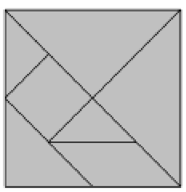
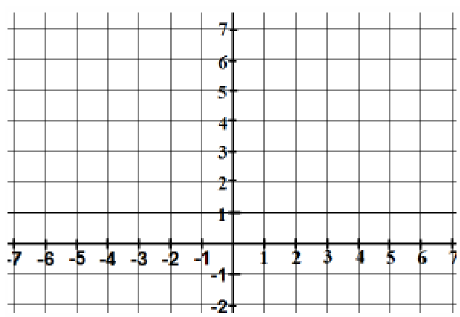
1) If you walk 50 yards south, then 40 yards east, and finally 20 yards north, how far are you from your starting point? Express your answer in yards.

2) A 26 foot long ladder is leaning up against a house with its base 10 feet away from the house on the ground. If the side of the house is perfectly vertical, how far up the house would you be if you climbed to the top of the ladder? Express your answer in feet.

3) A tangram puzzle has 7 shapes that can be put together to make a square as shown. If the side of the large square measures 4 inches, what is the area of the small square?



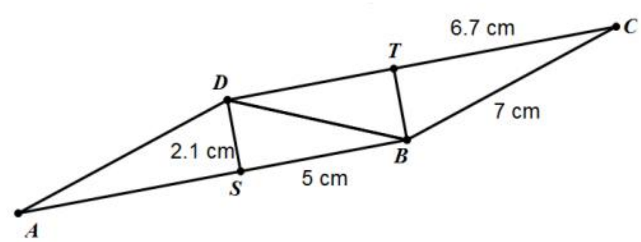
4) The points A (4, 0), B (6, 4) and C (2, 6) are three vertices of a rhombus. The fourth vertex, D, also lies on this coordinate grid. What are the coordinates of D?



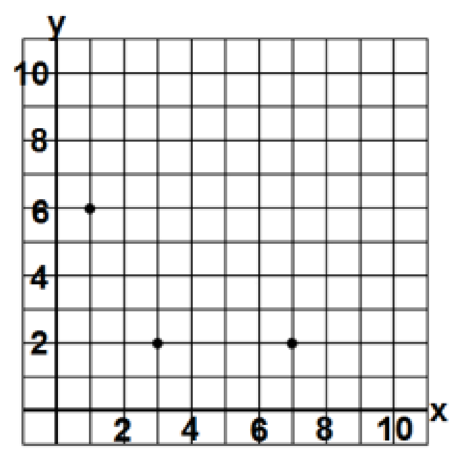
5) An 8-inch square of thin paper is folded in half vertically and then horizontally to create a new square. These 2 folds are repeated 5 times each, including the first two folds, to create a tiny square. What is the perimeter of the new square? (An 8-inch square is a square that is 8 inches on each side.)

6) At twelve noon the angle between the hour and minute hands on an analogue clock is 0˚. What is the angle between the hands on the clock at 12:30 pm?

7) To find the area of parallelogram ABCD, Drew draws the perpendicular segments DS and BT. He does some measuring. To the nearest tenth of a centimeter BC = 7 cm, CT = 6.7 cm, BS = 5 cm, and DS = 2.1 cm. What is the area of parallelogram ABCD, to the nearest tenth of a square centimeter.

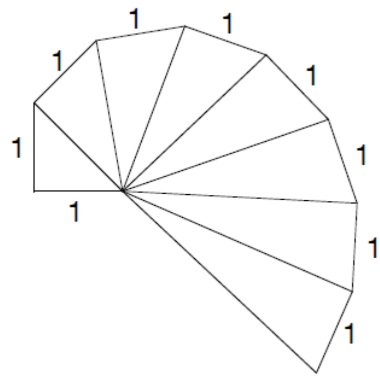


8) An isosceles trapezoid has a line of symmetry. Three of the vertices of the isosceles trapezoid are (1, 6), (3, 2), and (7, 2) as shown. The fourth vertex has whole number coordinates. What are the coordinates of the fourth vertex?



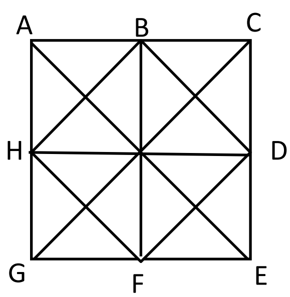
BONUS PROBLEMS

9) What is the length of the hypotenuse for the longest triangle in the figure? (All triangles are right triangles)

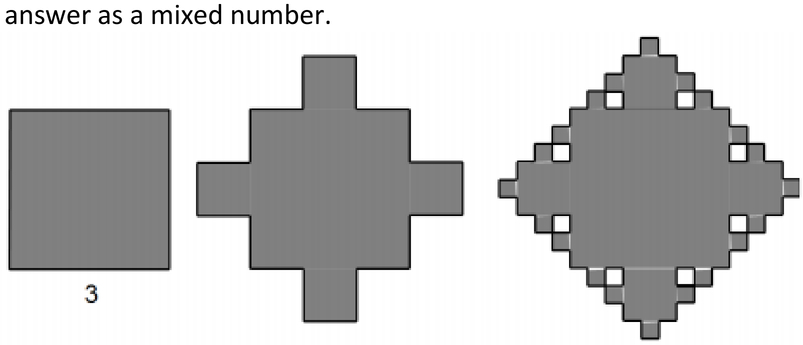


10) A "Pythagorean Triple" is a set of positive integers, **a**, **b** and **c** that fits the rule: $a^2 + b^2 = c^2$. The smallest Pythagorean Triple is 3, 4 and 5 because $3^2 + 4^2 = 5^2$. Name at least 2 other Pythagorean Triples.

11) Square ACEG is drawn below. Points B, D, F, and H are the midpoints of the sides of a square. What is the total number of squares of all sizes that can be traced using only the line segments shown?



12) The first figure is a square with side length 3 units. The second figure is obtained from the first by replacing each middle third of a side with three sides of a square. The third figure is obtained from the second by replacing each middle third of a side with three sides of a square. What is the area of the third figure? The third figure is not accurately drawn, it is there to help you visualize. Express your answer as a mixed number.



Solutions

Note: There are many acceptable strategies to solving each problem. This sheet shows just one strategy.

1) Drawing it out …

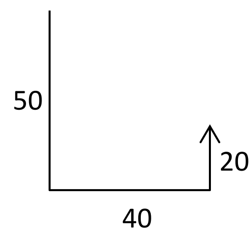
$30^2 + 40^2 = X^2$

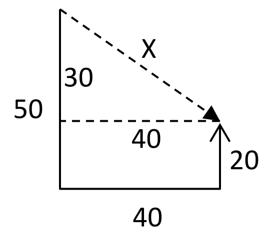
$X = \sqrt{30^2 + 40^2}$

$X = \sqrt{900 + 1600}$

$X = \sqrt{2500}$

$X = 50$





Answer: 50 yards

2) Let x be the height of the ladder along the side of the house:

$x^2 + 10^2 = 26^2$

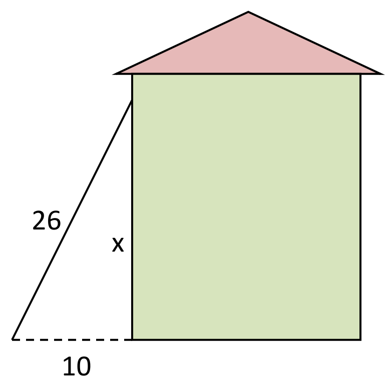
$x^2 = 26^2 - 10^2$

$x = \sqrt{26^2 - 10^2}$

$x = \sqrt{676 - 100}$

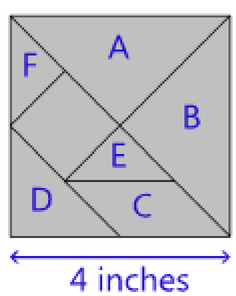
$x = \sqrt{576}$

$x = 24$



Answer: 24 ft.

3) You can start with the area of the large square, and subtract off the areas of all the other little shapes, until you're left with just the area of the small square:



Area of a square = base x height
Area of a triangle = ½ x base x height
Area of a parallelogram = base x height

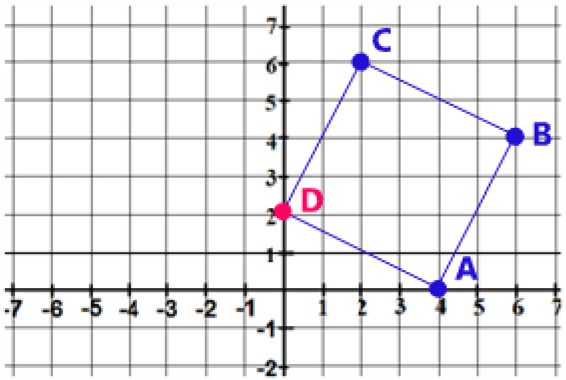
Area of large square	= 4 x 4	= 16
Area of triangle A	= ½ x 4 x 2	= 4
Area of triangle B	= ½ x 4 x 2	= 4
Area of parallelogram C	= 2 x 1	= 2
Area of triangle D	= ½ x 2 x 2	= 2

Area of triangle E	= ½ x 2 x 1	= 1
Area of triangle F	= ½ x 2 x 1	= 1

So, area of small square = 16 – 4 – 4 – 2 – 2 – 1 – 1 = 2

Answer: 2 in^2

4) In any rhombus, the four sides are of equal length. Plotting the three vertices given, you know that the distance between any two adjacent vertices is 2 units in one x-y direction and 4 units in the other x-y direction. So the fourth vertex (D) has to be at (0,2). It's actually a square, which is a special type of rhombus that has right angles at each corner.



Answer: (0,2)

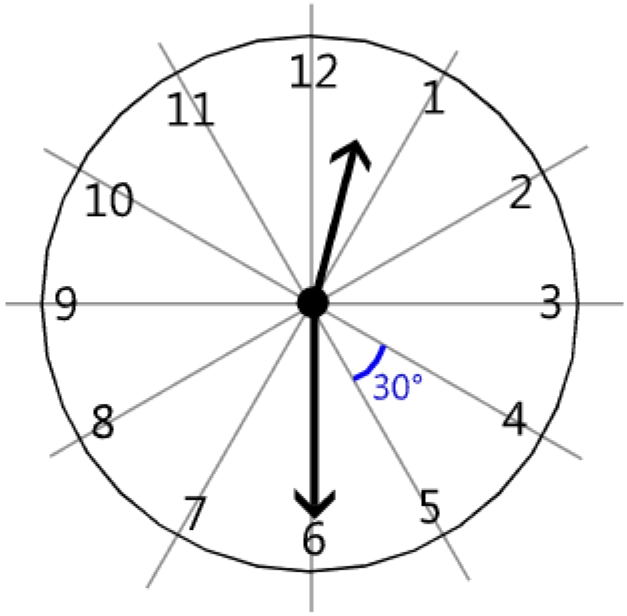
5) Making a chart to show the resulting dimensions after each pair of folds:

Starting	8 in x 8 in
After 1st pair of folds	4 in x 4 in
After 2nd pair of folds	2 in x 2 in
After 3rd pair of folds	1 in x 1 in
After 4th pair of folds	½ in x ½ in
After 5th pair of folds	¼ in x ¼ in

The final square has a perimeter of ¼ + ¼ + ¼ + ¼ = 1 in.

Answer: 1 inch

6) At 12:30pm, the clock looks like this:

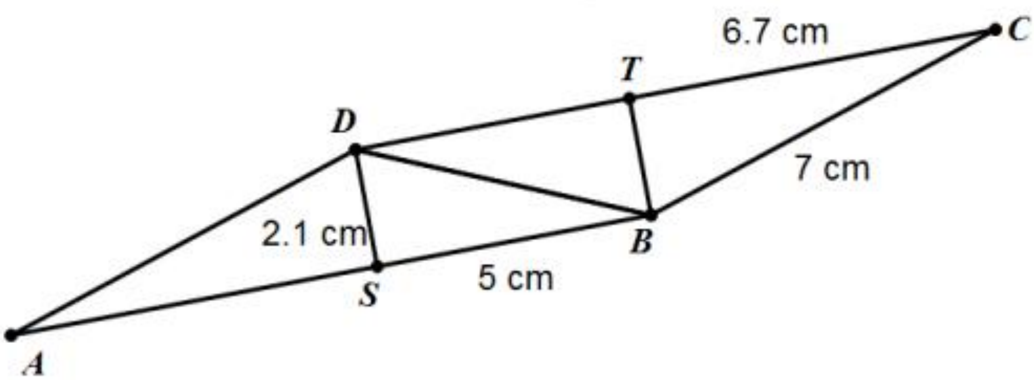


The angle formed between two consecutive numbers on the clock is 30°, because the full circle contains 360°, and there are twelve equal sections.

The angle formed between the hour hand and minute hand comprises 5½ of these 30° sections. So the total angle between the hour hand and minute hand is 5.5 x 30 = 165°

Answer: 165°

7) To find the area of the whole parallelogram, add up the areas of the individual parts:

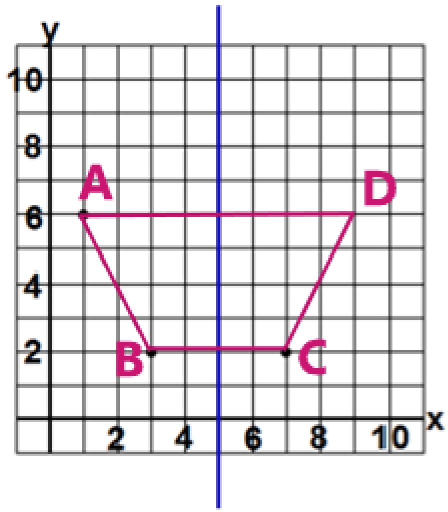


Rectangle DTSB	length x width	5 x 2.1	10.5 cm^2
Triangle TBC	½ x base x height	½ x 6.7 x 2.1	7.035 cm^2
Triangle ADS	(same as ΔTBC)	½ x 6.7 x 2.1	7.035 cm^2
TOTAL			24.57 cm^2

Alternatively, the area of any parallelogram can be found simply by calculating base x height. In this case, the base is 5 + 6.7 = 11.7 cm. The height is 2.1 cm. So the area is 11.7 x 2.1 = 24.57 cm^2.

Answer: 24.6 cm^2

8) By observation, the easiest line of symmetry will be the line at x=5 (shown in blue below).



So, we need to find a point D, such that the trapezoid is symmetrical across the blue line. Since getting from point A to point B requires moving two units horizontally four units vertically, we do the same thing to get from point C to point D. Therefore point D is at (9,6).

Answer: (9,6)

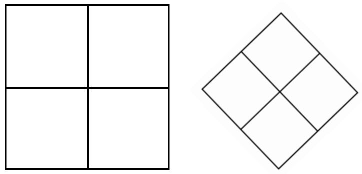
9) Drawing a chart will help reveal the pattern.

Leg 1	Leg 2	Hypotenuse
1	1	$\sqrt{2}$
1	$\sqrt{2}$	$\sqrt{3}$
1	$\sqrt{3}$	$\sqrt{4} = 2$
1	$\sqrt{4}$	$\sqrt{5}$
1	$\sqrt{5}$	$\sqrt{6}$
1	$\sqrt{6}$	$\sqrt{7}$
1	$\sqrt{7}$	$\sqrt{8}$
1	$\sqrt{8}$	$\sqrt{9} = 3$

Answer: 3

10) Possible answers include (5,12,13), (9,12,15), (6,8,10), (10,24,26) or (15,36,39), though the possibilities are infinite.

11) The diagram is the result of combining these two figures:



Each has 4 small squares and 1 large square for a total of 5 squares. 5 + 5 = 10.

Answer: 10 squares

12) The area of the original square is 3 × 3 = 9 square units.

The area of the second figure adds four new smaller squares (one on each side), and each of those smaller squares is 1 × 1 = 1 square unit. So the area of the second figure is 9 + 4 = 13 square units.

The third figure adds a whole bunch of tiny squares, and each of those tiny squares is $\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$ square unit. So, how many of those tiny squares are there? We can just count the number of sides in the second figure to determine this, and there are 20 sides. So the additional area added by the third figure is $20 \times \frac{1}{9} = 2\frac{2}{9}$. So the total area of the third figure is $15\frac{2}{9}$ square units.

Answer: $15\frac{2}{9}$ square units