Math 6d: Homework 11
Due: December 16

Prepare for a test on Transformations next class, including Constructions.
Expect questions on Logic and Proof, as well.

## Logic Summary

| $p$ | $q$ | $p \wedge q$ |
|---|---|---|
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | F |

| $p$ | $q$ | $p \vee q$ |
|---|---|---|
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | F |

| $p$ | $q$ | $p \rightarrow q$ |
|---|---|---|
| T | T | T |
| T | F | F |
| F | T | T |
| F | F | T |

| $p$ | $q$ | $p \leftrightarrow q$ |
|---|---|---|
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | T |

**Definition.** Let $p$ and $q$ be two statements.
The statement $q \rightarrow p$ is called the **converse** of the implication $p \rightarrow q$.
The statement $\sim p \rightarrow \sim q$ is called the **inverse** of the implication $p \rightarrow q$.
The statement $\sim q \rightarrow \sim p$ is called the **contrapositive** of the implication $p \rightarrow q$.

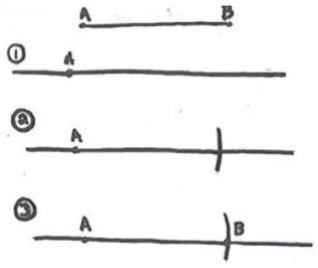
***De Morgan's Laws***

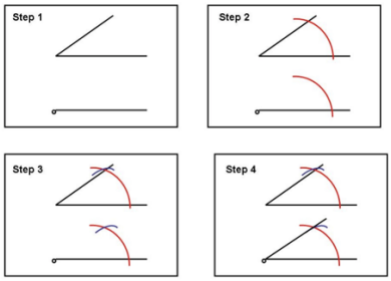
(i) $\sim(p \vee q) \equiv (\sim p) \wedge (\sim q)$
(ii) $\sim(p \wedge q) \equiv (\sim p) \vee (\sim q)$

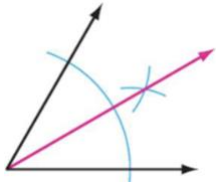
Rules of Inference

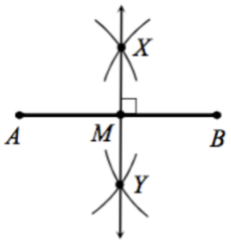
1. Modus Ponens (method of affirming)
   premises: p, $p \rightarrow q$
   conclusion: q
2. Modus Tollens (method of denying)
   premises: $\neg$ q, $p \rightarrow q$
   conclusion: $\neg$ p
3. Hypothetical Syllogism
   premises: $p \rightarrow q$, $q \rightarrow r$
   conclusion: $p \rightarrow r$
4. Disjunctive Syllogism
   premises: $\neg$ p, $p \vee q$
   conclusion: q
5. Addition
   premises: p
   conclusion: $p \vee q$
6. Simplification
   premises: $p \wedge q$
   conclusion: p

Constructions Summary





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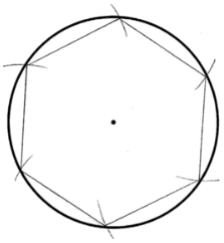
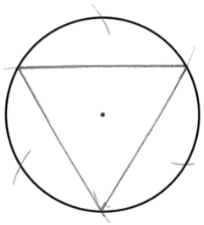
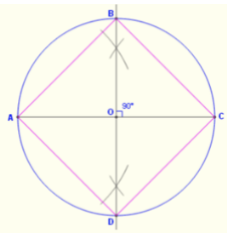




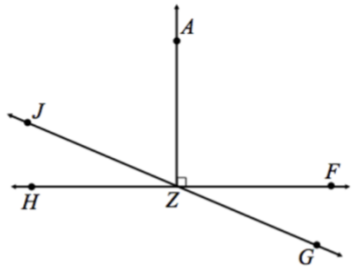
Be prepared to hand in your work.

| | |
|---|---|
| 1. | Divide the following segment $AB$ into four segments of equal length. |

$A$ $B$

2.

Use the following diagram to answer the questions below:




1.

a. Name an angle supplementary to $\angle HZJ$, and provide the reason for your calculation.

b. Name an angle complementary to $\angle HZJ$, and provide the reason for your calculation.

2. If $m\angle HZJ = 38°$, what is the measure of each of the following angles? Provide reasons for your calculations.

a. $m\angle FZG$

b. $m\angle HZG$

c. $m\angle AZJ$

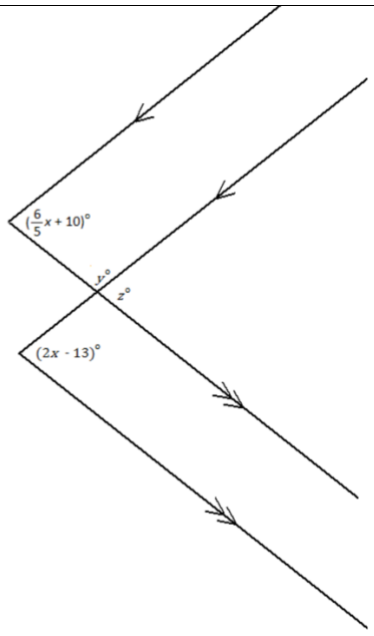
3.

Determine the value of each variable.

$x =$ _____

$y =$ _____

$z =$ _____

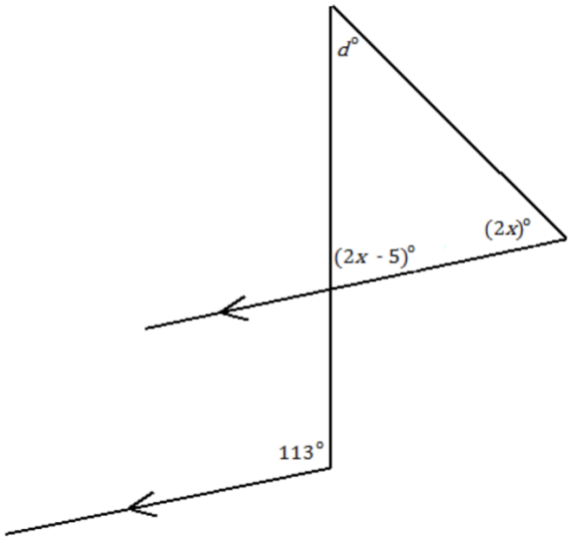


4.

Find the value of $d$ and $x$.

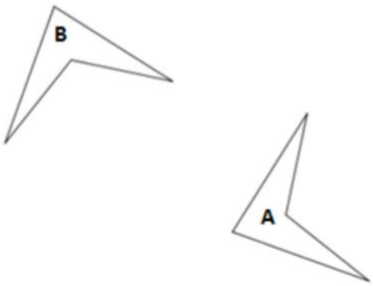
$d =$ _____

$x =$ _____



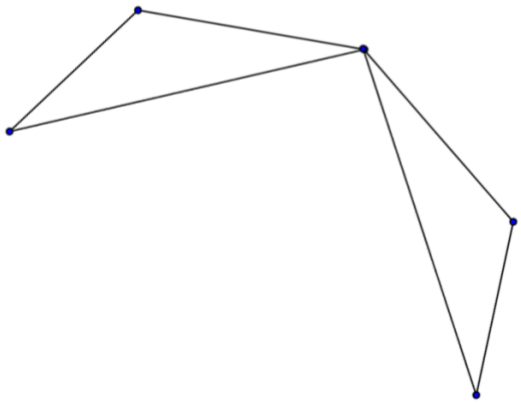

5.

Find the center of rotation and the angle of rotation for the transformation below that carries $A$ onto $B$.

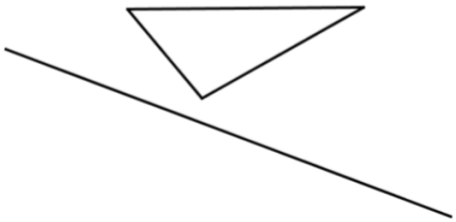


6.

1. Construct the line of reflection for the figures.

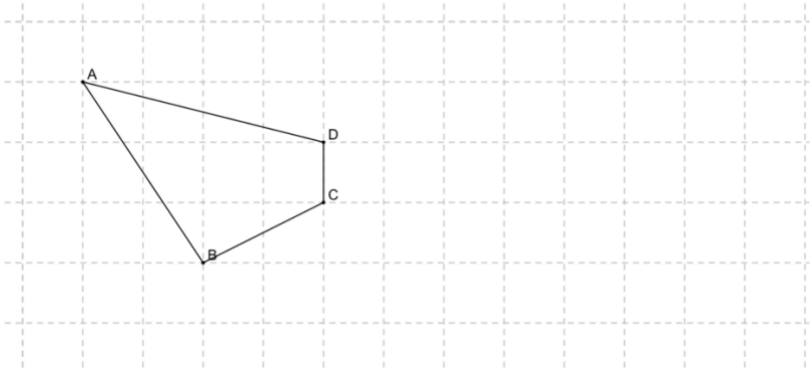


2. Reflect the given pre-image across the line of reflection provided.

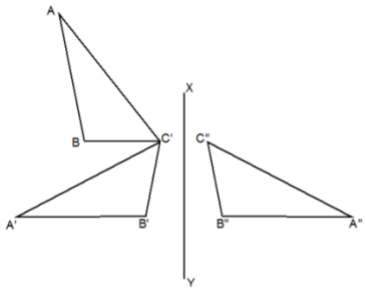


7.

Translate the figure one unit down and three units right. Draw the vector that defines the translation.



**8.** Complete the table based on the series of rigid motions performed on $\triangle ABC$ below.




| | |
|---|---|
| **Sequence of Rigid Motions (2)** | |
| **Composition in Function Notation** | |
| **Sequence of Corresponding Sides** | |
| **Sequence of Corresponding Angles** | |
| **Triangle Congruence Statement** | |

**9.**

a) On graph paper, plot the pre-image, Quadrilateral ABCD:
A(-6,4), B(-5,6), C(-4,4), D(-5,2)

b) Then, reflect the quadrilateral across the line x = -2 creating image A'B'C'D'

c) Then, translate the image A'B'C'D' (x,y) →(x+3, y-5) to create image A''B''C''D''

**10.**

a) On graph paper, plot the pre-image, Pentagon EFGHI:
E(-5,1), F(-3,3), G(-1,3), H(1,1), I(-2,0)

b) Then, reflect the pentagon across the line y = 3 creating image E'F'G'H'I'

c) Then, rotate E'F'G'H'I' 90° counterclockwise about the origin to create image E"F"G"H"I"

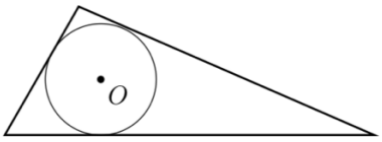
**11.** Given length a, construct a square with side a

**12.** Given length a, construct a regular hexagon with side a

**13.** Given the following points, caluclate the distance in simplest radical form and identify the coordinates of the midpoint:

A (-3, -4)  B (7, -2)

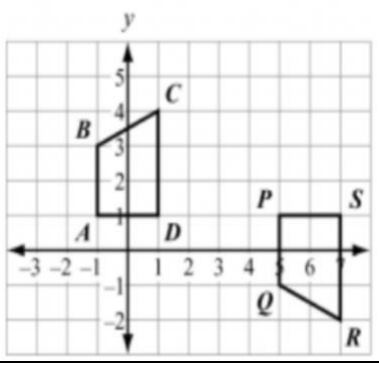
**14.** Given a triangle ABC, construct a circle inscribed in the triangle:

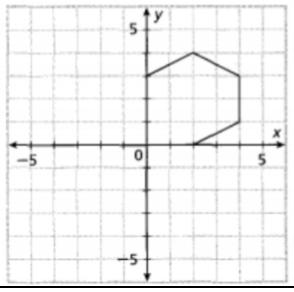
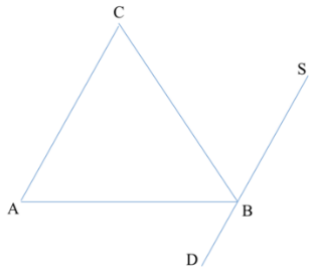



**15.** Find the coordinates of the point that partitions the following segment into a 2:3 ratio

P (7, 1)  Q (-3, -4)

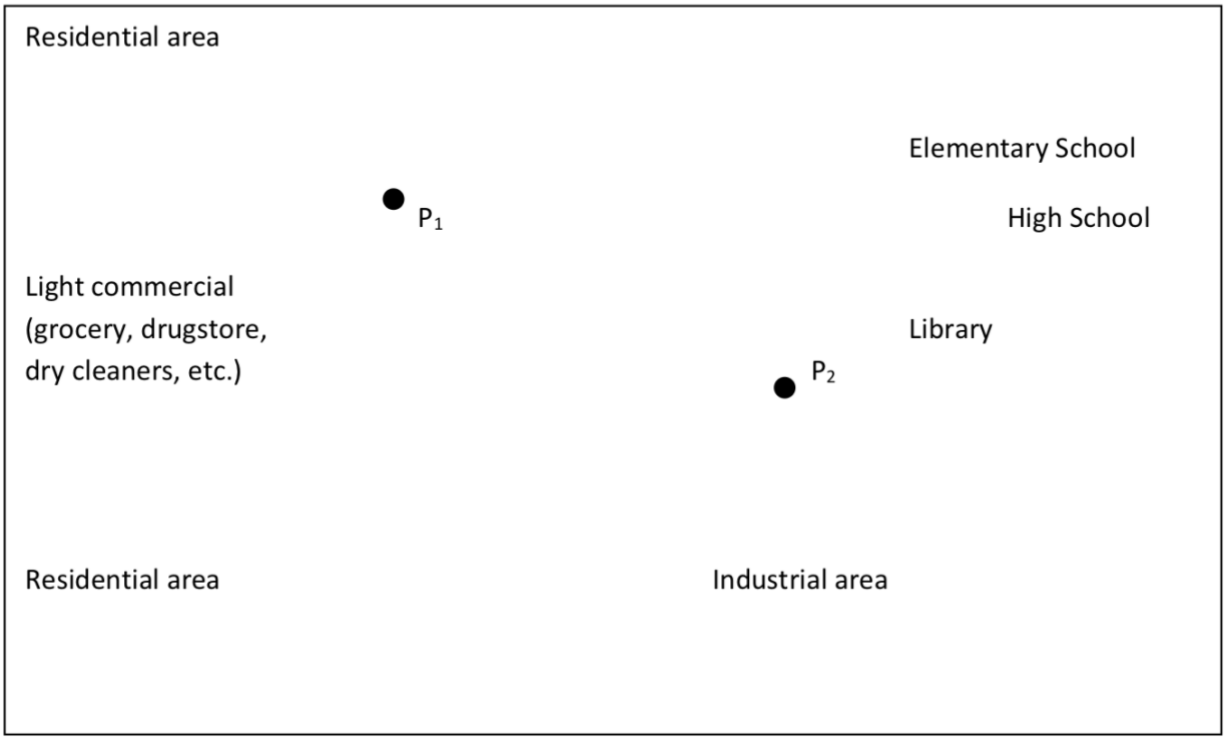
**16.** Specify a sequence of transformations that will map ABCD onto PQRS.



| | |
|---|---|
| 17. | As the first step in designing a logo, you draw the figure shown in the first quadrant of the coordinate plane. Then you reflect the figure across the *x*-axis. You complete the design by reflecting the original figure and its image across the *y*-axis. **Draw the completed design.**<br>  |
| 18. | Intersecting at point B on triangle ABC is drawn line DS, such that DS is parallel to AC. Prove that (or say why the angles will be equal):<br>  <br>(a) ∠ACB = ∠SBC<br>(b) ∠CAB = ∠DBA<br>(c) ∠CAB = ∠SBK<br>(d) If ∠CAB = $40^{O}$ and ∠BCA = $60^{O}$, find angles ∠ABD and ∠SBC |

19. You need a compass and straightedge.

Cedar City boasts two city parks and is in the process of designing a third. The planning committee would like all three parks to be equidistant from one another to better serve the community. A sketch of the city appears below, with the centers of the existing parks labeled as $P_1$ and $P_2$. Identify two possible locations for the third park, and label them as $P_{3a}$ and $P_{3b}$ on the map. Clearly and precisely list the mathematical steps used to determine each of the two potential locations.




20. It is known that

1. If you send me an email, then I will finish my program.
2. If you do not send me an email, then I will go to sleep early.
3. If I go to sleep early, I will wake up refreshed.

• Can you conclude "If I do not finish my program, then I will wake up refreshed"?

Use symbolic logic and the laws of inference to create a proof.