

## Problem 1.1

Use the map on page 8 to answer these questions.

**Part A** Give the coordinates of each landmark.

1. gas station (     ,     )
2. animal shelter (     ,     )
3. stadium (     ,     )

### **Part B**

Pair 1- the police station to City Hall

- right/left \_\_\_\_\_ up/down \_\_\_\_\_
- \_\_\_\_\_ blocks

Pair 2- the hospital to City Hall

- right/left \_\_\_\_\_ up/down \_\_\_\_\_
- \_\_\_\_\_ blocks

Pair 3- the hospital to the art museum

- right/left \_\_\_\_\_ up/down \_\_\_\_\_
- \_\_\_\_\_ blocks

### **Part C**

Suppose you know the coordinates of two landmarks in Euclid. How can you determine the shortest driving distance (in blocks) between them?

### **Part D**

A helicopter can travel directly from one point to another. For each pair in Question B, find the total distance (in blocks) a helicopter would have to travel to get from the starting location to the ending location. **You may find it helpful to use a centimeter ruler.**

Pair 1- the police station to City Hall \_\_\_\_\_ blocks

Pair 2- the hospital to City Hall \_\_\_\_\_ blocks

Pair 3- the hospital to the art museum \_\_\_\_\_ blocks

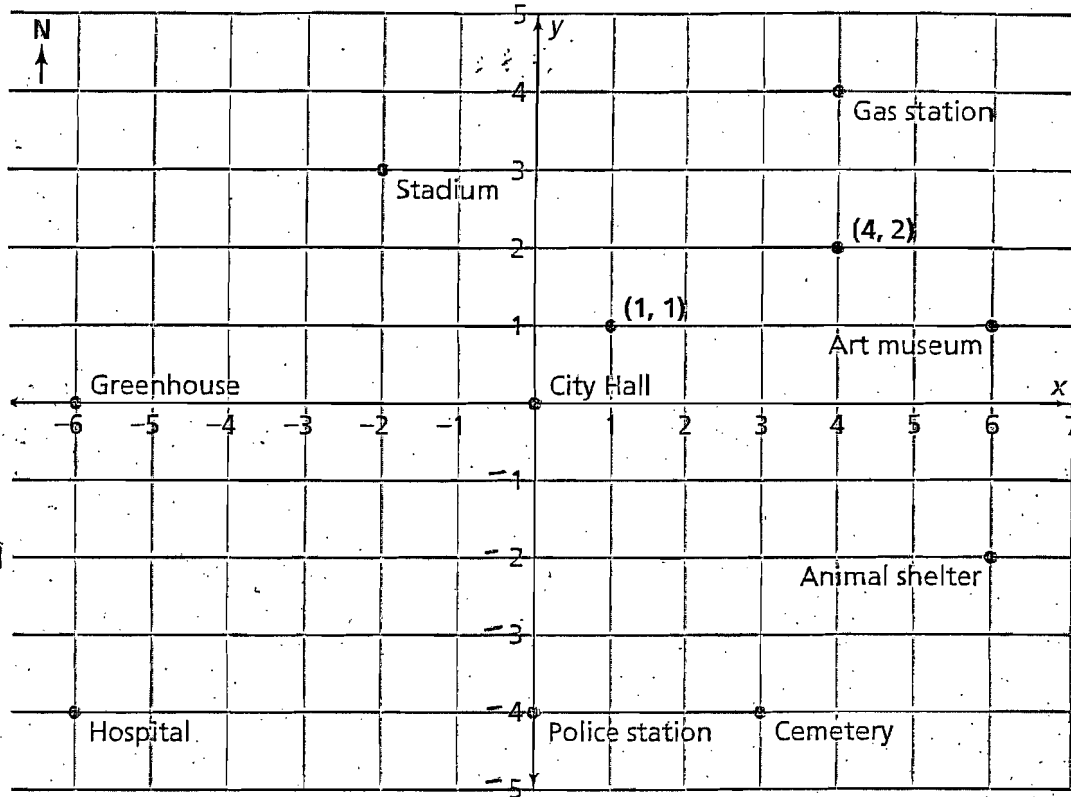
### **Part E**

Will a direct helicopter route between two locations always be shorter than a car route? Explain.

Planning Parks

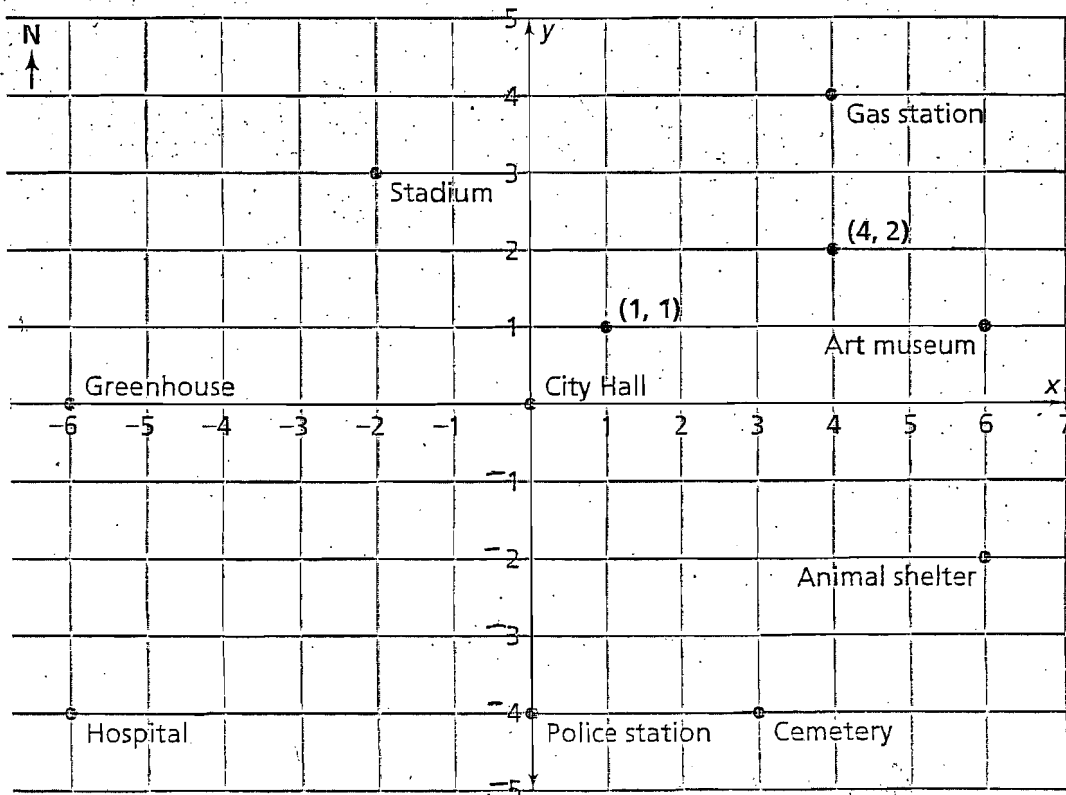
A  
Characteristics  
of squares:

- 4 sides equal
- 4 right angles
- opposite sides parallel (this means that the slope should be the same)



B  
Characteristics  
of non-square  
rectangles:

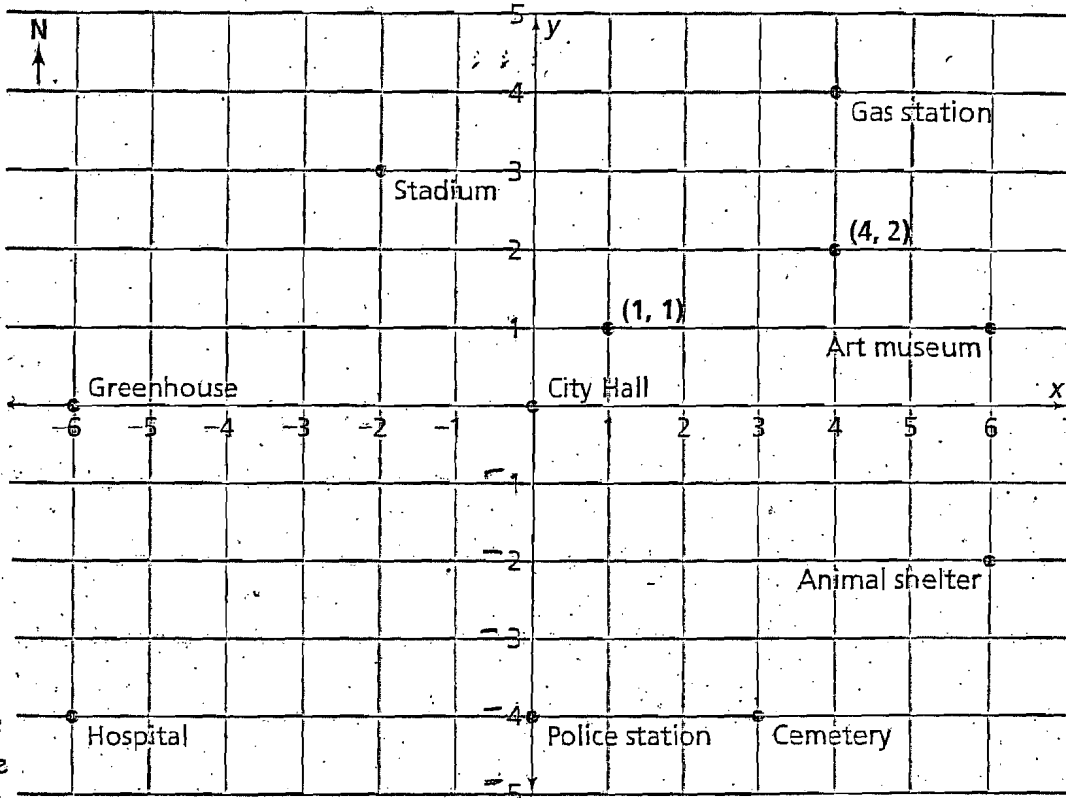
- 4 right angles
- opposite sides have the same length
- opposite sides are parallel (same slope)



Planning Parks

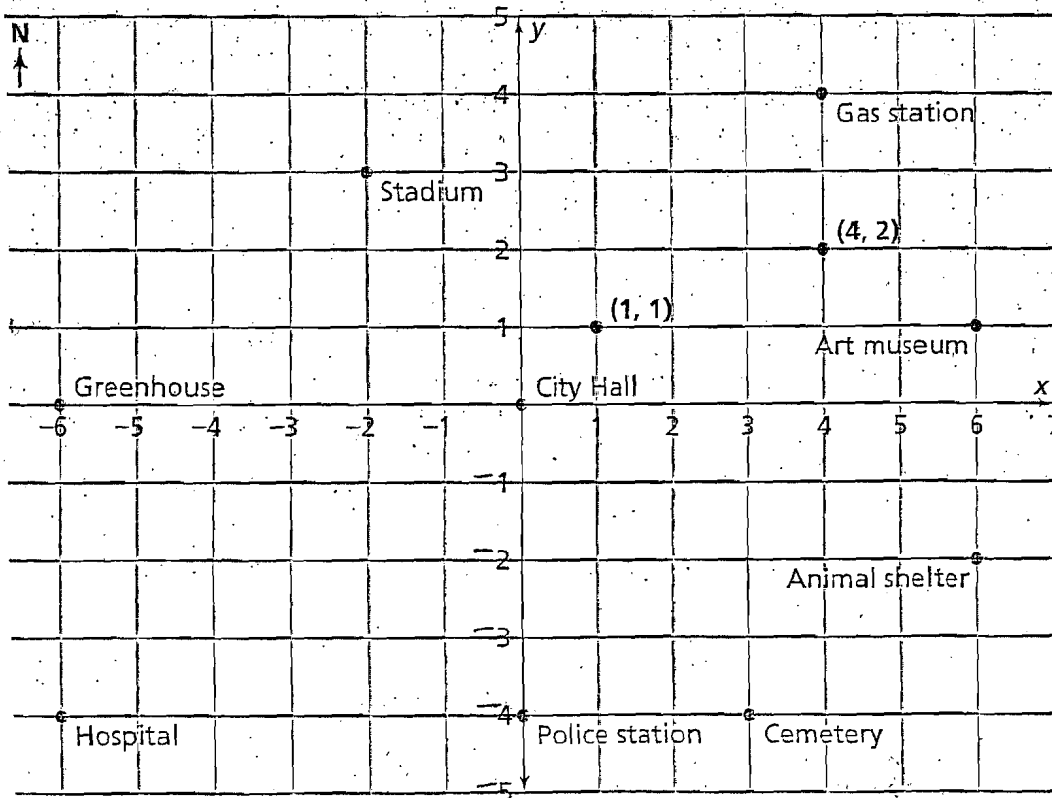
C  
Characteristics  
of right  
triangles:

- 3 sides
- 1 right angle (measures  $90^\circ$ )
- the 2 sides that make the right angle are perpendicular or (this means that their slopes are negative reciprocals)



D  
Characteristics  
of  
parallelograms:

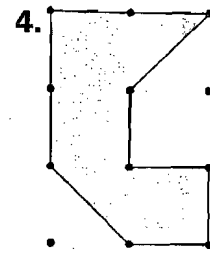
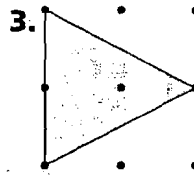
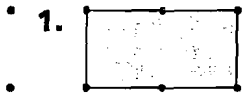
- opposite sides are parallel (same slope)
- opposite sides have same length
- opposite angles have same measure



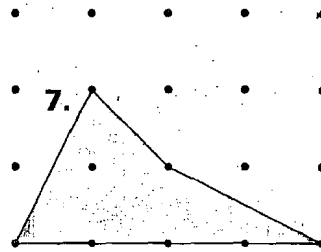
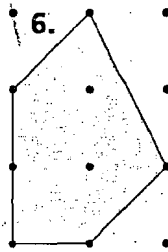
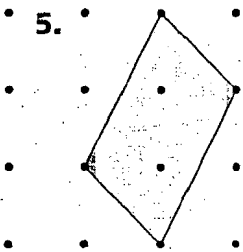
# Labsheet 1.3

Looking for Pythagoras

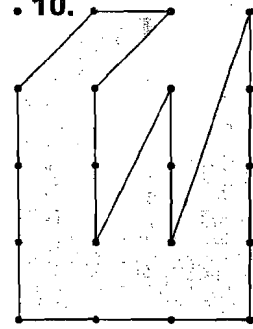
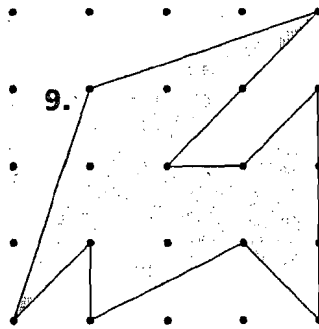
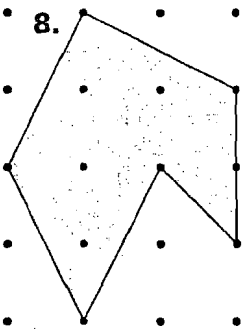
## Figures for Problem 1.3



adjacent or



not adjacent



### Problem 1.3

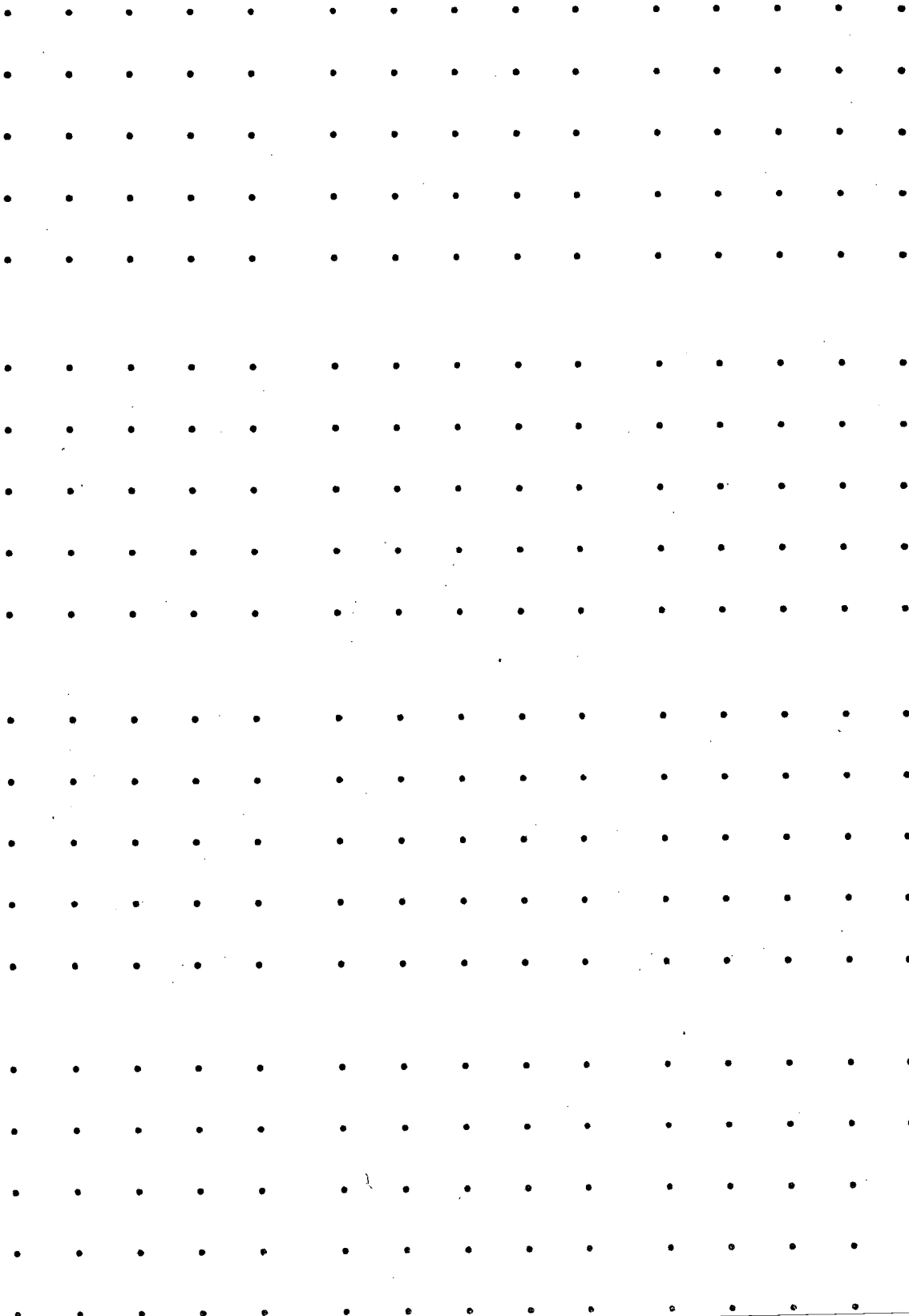
Two ways to find total area of an irregular figure:

1. Break figure into smaller shapes and add the area of each small shape.
2. Make a larger rectangle/square that surrounds the figure and subtract the area of the shapes that are not part of the figure.

## Problem 2.1

### Part A

In the 5 by 5 dot grids below, draw squares of various sizes by connecting dots. Draw squares with as many different areas as possible. Label each square with its area. Include at least one square whose sides are not horizontal and vertical. (There are 8 possible squares with 4 of them being diagonal)



## Problem 2.2

Use your calculator ONLY when the question directs you to.

**Part A** Find the side lengths of the squares below.

1. area of 1 square unit                      area of 9 square units

\_\_\_\_\_ x \_\_\_\_\_

\_\_\_\_\_ x \_\_\_\_\_

- area of 16 square unit                      area of 25 square units

\_\_\_\_\_ x \_\_\_\_\_

\_\_\_\_\_ x \_\_\_\_\_

2. Find the following values:

$$\sqrt{1}$$

$$\sqrt{9}$$

$$\sqrt{16}$$

$$\sqrt{25}$$

**Part B**

- What is the area of a square with a side length of 12 units? \_\_\_\_\_ square units  
What is the area of a square with a side length of 2.5 units? \_\_\_\_\_ square units

- Find the missing numbers.

$$\sqrt{\quad} = 12$$

$$\sqrt{\quad} = 2.5$$

**Part C** Refer to the square with an area of 2 square units you drew in Problem 2.1.  
The exact side length of this square is  $\sqrt{2}$  units.

- Estimate the  $\sqrt{2}$  by measuring a side of the square with a centimeter ruler.

- Calculate the area of the square, using your measurement from part 1.

Is the result exactly equal to 2?

- Use the square root key on your calculator to estimate  $\sqrt{2}$ .

How does your ruler estimate compare to your calculator estimate.

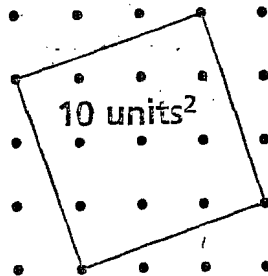
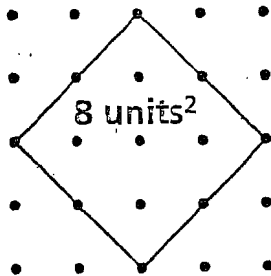
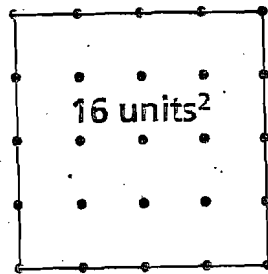
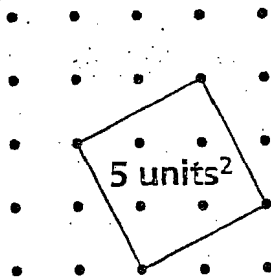
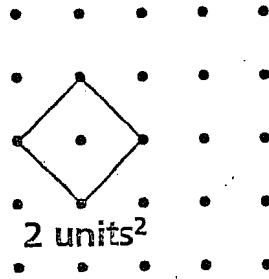
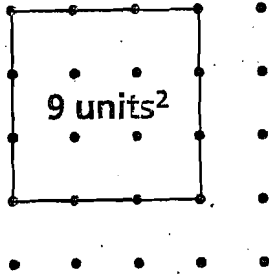
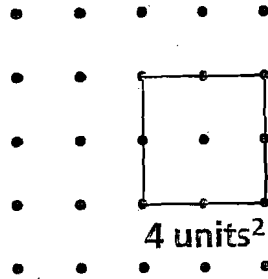
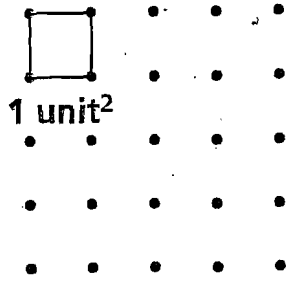
**Part D**

Which 2 whole numbers is  $\sqrt{5}$  between? Explain how you know.

Which whole number is  $\sqrt{5}$  closer to? Explain how you know.

Without using the square root key on your calculator, estimate the value of  $\sqrt{5}$  to two decimal places.

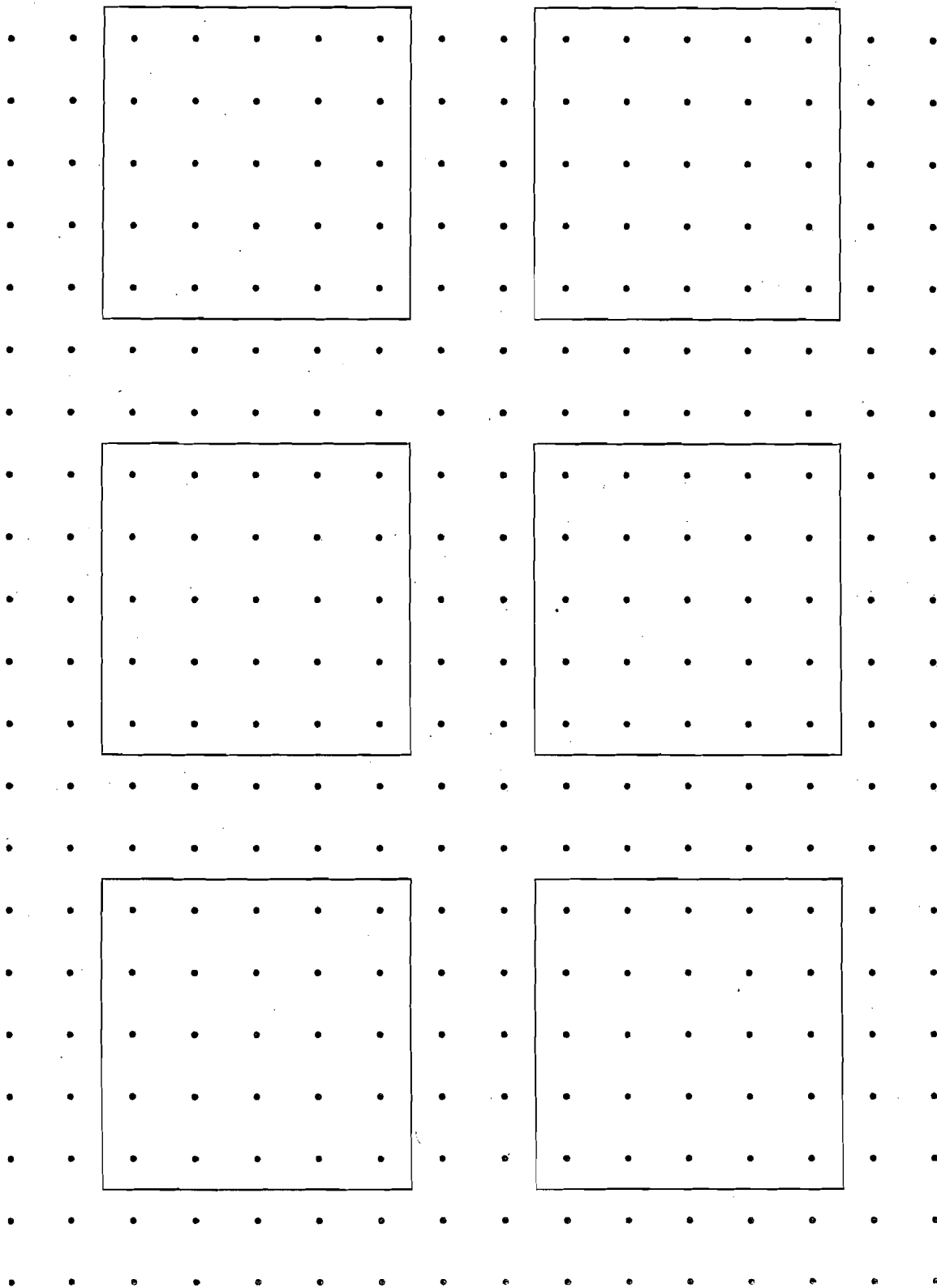
**Part E**  
Give the exact side length of each of the squares below.



### Problem 2.3

#### Part A

On the 5 by 5 dot grids below, draw line segments with as many different lengths as possible by connecting dots. Label each segment with its length. Use the  $\sqrt{\quad}$  symbol to express lengths that are not whole numbers. (hint: you will need to draw squares that extend beyond the 5 by 5 dot grids; there are 14)



List the lengths in increasing order.

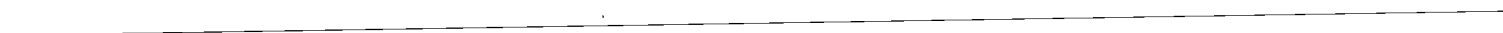
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Estimate each non-whole number length to one decimal place.

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**Part B**

John says the length of the segment below is  $\sqrt{8}$  units. Isabel says it is  $2\sqrt{2}$  units. Are both students correct? Explain.



### Problem 3.1

#### Part A

Length of Leg 1	Length of Leg 2	Area of Square On Leg 1	Area of Square On Leg 2	Area of Square On Hypotenuse
1	1	1	1	2
1	2			
2	2			
1	3			
2	3			
3	3			
3	4			

For each row in the table:

- Draw a right triangle with the given leg lengths on dot paper.
- Draw a square on each side of the triangle.
- Find the areas of the squares and record the results in the table.

#### Part B

Recall that a **conjecture** is your best guess about a mathematical relationship. It is usually a generalization about a pattern you think might be true, but that you do not yet know for sure is true.

For each triangle, look for a relationship or pattern among the areas of the three squares. Make a conjecture about the areas of squares drawn on the sides of any right triangle.

#### Part C

Draw a right triangle with the side lengths that are different than those given in the table. Use your triangle to test your conjecture from Part B.

### Problem 3.2

Use the puzzles your teacher gives you.

#### **Part A**

Study the triangle pieces and the 3 square pieces. How do the side lengths of the squares compare to the side lengths of the triangle?

#### **Part B**

Arrange the 11 puzzle pieces to fit exactly into the 2 puzzle frames.  
What conclusion can you draw about the relationship among the areas of the 3 squares?

What does the conclusion you reached in number 2 mean in terms of the side lengths of the triangles?

Compare your results with those of another group. Did that group come to the same conclusion your group did? Yes/No Is this conclusion true for all right triangles? Explain.

#### **Part C**

Suppose a right triangle has legs of length 3 cm and 5 cm.

Use your conclusion from Part B to find the area of a square drawn on the hypotenuse of the triangle.

What is the length of the hypotenuse?

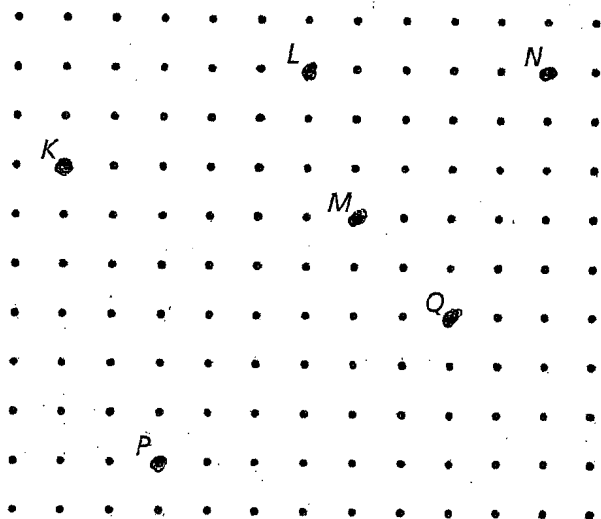
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Part D

In this problem and Problem 3.1, you explored the Pythagorean Theorem, a relationship among the side lengths of a right triangle. State this theorem as a rule for any right triangle with leg lengths  $a$  and  $b$  and hypotenuse length  $c$ .

### Problem 3.3

In Parts A-D use the grid below.



#### Part A

Draw a right triangle with segment  $KL$  as its hypotenuse.  
Find the lengths of the legs of the triangle.

Use the Pythagorean theorem to find the length of segment  $KL$ .

#### Part B

Find the distance between points  $M$  and  $N$  by connecting them with a segment and using the method in Part A.

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**Part C**

Find the distance between points  $P$  and  $Q$ .

**Part D**

Find 2 points that are  $\sqrt{13}$  units apart. Label the points  $X$  and  $Y$ . Explain how you know the distance between the points is  $\sqrt{13}$  units.

**Problem 3.4**

**Part A**

Side lengths	Do the side lengths satisfy $a^2 + b^2 = c^2$	Is the triangle a right Triangle?
3,4,5		
5,12,13		
5,6,10		
6,8,10		
4,4,4		
1,2,2		

**Part B**

1. Make a conjecture about triangles whose side lengths satisfy the relationship  $a^2 + b^2 = c^2$ .

2. Make a conjecture about triangles whose side lengths do not satisfy the relationship  $a^2 + b^2 = c^2$ .

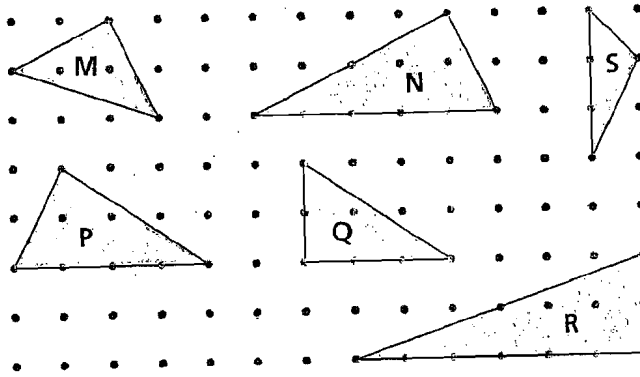
3. Check your conjecture with 2 other triangles.

Side lengths	Do the side lengths satisfy $a^2 + b^2 = c^2$	Is the triangle a right Triangle?

**Part C**

Side lengths	Do the side lengths satisfy $a^2 + b^2 = c^2$	Is the triangle a right Triangle?
12,16,20		
8,15,17		
12,9,16		

Look at the triangles below. Which are right triangles?



Triangle	Do the side lengths satisfy $a^2 + b^2 = c^2$	Is the triangle a right Triangle?
M		
N		
P		
Q		
R		
S		