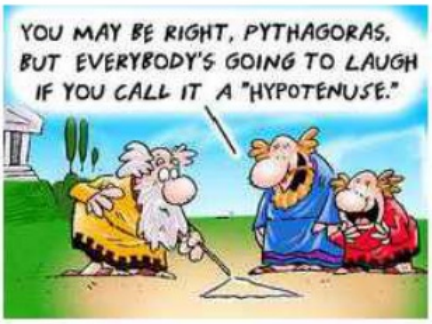
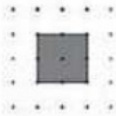
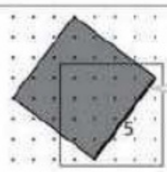
Looking for Pythagoras

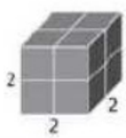
Date	Topic	Homework	IXL	√
5/3	Intro Day	Worksheet 1		
5/6	Inv 1.1 (start)	Worksheet 2		
5/7	Inv 1.1 (finish)	Worksheet 3		
5/8	Inv 1.2	Worksheet 4		
5/9	Inv 1.3	Worksheet 5		
5/10	Inv 2.1	Worksheet 6		
5/13	Inv 2.2	Worksheet 7		
5/15	Inv 2.3 (start)	Study for Quiz		
5/16	Quiz	Worksheet 8	R.1	
5/17	Inv 2.3 (finish)	Worksheet 9	R.2	
5/21	Inv 2.4 (start)	Worksheet 10	R.3	
5/22	Inv 2.4 (finish)	Worksheet 11	R.4	
5/23	Inv 3.1	Worksheet 12	R.5	
5/28	Inv 3.3	Study for quiz	F.16	
5/29	Quiz	Worksheet 13	F.18	
5/30	Irrational Numbers	Worksheet 14	F.20	
5/31	Inv 5.1	IXL night		
6/3	Practice Day	Review Packet		
6/4	Review - IXL Due	Study for test; IXL due		
6/5	Unit Test			

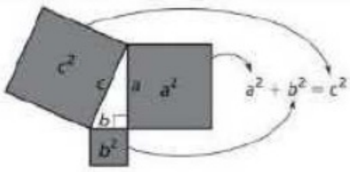
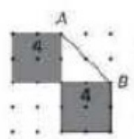


Quizzes: Thursday 5/16/19, Wednesday 5/29/19
Test: Wednesday 6/5/19

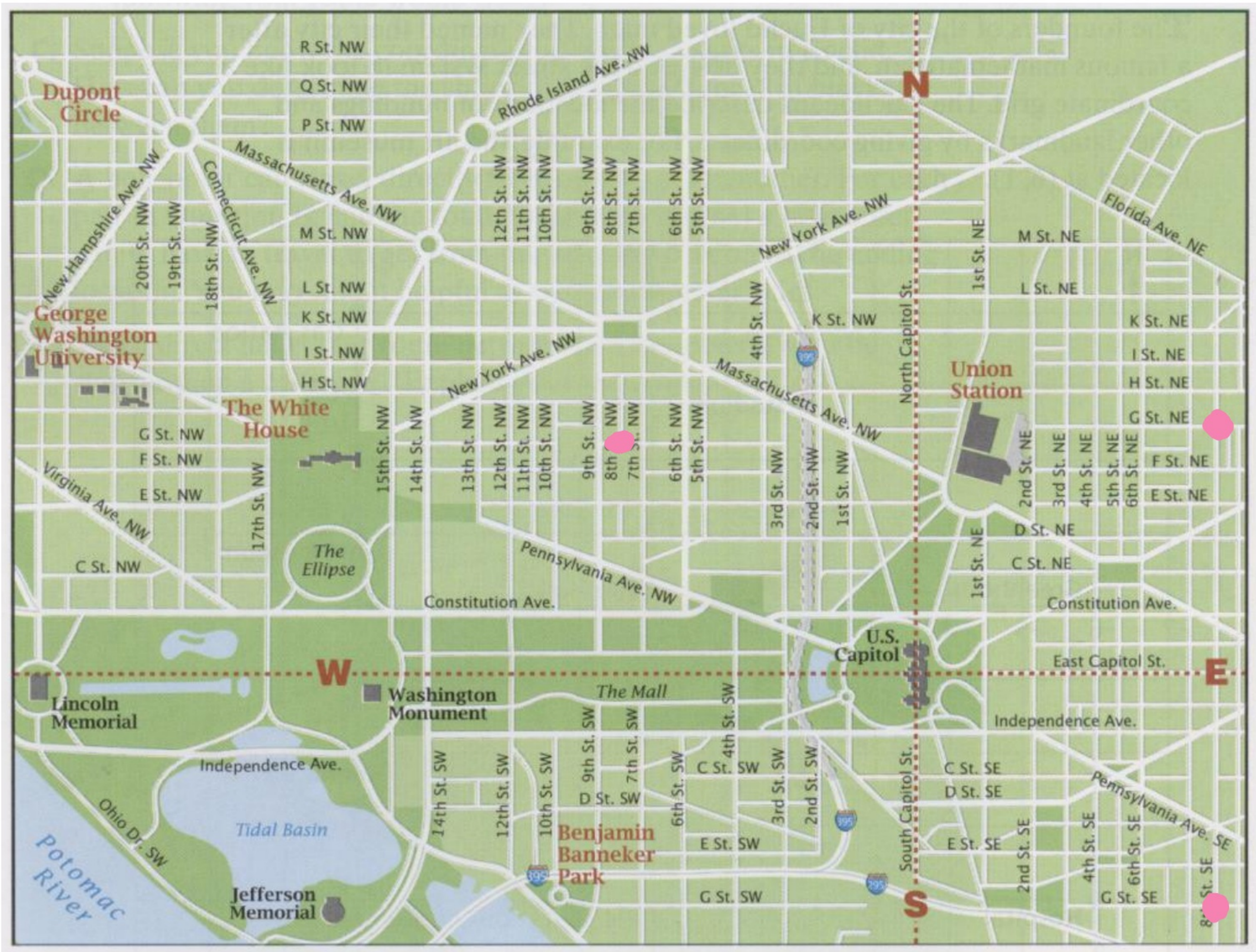
<table>
<tr><th>Important Concepts</th><th>Examples</th></tr>
<tr><td>Finding Area
Students find areas of irregular figures drawn on grids. One method is to subdivide the shape and add the areas of the component shapes. Another method is to enclose the shape in a rectangle and subtract the area outside the figure from the area of the rectangle.</td><td>
Subdivide to find the area: $2 + 2 + 1 + 1 = 6$

Enclose in a square to find the area: $16 - (4 + 2 + 2\frac{1}{2} + 1\frac{1}{2}) = 6$</td></tr>
<tr><td>Square Roots
If the area of a square is known, its side length is the number whose square is equal to the area. The side length of a square is not always a whole number. You can use the $\sqrt{\ }$ symbol to represent these nonwhole numbers.</td><td>
This square has an area of 4 square units. The length of each side is the square root of 4 units, which is equal to 2 units.</td></tr>
<tr><td>Estimating Square Roots
Students develop benchmarks for estimating square roots. Students also estimate square roots with a number line ruler, which helps them to develop a sense of the size of irrational numbers, such as $\sqrt{3}$, $\sqrt{5}$, and $\sqrt{7}$.</td><td>$\sqrt{5}$ is between 2 and 3 because $2^2 < 5 < 3^2$. It is closer to 2. Try 2.25: $2.25^2 = 5.0625$. So $\sqrt{5}$ is between 2 and 2.25, but closer to 2.25. Try 2.24: $2.24^2 = 5.0176$. This estimate is even closer. Continue until the desired accuracy is obtained.</td></tr>
<tr><td>Finding Distances
To find various lengths of line segments, students begin by drawing a square that is associated with the length.</td><td>

This segment is the side of a square with area 25 square units. So its area is $\sqrt{25}$, or 5 units</td></tr>
<tr><td>Cube Roots
If the volume of a cube is known, its edge length is the number that when multiplied by itself 3 times is equal to the volume. The edge length of a cube is not always a whole number. You can use the $\sqrt[3]{\ }$ symbol to represent these nonwhole numbers.</td><td>

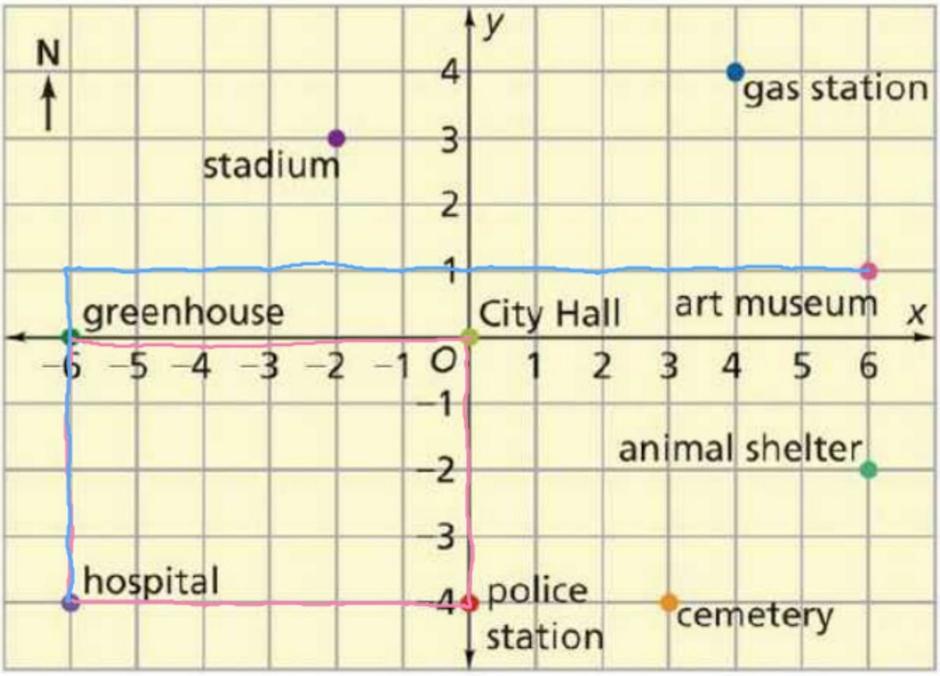
This cube has the volume of 8 cubic units. The length of each edge is the cube root of 8 units, which is equal to 2 units.</td></tr>
<tr><td>Pythagorean Theorem
In a right triangle, the sum of the squares of the lengths of the two legs is equal to the square of the length of the longest side, called the hypotenuse. Symbolically, this is $a^2 + b^2 = c^2$, where a and b are the lengths of the legs and c is the length of the hypotenuse.</td><td>
</td></tr>
<tr><td>Finding the Length of a Line Segment
On a grid, you can find the length of a horizontal or vertical line segment by counting the distance. If a segment is not vertical or horizontal, you can treat it as the hypotenuse of a right triangle. You can use the Pythagorean Theorem to find the length of the hypotenuse.</td><td>

The length of line segment AB can be the hypotenuse of a right triangle, c. $2^2 + 2^2 = c^2$, so $4 + 4 = 8 = c^2$. $\sqrt{8} = c$</td></tr>
<tr><td>Irrational and Rational Numbers
An irrational number is a number that cannot be written as a quotient of two integers where the denominator is not 0. Decimal representations of irrational numbers never end and never show a repeating pattern for a fixed number of digits. Rational numbers can be written as a ratio of two integers. Decimal representations of rational numbers terminate or show a repeating pattern.</td><td>The numbers $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$, and π are examples of irrational numbers. The decimal form of $\sqrt{2}$ is 1.41421356237 . . . . The decimal part goes on forever without any repeating pattern. The numbers $\frac{1}{3}$, -2.7, and $\sqrt{4}$ are examples of rational numbers.</td></tr>
</table>



Dupont Circle
George Washington University
The White House
The Ellipse
Lincoln Memorial
Washington Monument
The Mall
Tidal Basin
Potomac River
Jefferson Memorial
Benjamin Banneker Park
U.S. Capitol
Union Station
N
S
E
W
R St. NW
Q St. NW
P St. NW
M St. NW
L St. NW
K St. NW
I St. NW
H St. NW
G St. NW
F St. NW
E St. NW
C St. NW
Rhode Island Ave. NW
Massachusetts Ave. NW
New Hampshire Ave. NW
Connecticut Ave. NW
New York Ave. NW
Virginia Ave. NW
Pennsylvania Ave. NW
Constitution Ave.
Independence Ave.
Ohio Dr. SW
East Capitol St.
North Capitol St.
South Capitol St.
Florida Ave. NE
Pennsylvania Ave. SE
20th St. NW
19th St. NW
18th St. NW
17th St. NW
15th St. NW
14th St. NW
13th St. NW
12th St. NW
11th St. NW
10th St. NW
9th St. NW
8th St. NW
7th St. NW
6th St. NW
5th St. NW
4th St. NW
3rd St. NW
2nd St. NW
1st St. NW
K St. NW
14th St. SW
12th St. SW
10th St. SW
9th St. SW
7th St. SW
6th St. SW
4th St. SW
3rd St. SW
2nd St. SW
C St. SW
D St. SW
E St. SW
G St. SW
M St. NE
L St. NE
K St. NE
I St. NE
H St. NE
G St. NE
F St. NE
E St. NE
D St. NE
C St. NE
1st St. NE
2nd St. NE
3rd St. NE
4th St. NE
5th St. NE
6th St. NE
C St. SE
D St. SE
E St. SE
G St. SE
2nd St. SE
4th St. SE
6th St. SE
8th St. SE
395

Labsheet 1.1 Map of Euclid



A) Give the coordinates of each landmark in the map above.

1) gas station (4,4)

2) animal shelter (6,-2)

3) stadium (-2,3)

B) Pair 1: police station to City Hall

Directions: North 4 blocks

Distance: 4 blocks

Pair 2: hospital to City Hall

Directions: 6E 4N 4N 6E

Distance: 10 blocks

Pair 3: hospital to art museum

Directions: 5N 12E 12E 5N

Distance: 17 blocks

C) stadium (-2, 3) & high school(1, 8)   Distance:
How did you find it?

+3 +5

E3 N5

$-2 \rightarrow 1 \quad +3$
$3 \rightarrow 8 \quad +5$

$-2-1=-3$
$3-8=-5$

$|-3|=3$
$|-5|=5$
$+$
8

$1--2=3$
$8-3=5$
$+$
8

Add Absolute Value of Differences

D) Helicopter Distances (find by measuring with a ruler (cm))

Pair 1: police station to City Hall   Distance: 4 blocks

Pair 2: hospital to City Hall   Distance: 7.4 7.5 7.6 blocks

Pair 3: hospital to art museum   Distance: 13.4 13.5 13.6 blocks

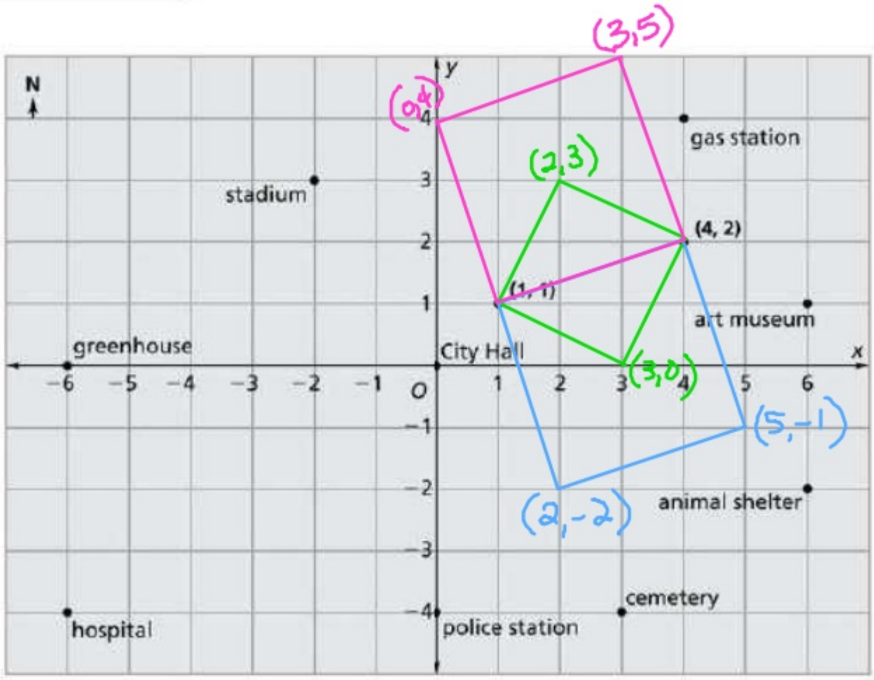
Will a helicopter disance always be shorter than a car distance? Explain.

No, a helicopter distance will not always be shorter than a car distance. They are the same when the car does not have to turn.

The helicopter distance will never be longer than the car distance.

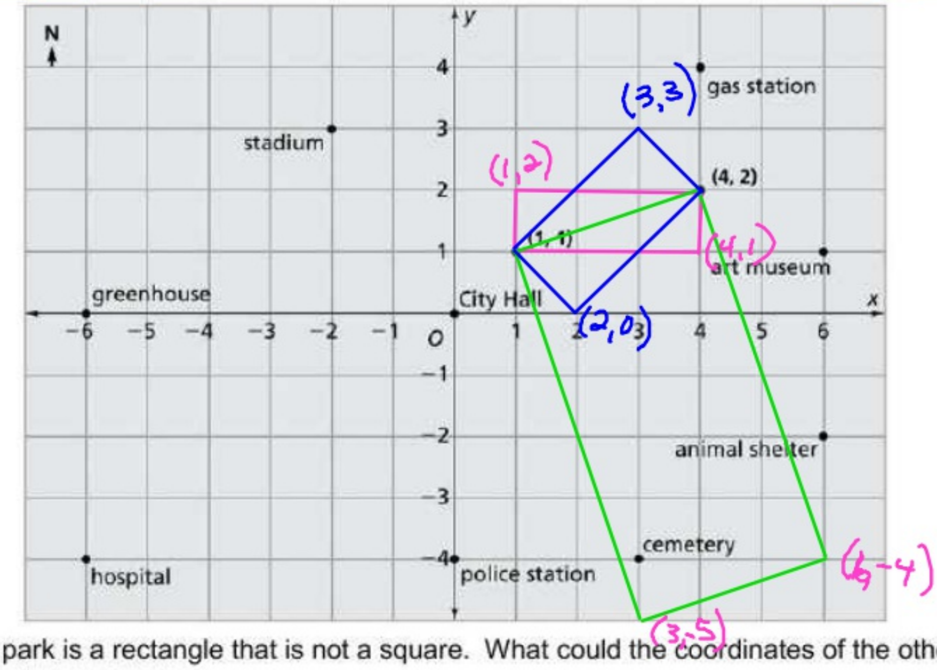
Labsheet 1.2 Planning Parks

A



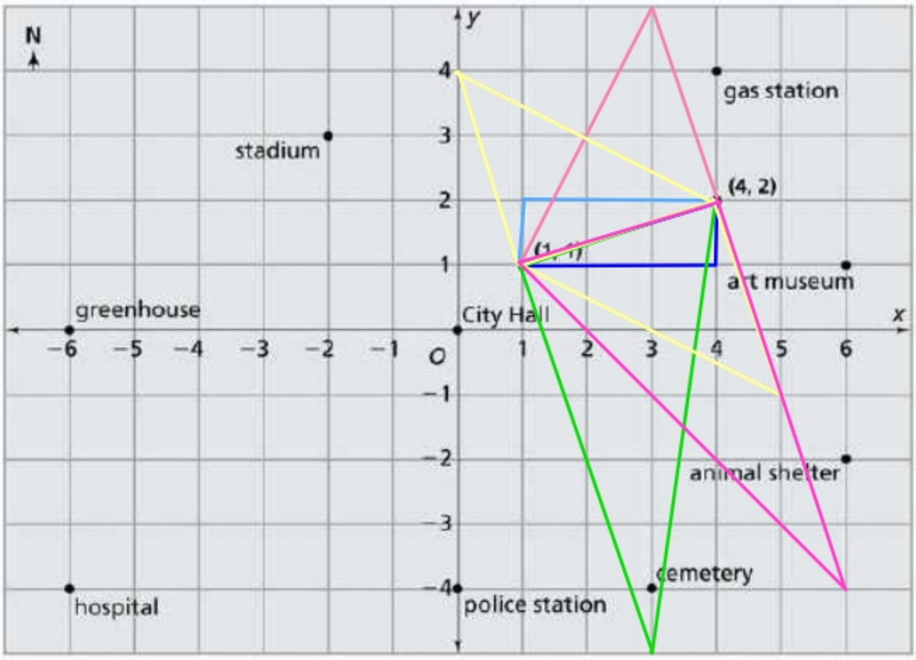
A) Suppose the park is to be a square. What could the coordinates of the other two vertices be? Give two answers.

B



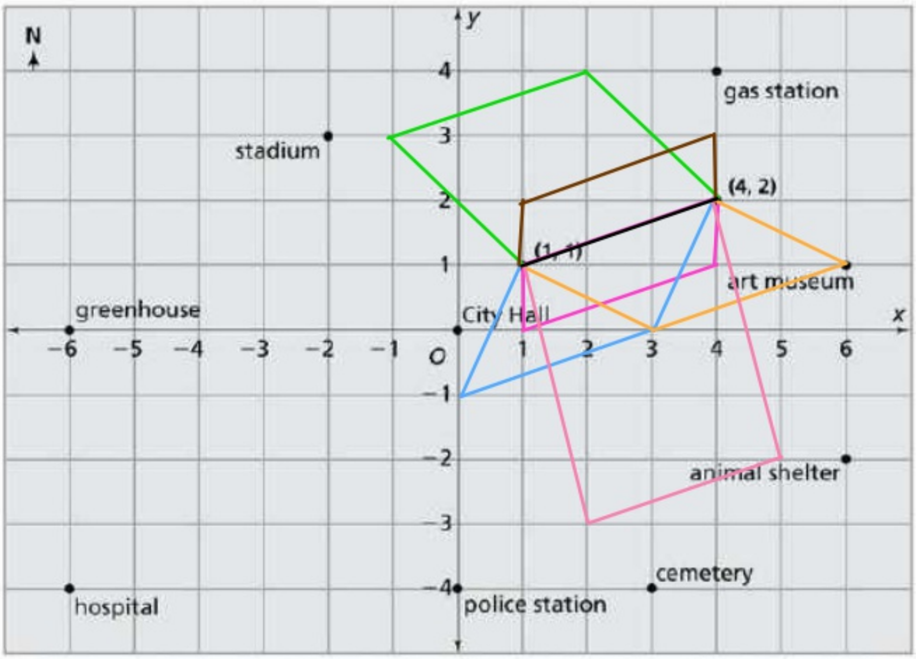
B) Suppose the park is a rectangle that is not a square. What could the coordinates of the other two vertices be? Give two answers.

C)



C) Suppose the park is a right triangle. What could the coordinates of the other vertex be? Give two answers.

D)



D) Suppose the park is a parallelogram that is not a rectangle. What could the coordinates of the other two vertices be? Give two answers.

$A = \frac{1}{2}bh$
$= \frac{1}{2}(2)(2)$
$= 2$

Labsheet 1.3 Irregular Figures

$A = lw$
$A = 2 \cdot 1$
$A = 2$

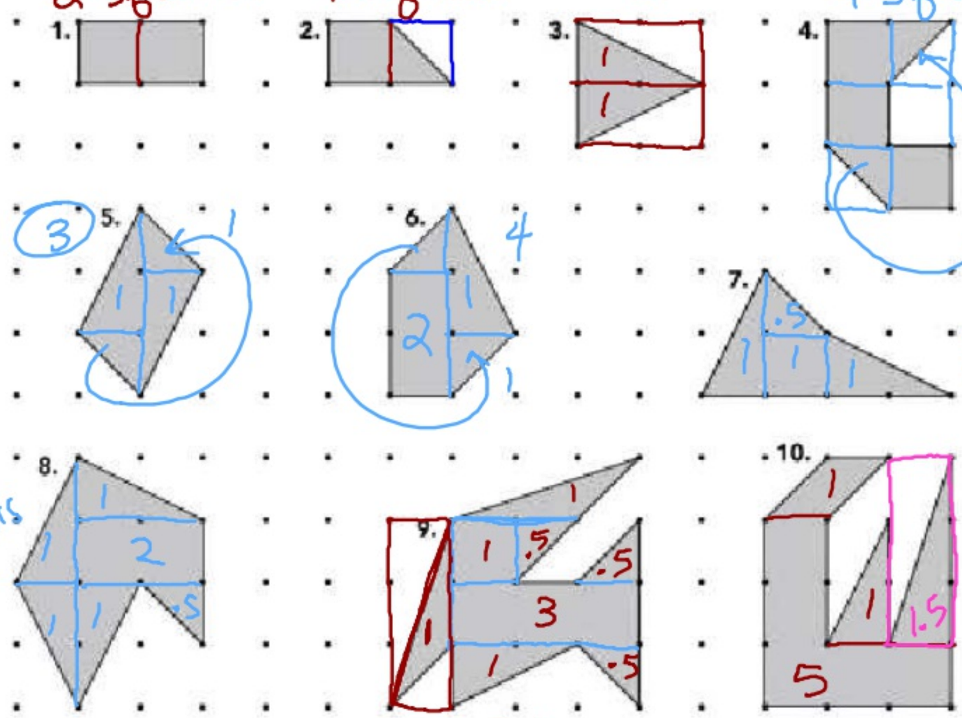
2 sq. units

1.5 sq. units

2 sq. units

4 sq. units

$$\begin{array}{r} 6 \\ -1 \\ -.5 \\ -.5 \\ \hline 4 \end{array}$$



3.5 sq. units

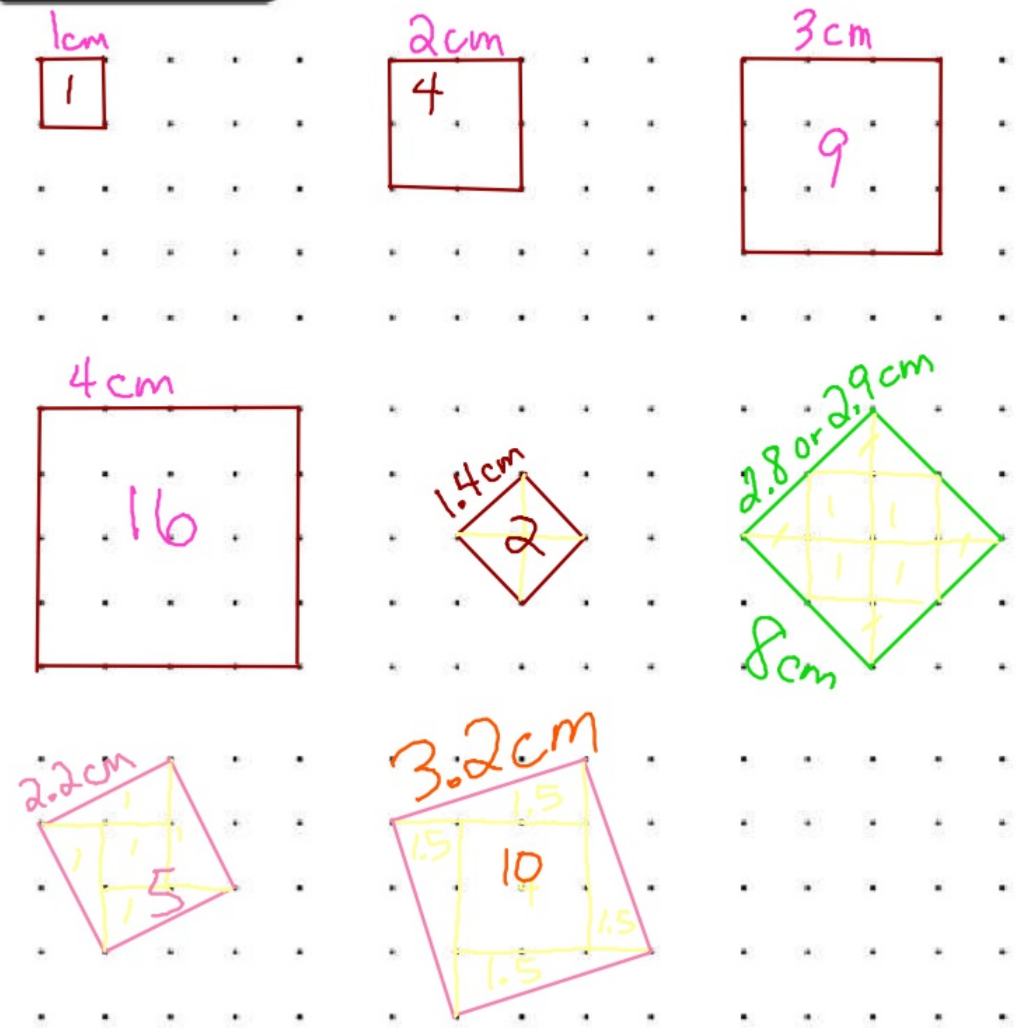
6.5 sq. units

8.5 sq. units

8.5 sq. units

$$\begin{array}{r} 3 \\ -1.5 \\ \hline 1.5 \\ -.5 \\ \hline 1 \end{array}$$

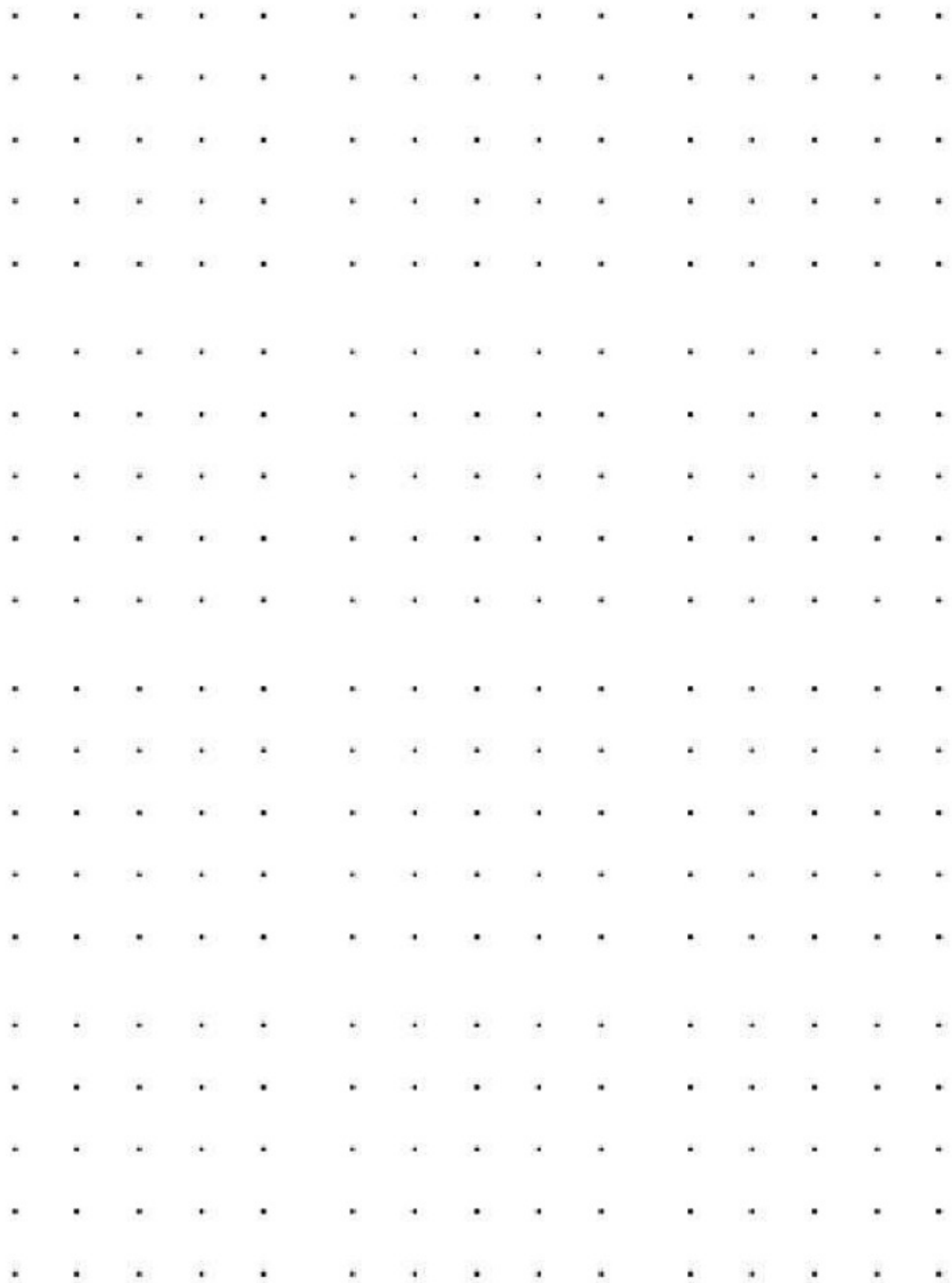
Labsheet 2.1 5 Dot-by–5 Dot Grids



1, 2, 4, 5, 8, 9, 10, 16

1, 1.4, 2, 2.2, 2.9, 3, 3.2, 4

Labsheet 2.1 5 Dot-by–5 Dot Grids



$\sqrt{}$ $\sqrt{64} = 8$ area side length

because $8 \cdot 8 = 64$

Labsheet 2.2 Square Roots

2nd $\sqrt{x^2}$ $\boxed{7}$

Area of a square: A = $S \cdot S$ or A = S^2

If you know the area of a square, you can work backwards to find the side length of the square by finding the square root $\sqrt{}$ of the area. $\sqrt{}$ Radical

If A = s^2 then s is the square root of A because $S \cdot S$ = A

principle square root

$\sqrt{4} = 2$ *and* $-\sqrt{4} = -2$. However, if asked to find the square root of 4, the answer is 2 and -2 because $2 \cdot 2 = 4$ and $-2 \cdot -2 = 4$.

Root	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Side lengths
Square	1	4	9	16	25	36	49	64	81	100	121	144	169	196	225	Areas

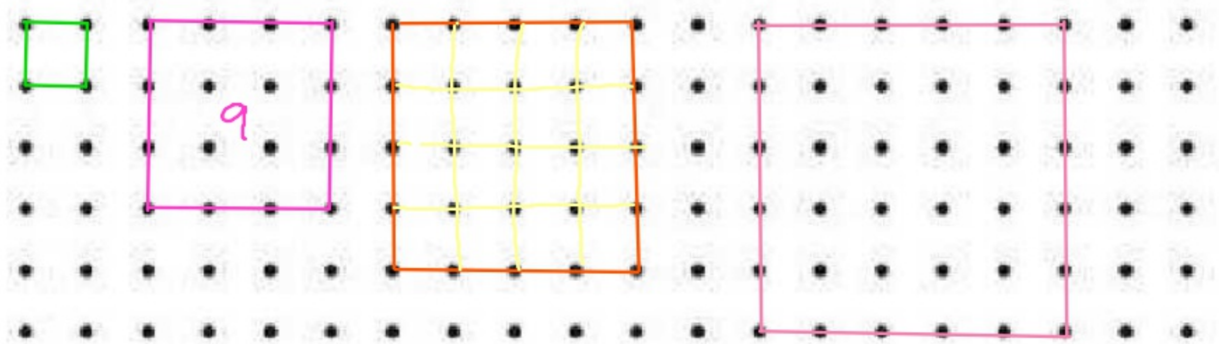
"Perfect" $\sqrt{5}$ 5

196
169

ONLY USE YOUR CALCULATOR IF THE QUESTION TELLS YOU TO!!

A) 1) Find the side lengths of squares with areas of 1, 9, 16, and 25.

1: 1 9: 3 16: 4 25: 5



2) Use your calculator to find the following values:

$\sqrt{1}$ = 1 $\sqrt{9}$ = 3 $\sqrt{16}$ = 4 $\sqrt{25}$ = 5

B) 1) What is the area of a square with side lengths of 12 units? 144 sq. units 12^2 12 units

What is the area of a square with side lengths of 2.5 units? 6.25 sq. units 2.5^2 2.5 units

2) Find the missing numbers (use your calculator)

$\sqrt{144} = 12$ $\sqrt{6.25} = 2.5$

area side

3) Find x.

a. $\sqrt{x^2} = \sqrt{121}$

$\boxed{x = \pm 11}$

$(-1)^2$

$(\sqrt{17})^2 = 17$

$(\sqrt{5})^2 = 5$

$(\sqrt{146})^2 = 146$

$\sqrt{(146)^2} = 146$

b. $\sqrt{x^2} = \sqrt{2.25}$

$\boxed{x = \pm 1.5}$

Check

If $x = 1.5$

$x^2 = 2.25$

$(1.5)^2 = 2.25$

$2.25 = 2.25$ ✓

If $x = -1.5$

$x^2 = 2.25$

$(-1.5)^2 = 2.25$

$2.25 = 2.25$ ✓

c. $(\sqrt{x})^2 = (121)^2$

$\boxed{x = 14{,}641}$

d. $\sqrt{2.25} = x$

$\boxed{1.5 = x}$

4)

C) 1) Measure the side of the square with an area of 2 with your ruler. 1.4 cm

2) Use your answer as a side length of a square to find the area. (square your answer from #1)

1.4

$A = 1.4^2 = 1.96$

3) Use your calculator to find $\sqrt{2}$. 1.414213562

Round it to the nearest tenth. 1.4

4) Compare your answers from # 1 and # 3.

They are the same.

5)

$\sqrt{2}$ ← exact

1.4142 ← approximate (estimate)

A = 2 sq. m.

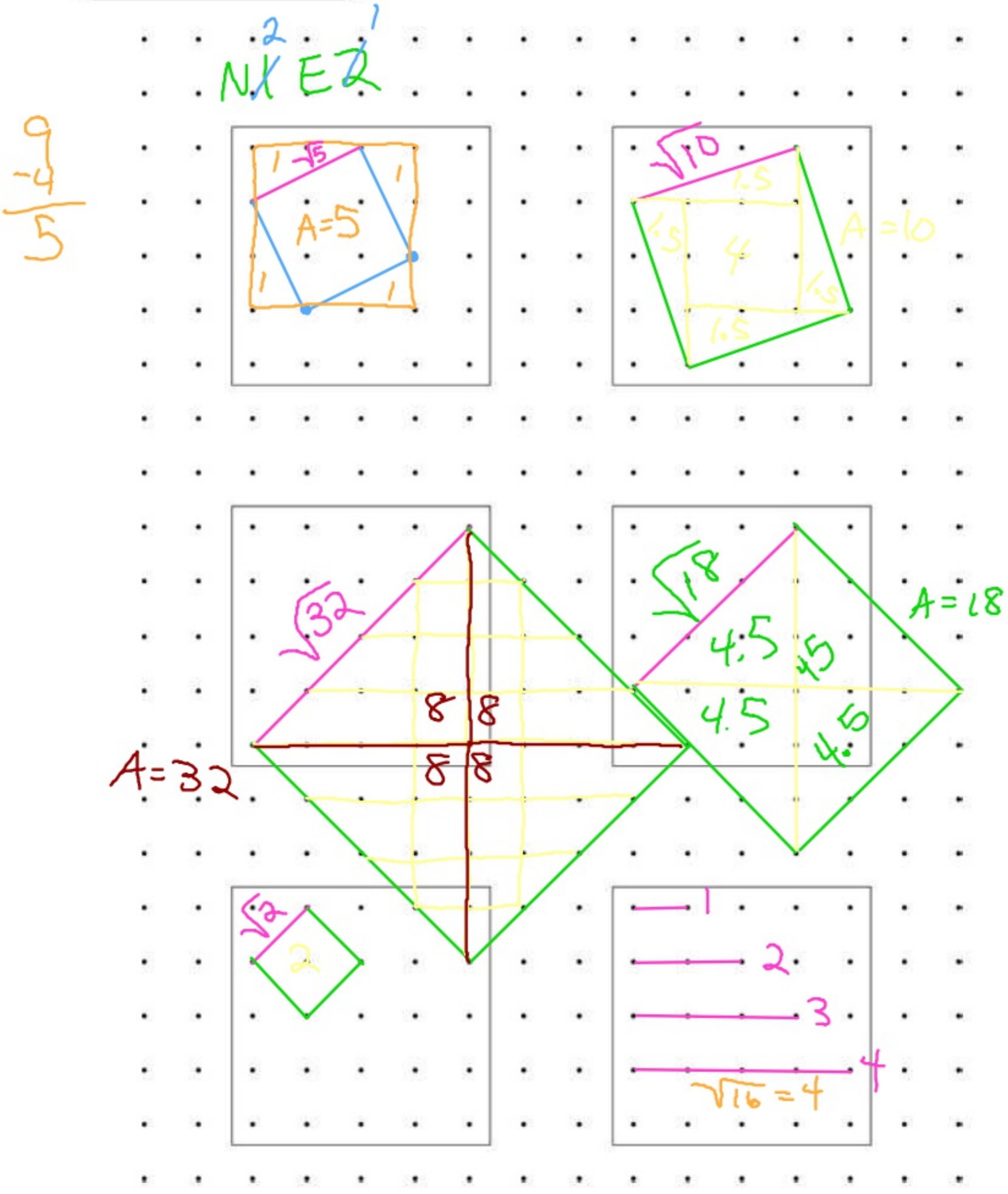
Study for Quiz

- Plot points
- State coordinates of points
- Find driving distances
- Give driving directions
- Draw square given 1 side
- Find areas of weird shapes.
- Use calculator to find $\sqrt{\ }$

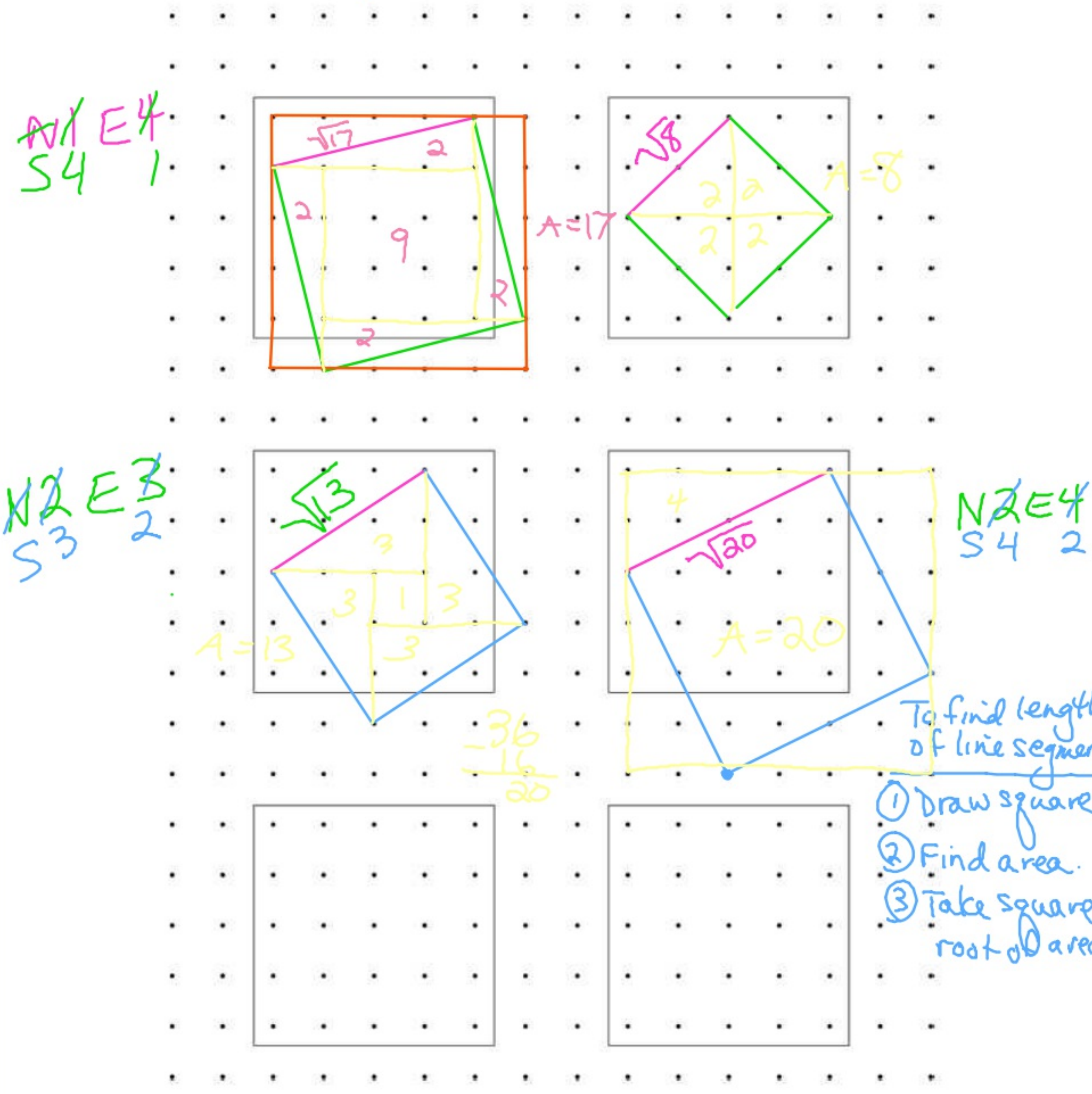
Between what 2 whole numbers does $\sqrt{5}$ lie?
2 and 3
because $\sqrt{5} \approx 2.23$

Labsheet 2.3

Figures on a Dot Grid



$$\begin{array}{r} 25 \\ -\ 8 \\ \hline 17 \end{array}$$



To find length of line segment

① Draw square

② Find area.

③ Take square root of area.

$\sqrt{8} = 2.828427125$

$2\sqrt{2} = 2.828427125$

B)

1. Ella says the length of the segment in Figure 1 is $\sqrt{8}$ units. Oskar says it is $2\sqrt{2}$ units. Are both students correct? Explain.

$\frac{16}{8}$

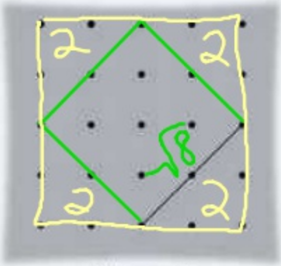


Figure 1

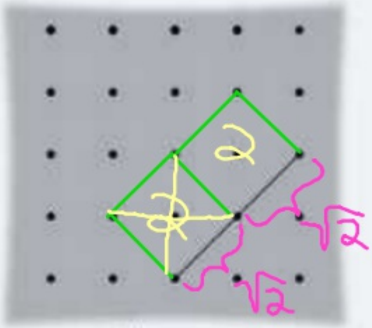


Figure 1

2. Express the exact length of the segr

3. Can you find a segment whose length cannot be expressed in two ways? Explain.

4. Which of the following lengths can be expressed in two ways: $\sqrt{5}$, $\sqrt{10}$, $\sqrt{18}$? Check your answers on a grid.

$V = lwh$
$V = e \cdot e \cdot e$

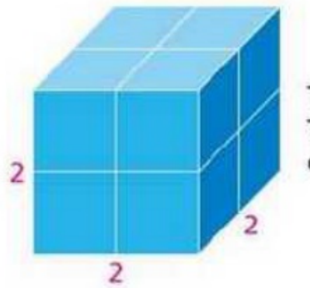
Labsheet 2.4

Cube Roots

$V = e^3$

3 $\boxed{2^{nd}}$ $\boxed{\wedge}$ $\sqrt[3]{\ }$

$\sqrt[3]{8} = 2$
Volume edge



This cube has the volume of 8 cubic units. The length of each edge is the cube root of 8 units, which is equal to 2 units.

In general, if $V = e^3$, then e is the cube root of V. Because $2 \cdot 2 \cdot 2 = 8$, 2 is the cube root of 8. Because $-2 \cdot (-2) \cdot (-2) = -8$, -2 is the cube root of -8.

$\sqrt[3]{-8} = -2$

You can use the symbol, $\sqrt[3]{\ }$, to indicate cube root. For any number N, $\sqrt[3]{N}$ indicates the cube root of N. For example, $\sqrt[3]{8} = 2$ and $\sqrt[3]{-8} = -2$.

$(-2)^3$

A **1.** Find the edge lengths of cubes with volumes of 1, 27, 64, and 125 cubic units.

1: $e = 1$ because $1 \cdot 1 \cdot 1 = 1$
27: $e = 3$ because $3 \cdot 3 \cdot 3 = 27$
64: $e = 4$ b/c $4 \cdot 4 \cdot 4 = 64$
125: $e = 5$ b/c $5 \cdot 5 \cdot 5 = 125$

2. Find the values of $\sqrt[3]{1}$, $\sqrt[3]{27}$, $\sqrt[3]{64}$, and $\sqrt[3]{125}$.

$\sqrt[3]{1} = 1$ $\sqrt[3]{64} = 4$
$\sqrt[3]{27} = 3$ $\sqrt[3]{125} = 5$

B **1.** What is the volume of a cube with an edge length of 5 units? What is the volume of a cube with an edge length of 2.5 units?

$e = 5$ $V = e^3 = 5^3 = 125$ units^3
$e = 2.5$ $V = (2.5)^3 = 15.625$ units^3

2. Find the missing numbers.

a. $\sqrt[3]{\blacksquare} = 5$ 125

b. $\sqrt[3]{\blacksquare} = 2.5$ 15.625

3. Find x.

a. $\sqrt[3]{x^3} = \sqrt[3]{27}$

$x = 3$

$x^3 = 27$
$3^3 = 27$
$27 = 27$ ✓

b. $\sqrt[3]{x^3} = \sqrt[3]{-27}$

$\boxed{x = -3}$

c. $\sqrt[3]{x^3} = \sqrt[3]{\frac{1}{8}}$

$x = \frac{1}{2}$

d. $\left(\sqrt[3]{x}\right)^3 = (27)^3$

$\boxed{x = 19{,}683}$

e. $\left(\sqrt[3]{x}\right)^3 = (-27)^3$

$\boxed{x = -19{,}683}$

f. $\left(\sqrt[3]{x}\right)^3 = \left(-\frac{1}{8}\right)^3$

$\boxed{x = -\frac{1}{512}}$

4. Explain what each positive value of x might represent in terms of volume and length.

$\sqrt[3]{\text{Volume}} = \text{Edge}$

19,683 is volume
27 is edge length

$(\text{Edge})^3 = \text{Volume}$

C **1.** Between which two consecutive whole numbers does $\sqrt[3]{10}$ lie? Explain.

in a row

If I were to plot $\sqrt[3]{10}$ on a number line, I would put it between 2 and 3.

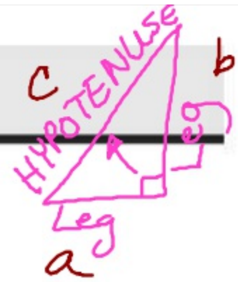
$\sqrt[3]{10} = 2.15443469 \approx 2$

2 and 3

2. Which whole number from part (1) is closer to $\sqrt[3]{10}$? Explain.

2

Labsheet 3.1 Discovering the Pythagorean Theorem

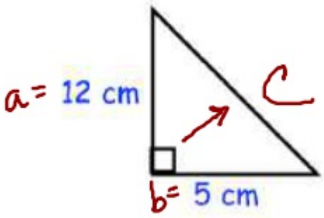


$a^2+b^2=c^2$

SQUARE SQUARE

Side a	Side b	Area of Square On Side a	Area of Square On Side b	Area of Square on Side C	Side C
1	2	1 +	4 =	5	$\sqrt{5}$
1	3	1 +	9 =	10	$\sqrt{10}$
1	4	1 +	16 =	17	$\sqrt{17}$
2	2	4 +	4 =	8	$\sqrt{8}$
2	3	4	9	13	$\sqrt{13}$
4	5	16	25	41	$\sqrt{41}$

Find the missing side. Round to the nearest hundredth if necessary.



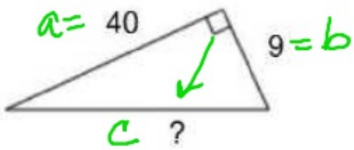
$a^2+b^2=c^2$

$12^2+5^2=c^2$

$144+25=c^2$

$\sqrt{169}=\sqrt{c^2}$

$c=\sqrt{169}=13\text{cm}$



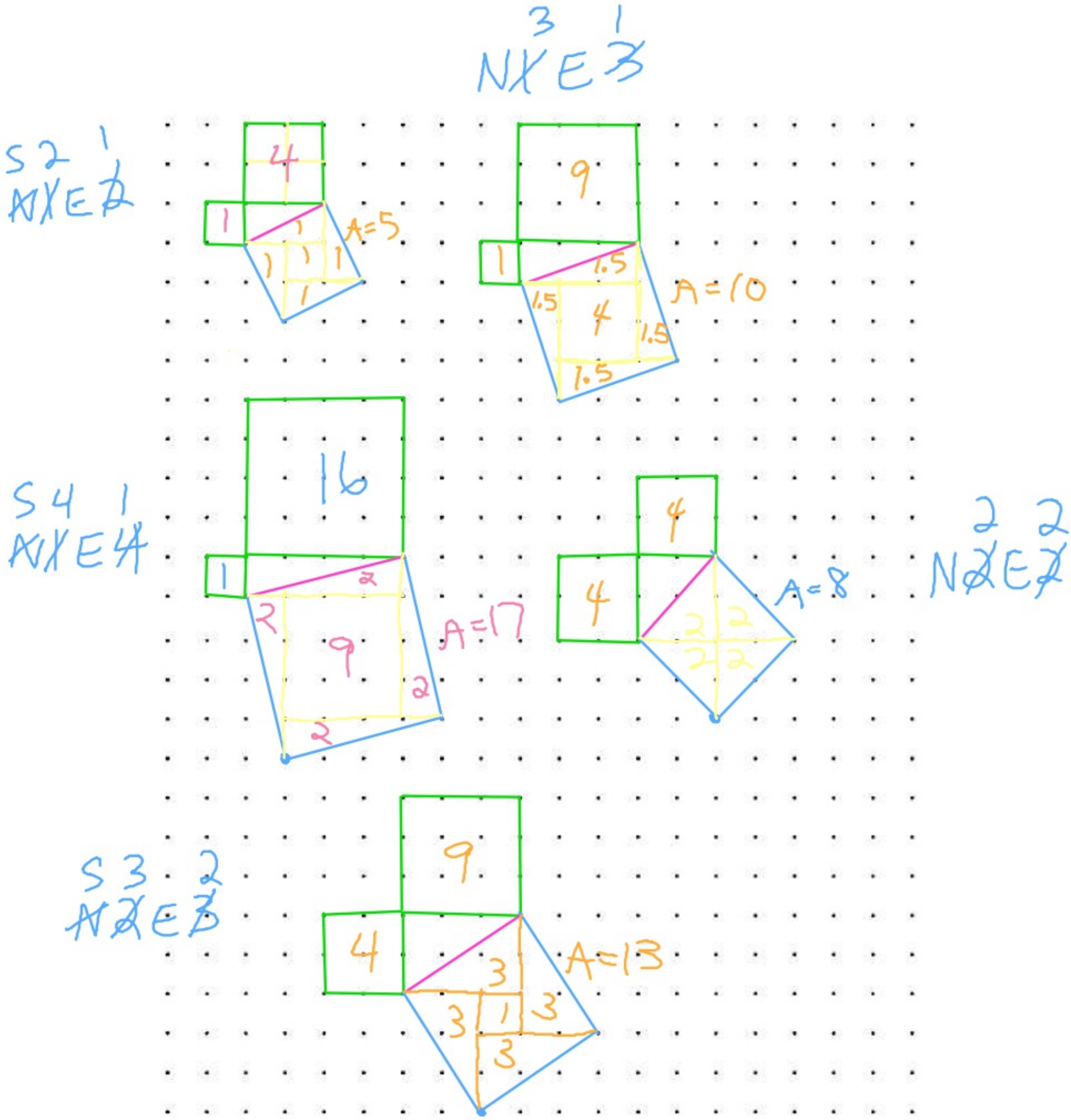
$a^2+b^2=c^2$

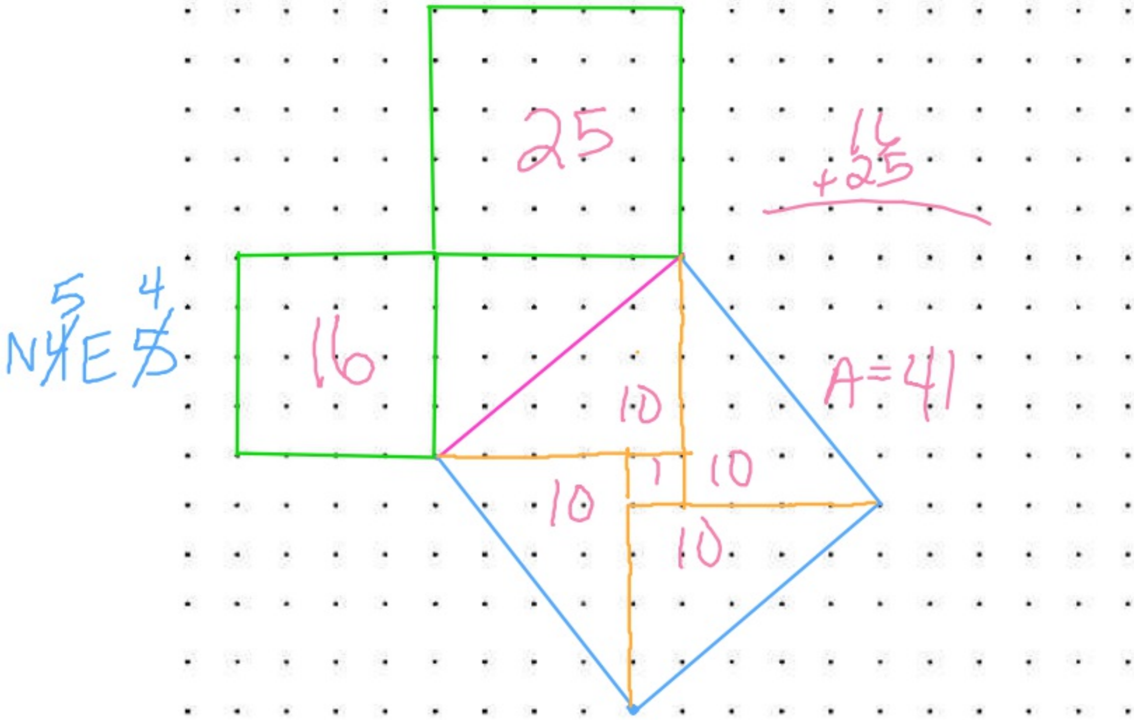
$40^2+9^2=c^2$

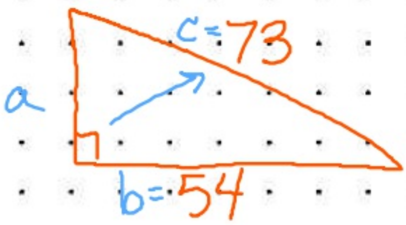
$1600+81=c^2$

$\sqrt{1681}=\sqrt{c^2}$

$c=\sqrt{1681}=41$


3 1
NXE3
S2 1
NXE2
A=5
A=10
S4 1
NXE4
16
A=17
A=8
2 2
NXE2
S3 2
NXE3
A=13





$$a^2+b^2=c^2$$

$$a^2+54^2=73^2$$

$$a^2+2916=5329$$

$$-2916 \qquad -2916$$

$$\sqrt{a^2}=\sqrt{2413}$$

$$a=\sqrt{2413}\approx 49.12$$

exact approximate

$\sqrt{15}, \sqrt{17}, 3.7$

a c b

$$a^2 + b^2 = c^2$$

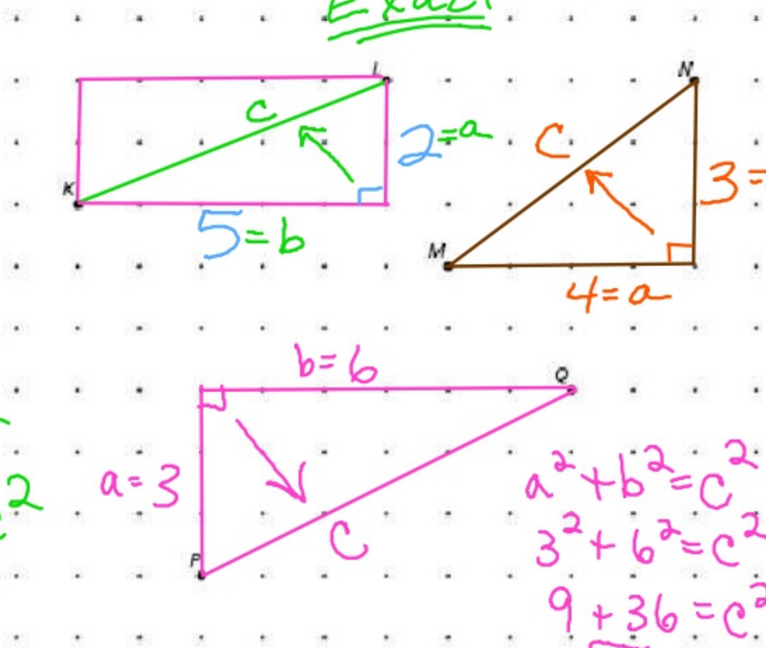
$$(\sqrt{15})^2 + 3.7^2 = (\sqrt{17})^2$$

$$15 + 13.69 = 17$$

$$28.69 \neq 17$$ <u>NO</u>

Labsheet 3.3 Points on a Grid

Exact



5 2

NAES

A = 29

$\sqrt{29}$

$a^2+b^2=c^2$

$2^2+5^2=c^2$

$4+25=c^2$

$\sqrt{29}=\sqrt{c^2}$

$c=\sqrt{29}$

c

$2=a$

$5=b$

c

$3=b$

$4=a$

$a^2+b^2=c^2$

$4^2+3^2=c^2$

$16+9=c^2$

$\sqrt{25}=\sqrt{c^2}$

$c=\sqrt{25}$

$c=5$

$b=6$

$a=3$

c

$a^2+b^2=c^2$

$3^2+6^2=c^2$

$9+36=c^2$

$\sqrt{45}=\sqrt{c^2}$

$c=\sqrt{45}$

D. In problem 1.1 Question C, you found the driving distance between the stadium at (-2,3) and the high school at (1,8). What is the helicopter distance between these two locations? Find the answer exactly and rounded to the nearest thousandth.

A triangle has sides of 5, 12 and 13. Is it a right triangle?

$a^2+b^2=c^2$

$5^2+12^2=13^2$

$25+144=169$

$169=169$

Yes

$\sqrt{15}, \sqrt{17}, 3.7$

$a^2+b^2=c^2$

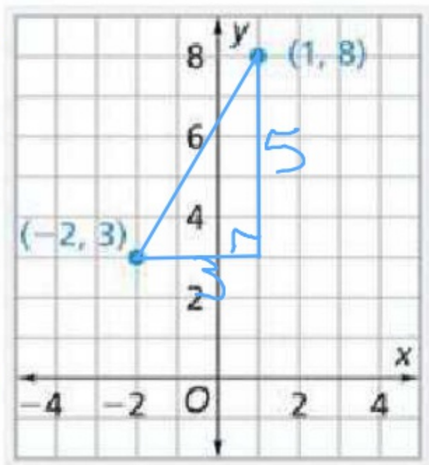
$3^2+5^2=c^2$

$9+25=c^2$

$\sqrt{34}=\sqrt{c^2}$

$\boxed{c=\sqrt{34}}$

$c=5.831$



Irrational Numbers

In Problem 4.2, you saw that 10.111213141516 . . . is an example of a decimal that never repeats and never terminates. Here is another example:

$$0.12122122212222\ldots$$

- Why does this pattern go on forever without repeating?

You can never represent a nonrepeating, nonterminating decimal as a fraction, or rational number. For example, $\frac{1}{10}$ is a close fraction representation of the decimal above, $\frac{12}{100}$ is closer, and $\frac{121}{1{,}000}$ is even closer. You cannot, however, get an exact fraction representation for this decimal.

- How is this kind of decimal the same as or different from the repeating decimal 0.6666 . . . ? The repeating decimal 0.121212 . . . ? The terminating decimal 1.414213562?

RATIONAL
write as fraction (ratio)
all fractions either terminate or repeat.

Numbers with decimal representations that are nonterminating and nonrepeating are called **irrational numbers.** Some irrational numbers have patterns, as above. Some have no patterns, but the decimals never terminate and never repeat. You cannot express these numbers as ratios of integers.

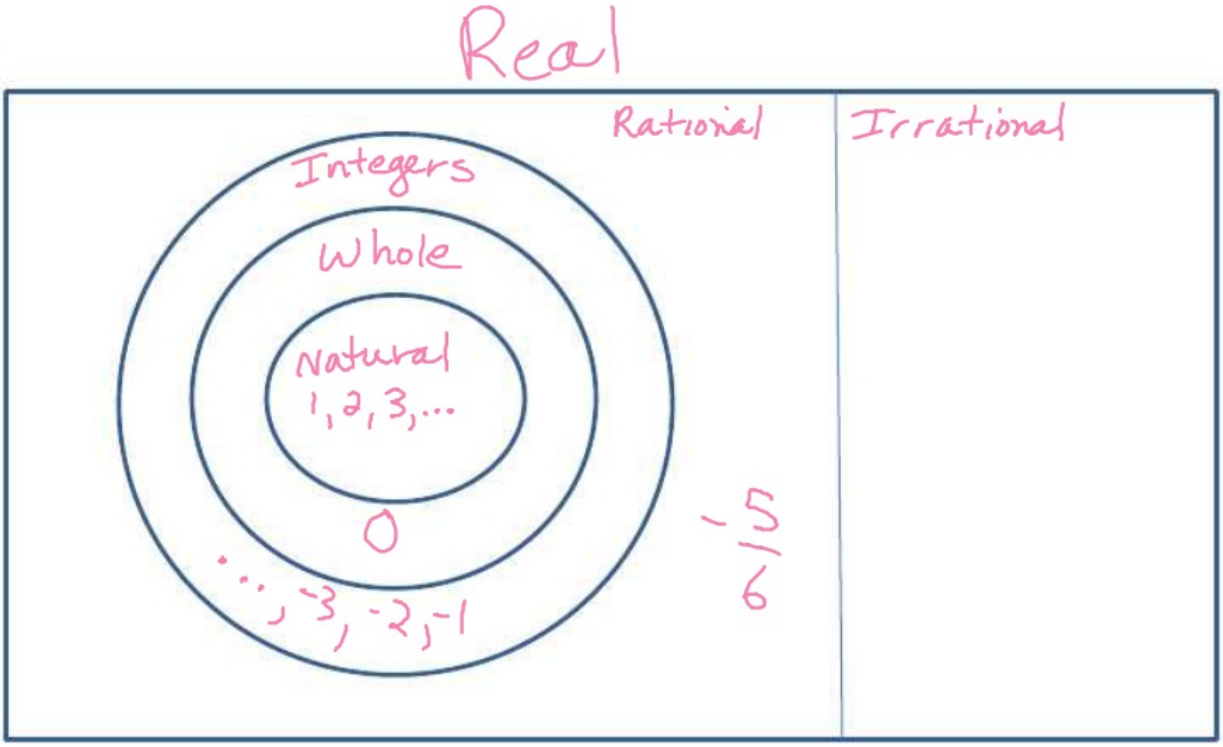
You have worked with irrational numbers before. For example, the decimal representation of the number π starts with the digits 3.14159265 . . . and goes forever without repeating any sequence of digits. The number π is irrational.

3.623
$3\frac{623}{1000}$

The number $\sqrt{2}$ is also irrational. You could not find an exact terminating or repeating decimal representation for $\sqrt{2}$ because such a representation does not exist! Other irrational numbers are $\sqrt{3}$, $\sqrt{5}$, and $\sqrt{11}$. In fact, $\sqrt{n}$ is an irrational number for any whole number value of n that is not a square number.

- Are the following numbers rational or irrational: $\sqrt{7}$, $\sqrt{9}$, $\sqrt{0.25}$? Why or why not?
- Can you give another number that has a rational square root?
- Can you give another number that does not have a rational square root?

The set of irrational and rational numbers is called the set of **real numbers.** An amazing fact is that there are an infinite number of irrational numbers between any two fractions! You will explore irrational and rational numbers in this Problem.



Tell whether each number is *rational* or *irrational*. Explain your reasoning.

1. $\sqrt{7}$ **2.** $\sqrt{16}$ **3.** $\sqrt{4} \cdot \sqrt{4}$

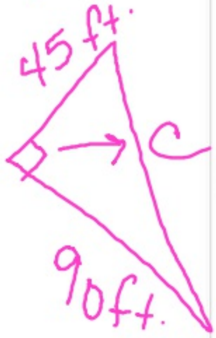
4. $\sqrt{7} \cdot \sqrt{7}$ **5.** $2\sqrt{7}$ **6.** $\sqrt{28}$

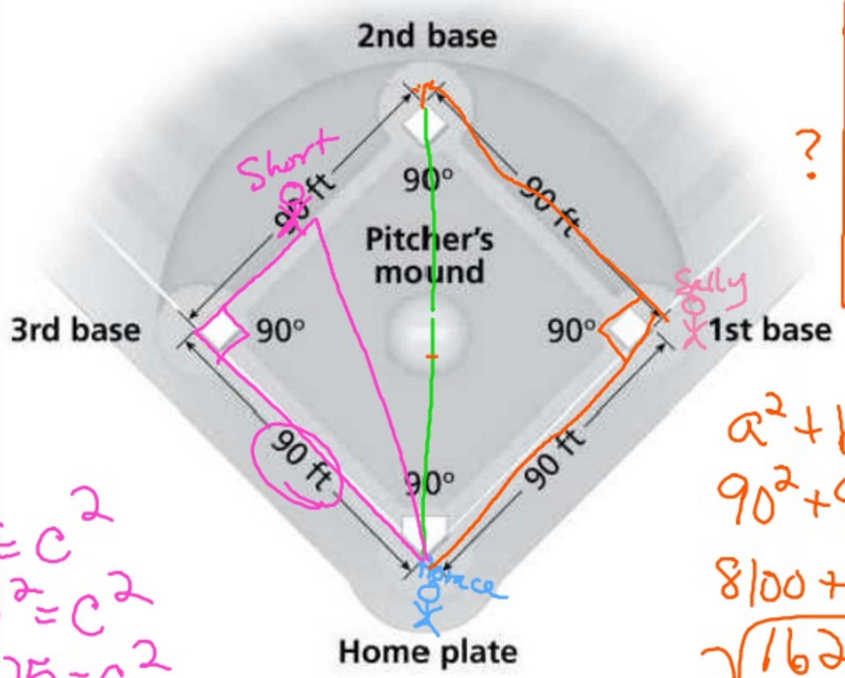
7. $\sqrt{14}$ **8.** $\sqrt{\frac{1}{16}}$ **9.** 2.45455

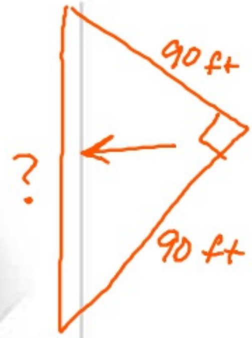
10. 2.45454545 . . . **11.** 2.454554555 . . . **12.** 2.455455545555 . . .

Labsheet 5.1 Baseball Diamond

$\frac{90}{2} = 45$







$a^2 + b^2 = c^2$

$90^2 + 45^2 = c^2$

$8100 + 2025 = c^2$

$\sqrt{10125} = \sqrt{c^2}$

$c = \sqrt{10125}$ $\quad c \approx 100.6$ ft.

$a^2 + b^2 = c^2$

$90^2 + 90^2 = c^2$

$8100 + 8100 = c^2$

$\sqrt{16200} = \sqrt{c^2}$

$c = \sqrt{16200}$

$c \approx 127.3$ ft.

A **1.** How far must Horace throw the baseball to get Sally out at second base? Explain.

B The shortstop is standing on the baseline, halfway between second base and third base. How far is the shortstop from Horace?

C The pitcher's mound is 60 feet 6 inches from home plate. Use this information and your answer to Question A to find the distance from the pitcher's mound to each base.

More Practice