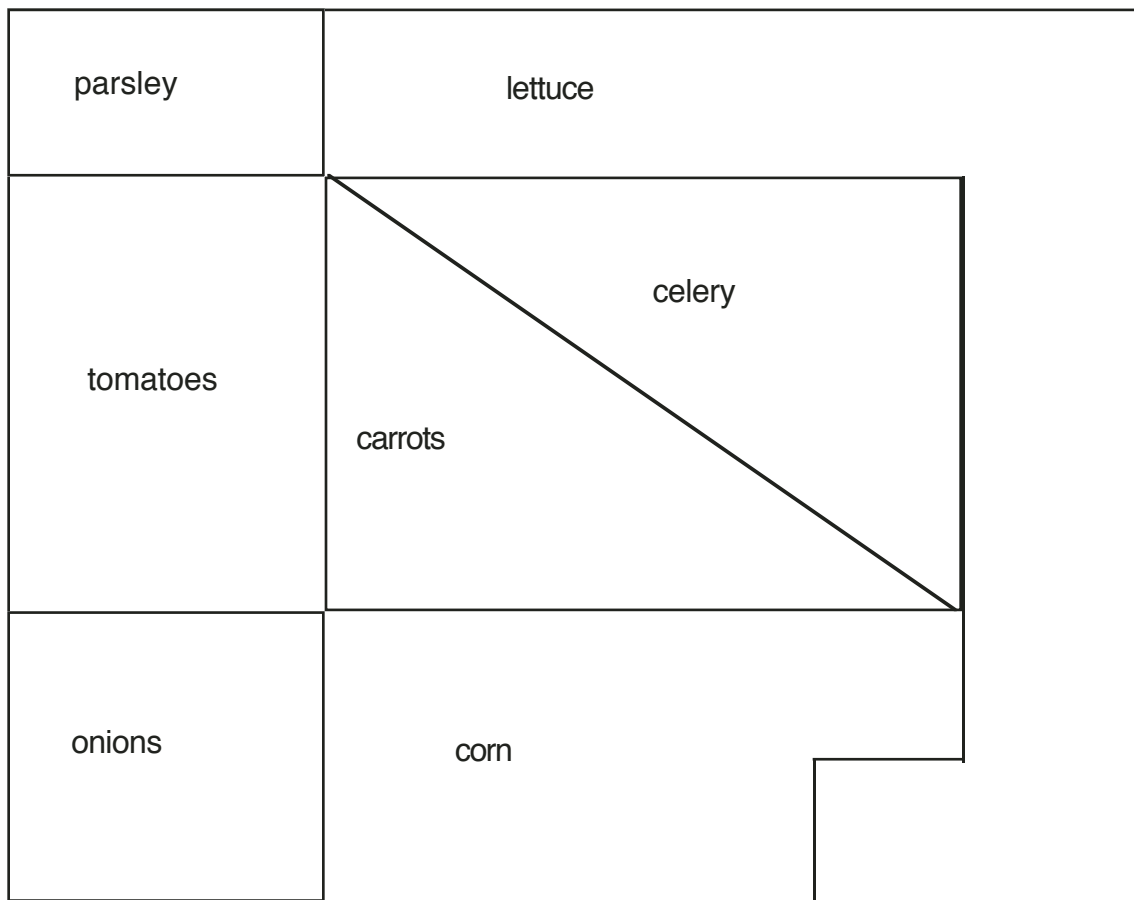


# Landing in the Carrot Patch

Farmer McGee has been working very hard to keep bunnies out of his carrot patch. He has put up an impenetrable wire fence around the entire perimeter. Each section of the garden is also fenced in. Brad the Bunny has plans to raid Farmer McGee's garden. He has decided to parachute into the garden, smack in the middle of the carrot patch. Unfortunately, the airplane pilot cannot guarantee that he will land in that particular area. He does guarantee that Brad will land somewhere in the garden. A map of the garden is shown below. What are the chances that Brad will randomly land in the carrot patch? Support your conclusion mathematically.



# Landing in the Carrot Patch – diagram



———— = 1 yard in real life



## Landing in the Carrot Patch

### Suggested Grade Span

Grades 6–8

### Grade(s) in Which Task Was Piloted

Grade 6

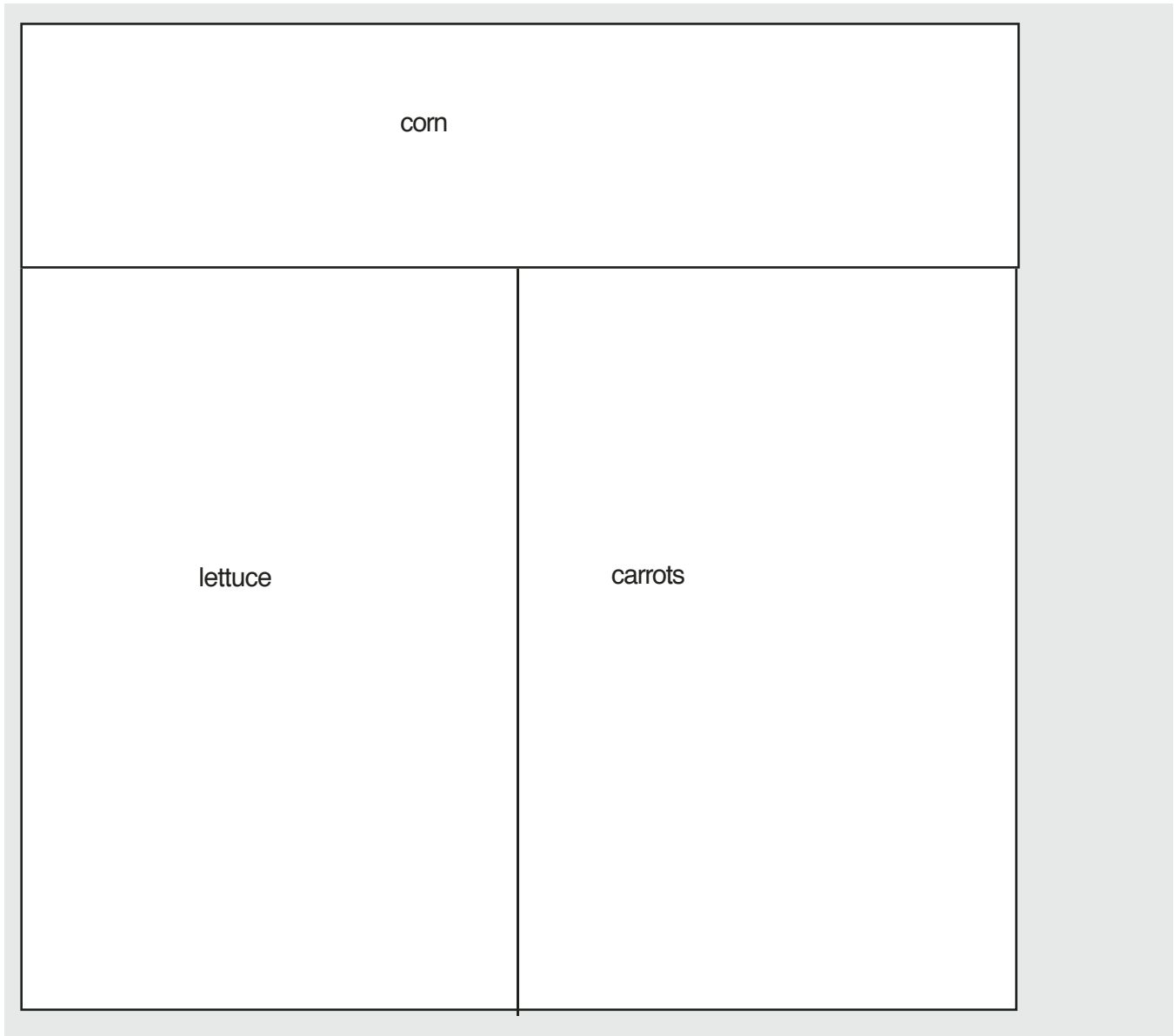
### Task

Farmer McGee has been working very hard to keep bunnies out of his carrot patch. He has put up an impenetrable wire fence around the entire perimeter. Each section of the garden is also fenced in. Brad the Bunny has plans to raid Farmer McGee’s garden. He has decided to parachute into the garden, smack in the middle of the carrot patch. Unfortunately, the airplane pilot cannot guarantee that he will land in that particular area. He does guarantee that Brad will land somewhere in the garden. A map of the garden is shown below. What are the chances that Brad will randomly land in the carrot patch? Support your conclusion mathematically. Refer to page 349 for diagram.

### Alternative Versions of Task

#### *More Accessible Version:*

Farmer McGee has been working very hard to keep bunnies out of his carrot patch. He has put up an impenetrable wire fence around the entire perimeter. Each section of the garden is also fenced in. Brad the Bunny has plans to raid Farmer McGee’s garden. He has decided to parachute into the garden, smack in the middle of the carrot patch. Unfortunately, the airplane pilot cannot guarantee that he will land in that particular area. He does guarantee that Brad will land somewhere in the garden. A map of the garden is shown below. What are the chances that Brad will randomly land in the carrot patch? Support your conclusion mathematically.



**More Challenging Version:**

The original task and...

Suppose Brad the Bunny must replace all of the carrots he eats or damaged in his landing. If there is 1 carrot every  $\frac{1}{2}$  of a square foot and he eats or destroys all of the carrots in the patch, how many carrots will he have to replace?

## NCTM Content Standards and Evidence

### Measurement Standard for Grades 6–8

Instructional programs from pre–kindergarten through grade 12 should enable all students to...

- Apply appropriate techniques, tools, and formulas to determine measurements.
  - *NCTM Evidence:* Select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels of precision.
  - *Exemplars Task Specific Evidence:* This task requires students measure a map to determine area.

### Data Standard for grades 6–8

Instructional programs from pre–kindergarten through grade 12 should enable all students to

- Understand and apply basic concepts of probability.
  - *NCTM Evidence:* Compute probabilities for simple compound events, using such methods as organized lists, tree diagrams, and area models.
  - *Exemplars Task Specific Evidence:* This task requires students to compute probability using an area model.

### Time/Context/Qualifiers/Tip(s) From Piloting Teacher

This is a medium length task.

### Links

This task could link to Easter, gardening or sky–diving. A web site where students can explore other area probability models can be found at [http://www.exploremath.com/activities/Activity\\_page.cfm?ActivityID=43](http://www.exploremath.com/activities/Activity_page.cfm?ActivityID=43)

### Common Strategies Used to Solve This Task

Most students determine the area of each individual parcel and compare each to the whole. I did have some students use an experimental approach where they designed pencil–dropping simulations. The best solutions were those that combined the two approaches.

## Possible Solutions

### *Original Version:*

#### Areas of each veggie space

Parsley: 2 square yards

Lettuce: 11 square yards

Tomatoes: 6 square yards

Celery: 6 square yards

Corn: 7 square yards

Onions: 4 square yards

Carrots: 6 square yards

Total area = 42 square yards

The chance of landing in the carrots is  $6/42$  or approximately 14%.

The chance of landing anywhere else in the garden is 86%.

### *More Accessible Version:*

Total Garden: 16 cm x 16 cm = 256 square cm

Carrot Plot: 8 cm x 12 cm = 96 square cm

$P(\text{landing in carrot patch}) = 96/256 = 3/8$

### *More Challenging Version:*

Carrot patch = 6 square yards

6 square yards = 54 square feet

54 square feet x 2 carrots per square foot = 108 carrots

## Task Specific Assessment Notes

### General Notes

This task has the potential to assess several different areas of mathematics, but the focus should be on whether the student has a concept of the probabilities involved. You could come up with an additional rubric or scoring guide to assess measurement accuracy and computation skills for those students who choose to use these.

### Novice

Some parts of the task may be correctly addressed, but much of the solution will be incorrect. Little evidence of understanding probability will be evident. There may be no mathematical basis to arguments made. No awareness of audience will be communicated. No connections will be made.

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## Exemplars

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### **Apprentice**

Many correct parts of the task will be present, but the final solution will be incorrect. Some evidence of understanding probability will be evident. Some awareness of audience will be present. Some correct reasoning will be present, but omissions may be made.

### **Practitioner**

A correct answer will be achieved with supporting work. All work will be shown and labeled. Representations will be created to organize the work and display the solution. Math connections will be recognized.

### **Expert**

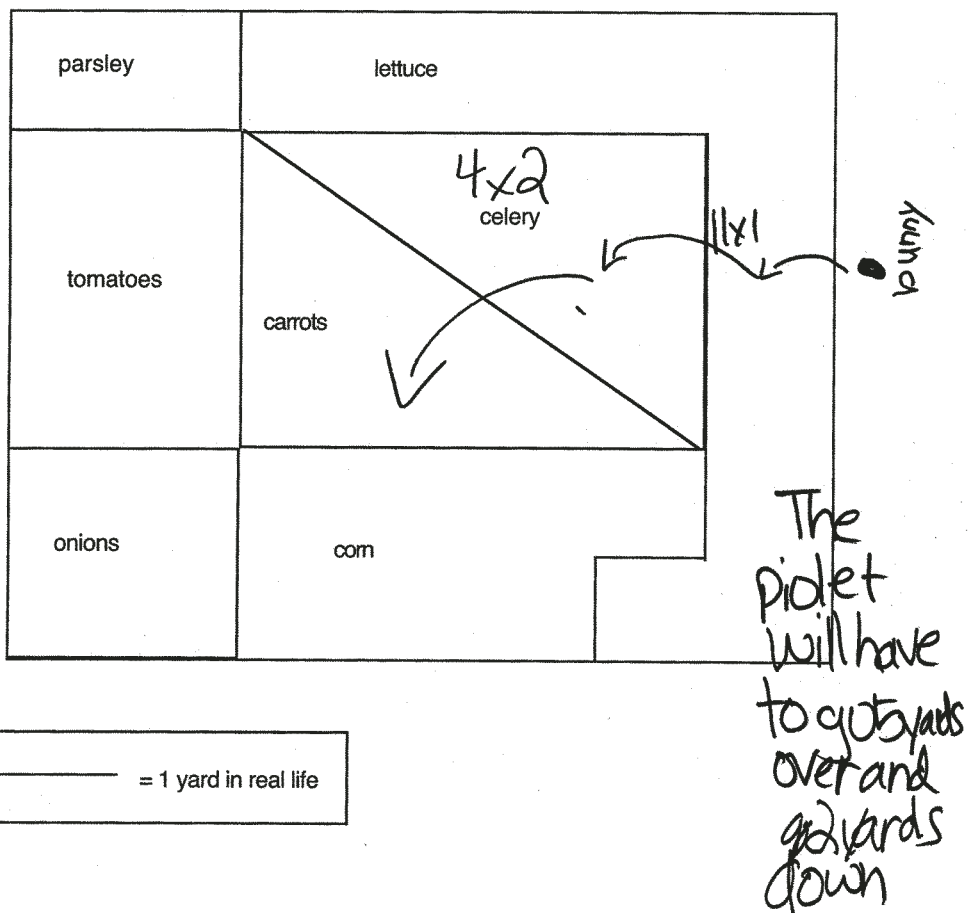
A correct answer will be achieved. All work will be shown, labeled, and justified. Evidence will be used to support decisions. Connections will be used to extend the solution.

# Exemplars

## Novice

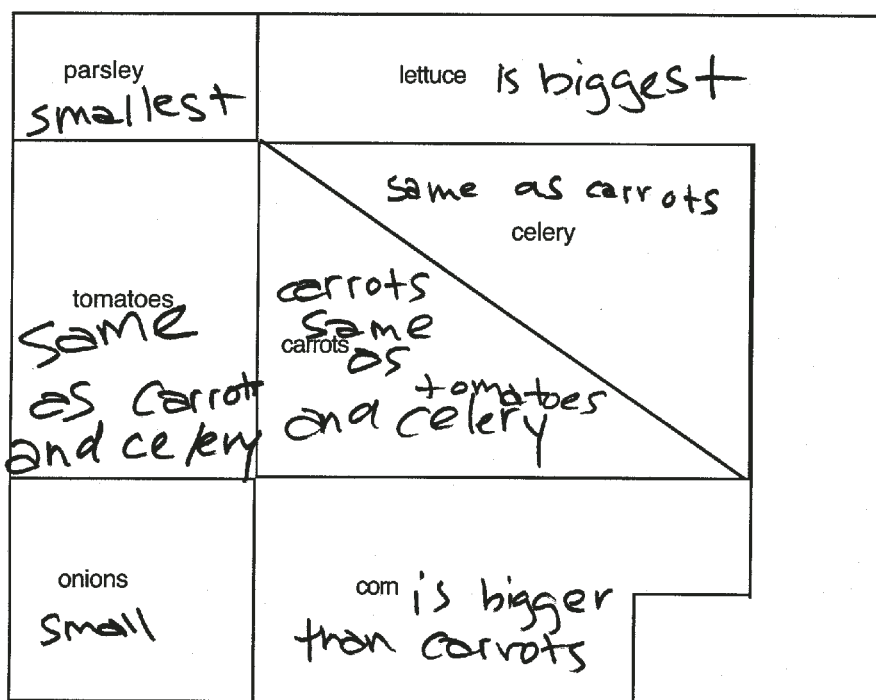
The student demonstrates no understanding of the task.

Little correct reasoning is used. No understanding of probability is demonstrated.



Apprentice

Some understanding of probability is evident. The student knows that the size of each garden plot is important to the solution and ranks the sizes.

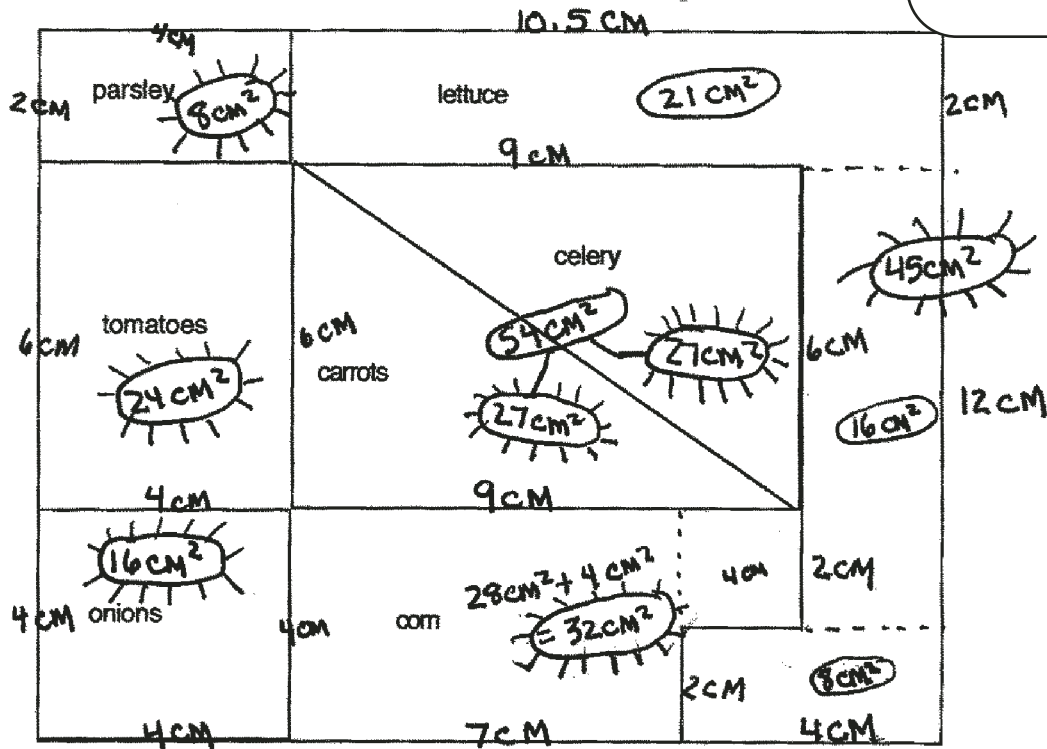


No linear measurements are used. No language of probability is utilized.


# Exemplars

## Practitioner

Math language is used to communicate.



1 cm = 1 yard in real life

Key  = whole area.

celery has biggest area  
~~celery has biggest area~~

Brad is most likely to land in lettuce, then in corn, then in carrots + celery, then in tomatoes, then in onions, then in parsley.

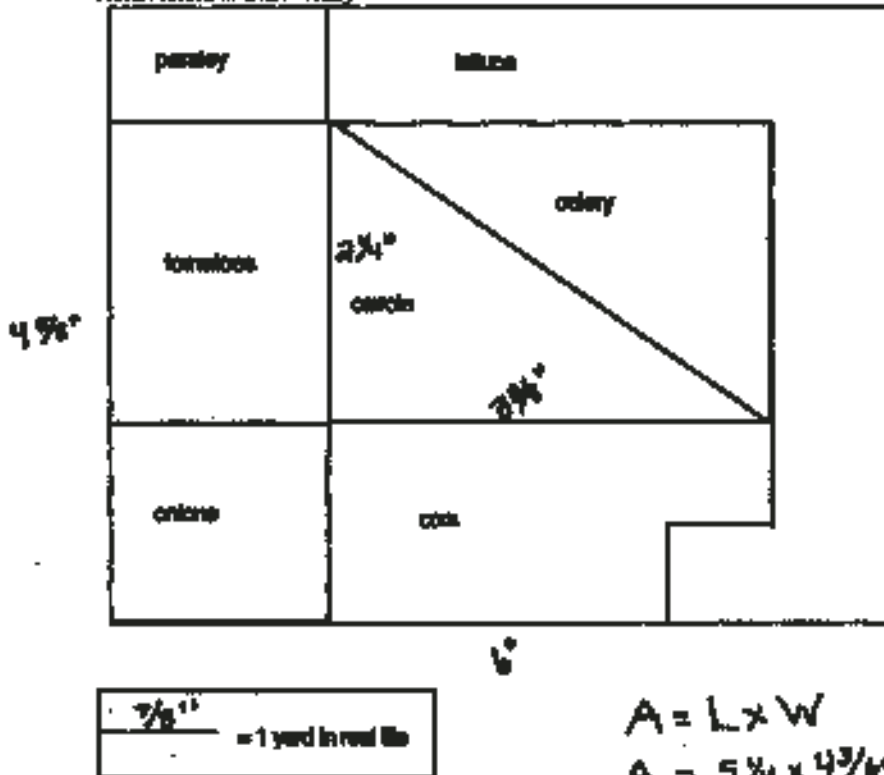
The student accurately determines the area of the carrots, and knows to compare it to other plots.

Correct conclusions are achieved and are supported with mathematical evidence.

# Exemplars

## Expert

Furmer McGee has been working very hard to keep bunnies out of his carrot patch. He has put up an impenetrable wire fence around the entire perimeter. Each section of the garden is also fenced in. Brad the Bunny has plans to raid Furmer McGee's garden. He has decided to parachute into the garden, straight in the middle of the carrot patch. Unfortunately, the airplane pilot cannot guarantee that he will land in that particular area. He does guarantee that Brad will land somewhere in the garden. A map of the garden is shown below. What are the chances that Brad will randomly land in the carrot patch? Support your conclusion mathematically.



*I used the fractions key on the calculator*

$$4 \frac{7}{8} \times \frac{7}{8} = 4 \frac{3}{64} \text{ yards}$$

$$6 \times \frac{7}{8} = 5 \frac{1}{4} \text{ yards}$$

$$A = L \times W$$

$$A = 5 \frac{1}{4} \times 4 \frac{3}{64}$$

$$A = 21 \frac{63}{256} \text{ square yards}$$

*This is the whole garden.*

The expert shows a command of probability concepts.

Precise math language is used to communicate with the audience.

# Exemplars

Expert cont.

$$\text{Area of a triangle} = \frac{1}{2} L \times W$$

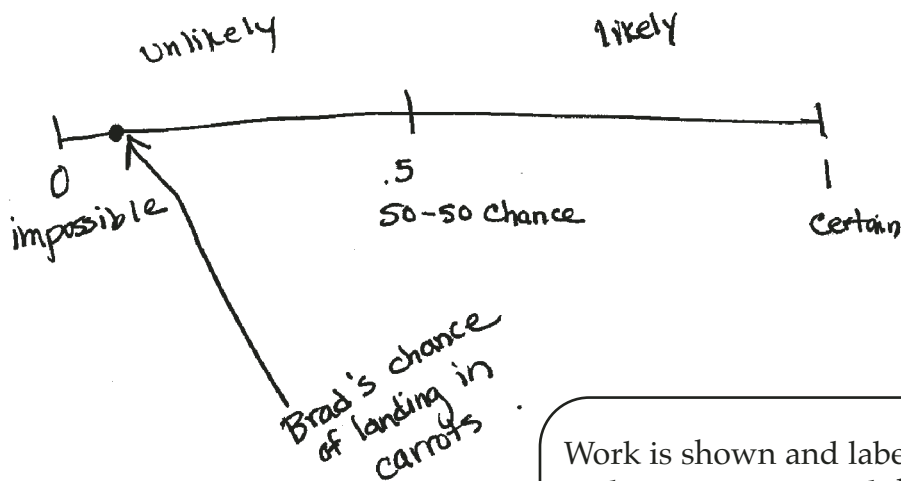
$$\text{Area of } \Delta = \frac{2\frac{1}{4} \times 3\frac{3}{8}}{2} = \frac{7\frac{19}{32}}{2} = 3\frac{5}{64}$$

$$P(\text{landing in carrots}) = \frac{3\frac{5}{64}}{21\frac{63}{256}}$$

$$P(\text{landing in carrots}) \approx .18 \text{ or } \frac{18}{100} \text{ of a chance.}$$

That means that  $\frac{82}{100} = P(\text{not landing in patch})$ .

Brad is much more likely to land in the rest of the garden.



Work is shown and labeled. Relevant observations extend the solution.