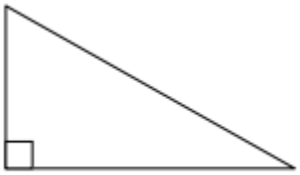
Name: _____ Date: _____ Math 9/10 Honors

Lesson 2.3 – Pythagorean Theorem, Distance & Midpoint Formulas, Shapes and Polygons

I. The Pythagorean Theorem

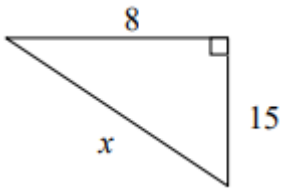
In a right triangle (a triangle with a right angle), the square of the length of the hypotenuse is equal to the sum of the squares of the length of the legs.

$a^2 + b^2 = c^2$ where a and b are the **legs**, and c is the **hypotenuse**.



1. Find the missing sides in the triangles below. Leave answers in simplest radical form.

(a)



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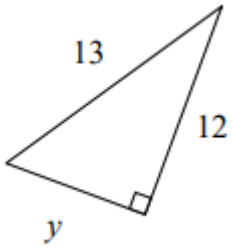
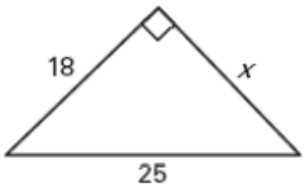


(c)



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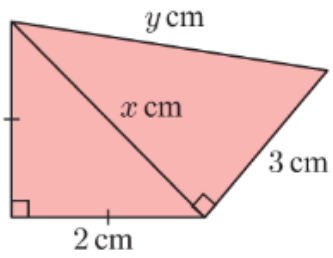

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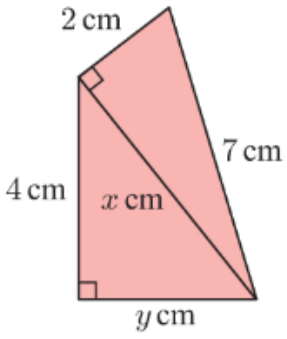

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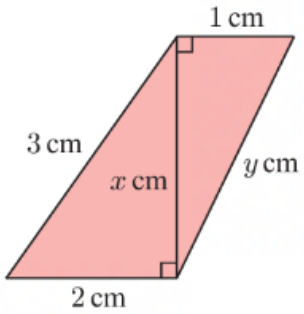

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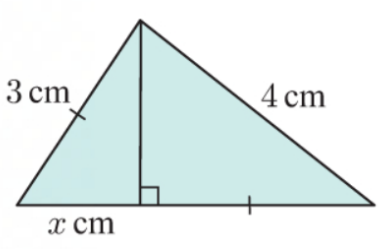
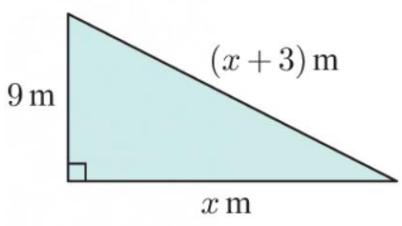


(h)

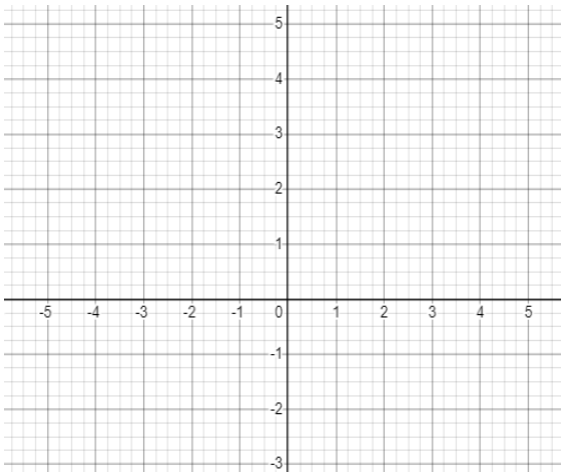


II. The Coordinate Plane, Distance and Midpoint Formulas

2. Recall the Segment Addition Postulate: Given that B is between A and C, find each missing measure.
   (a) $AB = 5.3, BC = \_\_\_\_\ , AC = 6.7$ (b) $AB = 3x, BC = 5x,\ AC = 8$

The year is 1619. René Descartes, a private boarding school student grounded in his dorm room because he sucked at his chores, stared up to the base of the top bunk bed and saw a fly. In his sheer boredom, he draws a grid with some tick marks on the bunk frame, and decides to keep track of the fly's position. This was later called the ***Cartesian (rectangular) plane,*** *and was first published by that name in 1637. It looks like two number lines perpendicular to each other like to the right.*

Points on a Cartesian plane are written (x,y) where x represents the value on the horizontal number line, and y represents the vertical.



3. Consider the points (-3,2) and (1,5).
   a. Plot the points on the grid to the right.
   b. Find the "midpoint" between the points (-3,2) and (1,5).

   c. Find the distance between the points (-3,2) and (1,5).

4. Y is the midpoint of XZ. Given Z(2,8) and Y(-2,2), find the distance of segment XZ and the coordinates of the midpoint Y.

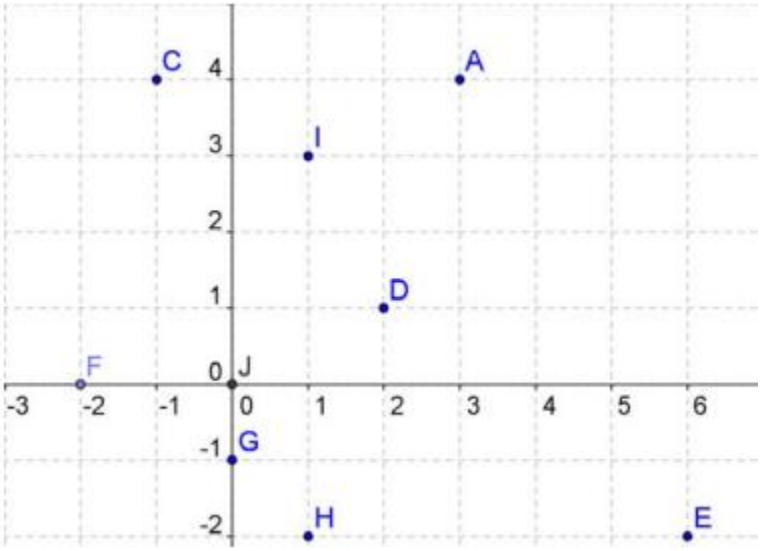
The Midpoint Formula:

(The midpoint is just average of the x values and the average of the y values.)

The Distance Formula:

(Remember: the distance formula comes from the Pythagorean Theorem, using $(x_2 - x_1)$ and $(y_2 - y_1)$.

5. Use the diagram to the right to find the midpoint and distance of the following segments.



(a) CD

(b) FD

(c) HE

(d) AJ

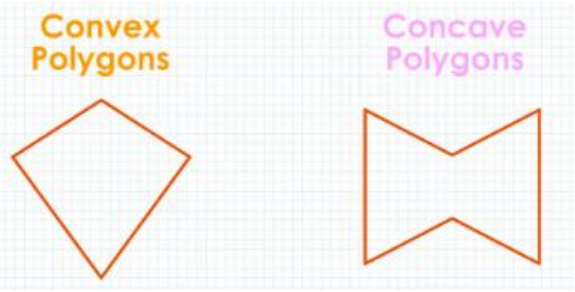
III. Polygons and Shapes

A _____ is a closed figure in a plane made by joining line segments, where each line segment intersects exactly two others. Each endpoint of a side is called a _____ of the polygon.

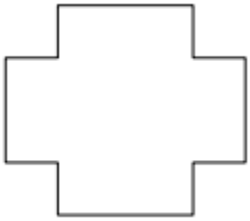
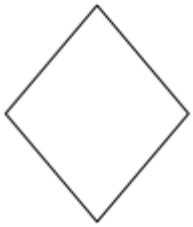
A polygon can be named by all its vertices in consecutive order.

Number of sides	Type of polygon	Number of sides	Type of polygon
3		8	
4		9	
5		10	
6		11	
7		12	

A _____ polygon has every interior angle less than 180º, while a _____ polygons has at least one angle greater than 180º.



The angles of a triangle sum to _____. The angles of a quadrilateral sum to _____. The angles of any polygon sum to _____, where n is the number of sides.

6. Tell whether the figure is a polygon. If it is not, say why. If it is, say whether it is convex or concave.
   (a) 
   (b) 
   (c) 

7. The lengths (in meters) of two sides of a regular heptagon are represented by the expression $11x - 32$ and $6x - 7$. Find the length of a side of the heptagon.

8. The expression $6x + 36.5$ and $13x - 54.5$ represent the lengths (in feet) of two sides of regular pentagon. Find the length of a side of the pentagon.

9. The vertices of a figure are given below. Plot and connect the points so that they form a convex polygon. Classify the figure. Then show that the figure is equilateral using algebra.
   $A(-2,-1),\ B(-1,2),\ C(2,3),\ D(5,2),\ E(4,-1),\ F(1,-2)$