

*Indicators tested on the Semester A Geometry/Honors Geometry Exam*

**2.1 *Expectation: The student will represent and analyze two- and three-dimensional figures using tools and technology when appropriate.***

**Indicators (Note: *Italics* designates an honors level indicator.)**

**2.1.1 The student will analyze properties of geometric figures.**

The student will:

- 2.1.1.a identify and describe the basic undefined terms of geometry.
- 2.1.1.b represent and analyze line/segment/plane relationships including parallel, perpendicular, intersecting, bisecting, midpoint, median, and altitude.
- 2.1.1.c represent and analyze point relationships including collinear and coplanar.
- 2.1.1.d represent and analyze angles and angle relationships including vertical, adjacent, complementary, supplementary, obtuse, acute, right, interior, and exterior.
- 2.1.1.e represent and analyze angle relationships with parallel lines.
- 2.1.1.f represent and analyze polygons including regular, non-regular, composite, equilateral, and equiangular.
- 2.1.1.h represent and analyze circles and spheres including radius, diameter, chord, tangent, secant, central/inscribed angle, inscribed and circumscribed.
- 2.1.1.1 determine the sum of the measures of the interior and exterior angles of a convex polygon.
- 2.1.1.2 determine the measure of each interior angle, each exterior angle and the number of sides, given a regular convex polygon,
- 2.1.1.3 analyze the relationship between the length of the sides of a triangle and the size of the angles.

**2.1.2 The student will identify and/or verify properties of geometric figures using the coordinate plane and concepts from algebra.**

Properties and relationships include:

- 2.1.2.a line/segment relationships including parallel, perpendicular, intersecting, bisecting, midpoint, median, and altitude.
- 2.1.2.b collinear point relationships
- 2.1.2.c angles and angle relationships including obtuse, acute and right.
- 2.1.2.d polygons including regular, non-regular, equilateral, and equiangular.
- 2.1.2.1 the student will apply properties of transformations using coordinate geometry.

**2.1.3 The student will use transformations to move figures create designs, and/or demonstrate geometric properties.**

Properties and relationships include:

- 2.1.3.a reflections, rotations, translations and dilations
- 2.1.3.b the properties and relationships involving congruence, similarity and symmetry

**2.1.4 the student will construct and/or draw and/or validate properties of geometric figures using appropriate tools and technology.**

Properties and relationships include:

- 2.1.4.a line/segment relationships including parallel, perpendicular, intersecting, bisecting, midpoint, median, and altitude.
- 2.1.4.b collinear point relationships
- 2.1.4.c angles and angle relationships including obtuse, acute and right.
- 2.1.4.d polygons including regular, non-regular, equilateral, and equiangular.
- 2.1.4.1 the student will solve problems using constructions.

**2.2. Expectation: The student will apply geometric properties and relationships to solve problems using tools and technology when appropriate.**

**Indicators**

**2.2.1 The student will identify and/or verify congruent and similar figures and/or apply equality or proportionality of their corresponding parts.**

The student will:

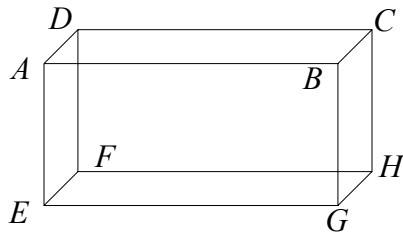
- 2.2.1.a identify and/or verify congruent figures and/or apply equality of their corresponding parts.

**2.2.3 The student will use inductive or deductive reasoning.**

The student will:

- 2.2.3.a define and apply deductive reasoning.
  - 2.2.3.b define and apply inductive reasoning.
  - 2.2.3.c distinguish between inductive and deductive reasoning.
  - 2.2.3.d develop direct proofs using a paragraph, flowchart, or 2-column format.
  - 2.2.3.e develop indirect proofs using a paragraph or 2-column format.
- 
- 2.2.3.1 prove properties of triangles and quadrilaterals using coordinate geometry.
  - 2.2.3.2 construct a logical argument.
  - 2.2.3.3 *determine the validity of a logical argument using truth tables.*
  - 2.2.3.4 solve problems deductively or inductively using the structure of logic.
  - 2.2.3.5 write and interpret conditional statements including the converse, inverse and contrapositive.

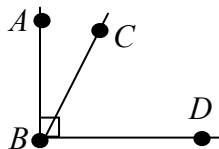
1. How many different lines are determined by two points?  
**A** 0                      **B** 1                      **C** 2                      **D** 3
2. How many different lines are determined by three noncollinear points?  
**A** 0                      **B** 1                      **C** 2                      **D** 3
3. How many different planes are determined by three noncollinear points?  
**A** 0                      **B** 1                      **C** 2                      **D** 3
4. Look at the rectangular prism below:



- a. Name the plane that is parallel to  $BCHG$ .
- b. Name the intersection of planes  $ABGE$  and  $ABCD$ .

In problems 5 –8 below, points  $A$ ,  $B$ , and  $C$  are on a number line, with  $B$  between  $A$  and  $C$ .

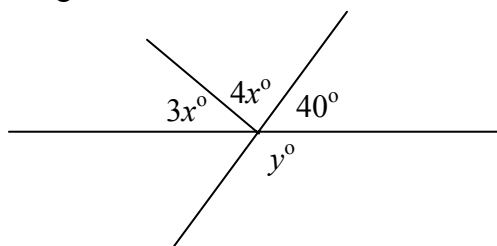
5. If  $AB = 10$  and  $BC = 20$ , then  $AC =$  \_\_\_\_\_
6. If  $AC = 20$  and  $BC = 12$ , then  $AB =$  \_\_\_\_\_
7. If  $AB = x$ ,  $BC = 2x + 30$ , and  $AC = 90$ , then  $x =$  \_\_\_\_\_
8. If  $AB = 2x + 10$ ,  $BC = 5x + 40$ , and  $AC = 9x - 70$ , what is the length of  $\overline{AB}$ ?
9. On a number line, point  $A$  has coordinate 5, and point  $D$  is on the line such that  $AD = 8$ . What are the two possible coordinates of point  $D$ ?
10. In the figure below,  $m\angle ABC = (2x + 20)^\circ$  and  $m\angle CBD = (4x + 40)^\circ$ .



**Figure NOT  
drawn to scale**

- a. What is the value of  $x$ ?
- b. What is the measure of  $\angle ABC$ ?

11. Look at the figure below



**Figure NOT  
drawn to scale**

- Find the values of  $x$  and  $y$ .
12. Point  $P$  is on the perpendicular bisector of  $\overline{AB}$ .  
Which of the following statements is true?
- I.  $AP = BP$
  - II.  $AP = \frac{1}{2} AB$
- A** Neither I or II      **B** I only      **C** II only      **D** Both I and II
13. Point  $P$  is on the angle bisector of  $\angle ABC$ .
- I. Point  $P$  is equidistant from  $\overline{BA}$  and  $\overline{BC}$ .
  - II.  $\angle PBA \cong \angle PBC$
- A** Neither I or II      **B** I only      **C** II only      **D** Both I and II
14. Write a rule in the form  $F(x, y) = (?, ?)$  that describes the given transformations.
- a.  $(x, y)$  is reflected about the  $x$ -axis.
  - b.  $(x, y)$  is reflected about the  $y$ -axis.
  - c.  $(x, y)$  is reflected about the line  $y = x$
  - d.  $(x, y)$  is rotated 180 degrees about the origin.
  - e.  $(x, y)$  is translated five units right and three units down.

15. Look at the conditional below.

*If an animal is a dog, then the animal is warm-blooded.*

- a. Draw an Euler diagram for this conditional.
- b. Write the converse of the conditional.
- c. Write the inverse of the conditional.
- d. Write the contrapositive of the conditional.

16. Which of the following are logically equivalent?

- A A statement and its converse
- B A statement and its inverse
- C A statement and its contrapositive
- D A statement, its converse, its inverse, and its contrapositive

17. Look at the statements below.

*If Chris earns \$10, then he will go to the game.*

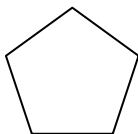
*If Chris goes to the game, then he will bring Jane.*

What is the valid conclusion from the statements above?

18. Look at the following statement.

*If you are 19 years old, then you can vote.*

- a. Draw an Euler diagram for this conditional.
  - b. Use the Euler diagram to evaluate the statement: *If you vote then you are 19 years old.*
19. Write a valid conclusion from the following statements:
- a. If a triangle is equilateral, then it is equiangular.  
Triangle ABC is equilateral
  - b. If Sally studies for a test, then she will pass the test.  
Sally does not pass the test.
20. Look at the regular pentagon below.



Which of the following is NOT a possible measure of the pentagon's rotational symmetry?

- A  $36^\circ$                       B  $72^\circ$                       C  $144^\circ$                       D  $216^\circ$

21. a. Complete the following. The first step in an indirect proof is to assume that what you are trying to prove is \_\_\_\_\_

b. Suppose you wish to prove the following using indirect proof.

*If two parallel lines are cut by a transversal, then the alternate interior angles are congruent.*

Which of the following would be the first statement of the indirect proof?

- A Suppose two parallel lines are cut by a transversal.
- B Suppose alternate interior angles are congruent.
- C Suppose alternate interior angles are not congruent.
- D Suppose two parallel lines are not cut by a transversal.

22. Quadrilateral  $PQRS$  has diagonals  $\overline{PR}$  and  $\overline{QS}$  that intersect at point  $T$ . For the conditions given below, state whether the quadrilateral is a rhombus, rectangle, parallelogram, or none of these figures.

- a.  $\overline{PS} \parallel \overline{QR}, \overline{PS} \cong \overline{QR}, \overline{PQ} \cong \overline{RS}, \overline{PQ} \parallel \overline{RS}$
- b.  $PQRS$  is a parallelogram,  $\overline{PR} \perp \overline{QS}$
- c.  $PQRS$  is a parallelogram,  $\overline{PR} \cong \overline{QS}$
- d.  $\overline{QP} \parallel \overline{RS}$

23. Use mathematics to justify each construction below.

**BCRs**

- a. The perpendicular bisector of a segment
- b. The bisector of an angle
- c. A line parallel to a given line, through a point not on the line

24. Find the sum of the interior angles of a pentagon.

25. Find the measure of each interior angle of a regular 15-sided polygon.

26. Determine the measure of each exterior angle of a regular 9-sided polygon.

27. The measure of each exterior angle of a regular polygon is  $45^\circ$ . How many sides does the polygon have?

28. The measure of each interior angle of a regular polygon is  $120^\circ$ . How many sides does the polygon have?

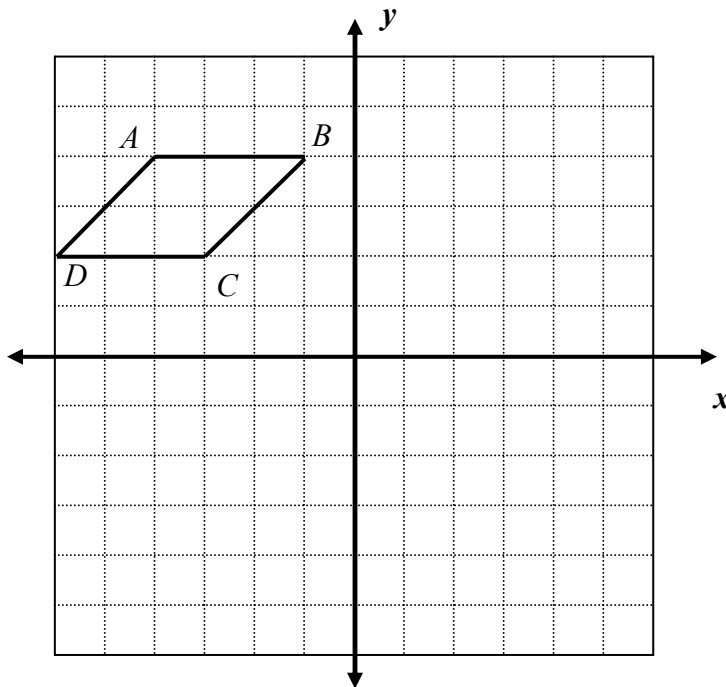
29.

**BCR**

Charlie states that the number of degrees of rotational symmetry for a regular hexagon is always a multiple of  $60^\circ$  ( $0^\circ$ ,  $60^\circ$ ,  $120^\circ$ ,  $180^\circ$ , ...). Is Charlie correct? Use mathematics to justify your answer.

30. Look at the parallelogram on the coordinate plane below.

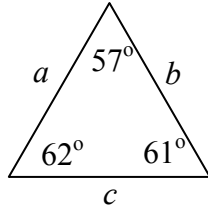
**ECR**



- Reflect  $ABCD$  across the  $y$ -axis. Name the reflected figure  $A'B'C'D'$ .
- Translate  $A'B'C'D'$  four units downward. Name the translated figure  $A''B''C''D''$ .
- Write the coordinates of  $C'$  and  $C''$ .
- If  $P(x, y)$  is on  $ABCD$ , what are the coordinates of the transformed point on  $A''B''C''D''$ ? Explain how you determined your answer. Use words, symbols, or both in your explanation.

31. What is the difference in the measures of an interior angle of a regular pentagon, and an exterior angle of a regular pentagon?

32. Look at the triangle below.



Which of the following statements is true about  $a, b$ , and  $c$ ?

- A.  $a < b < c$     B.  $b < c < a$     C.  $c < a < b$     D.  $a < c < b$

33. Points  $A, B$ , and  $C$  are collinear, with  $B$  the midpoint of  $\overline{AC}$ .

- a. If  $AB = 6$ , then  $AC = \underline{\hspace{2cm}}$   
 b. If  $AB = 3x + 20$  and  $BC = 50$ , then  $x = \underline{\hspace{2cm}}$   
 c. If  $AB = 4x + 20$  and  $BC = 6x - 30$ ,  $x = \underline{\hspace{2cm}}$   
 d. If  $AB = 5x + 30$  and  $AC = 12x + 10$ ,  $x = \underline{\hspace{2cm}}$

34. Find the value of  $x$  and/or  $y$  in each figure below.

a. **Figure NOT drawn to scale**

b. **Figure NOT drawn to scale**

c. **Figure NOT drawn to scale**

d. **Figure NOT drawn to scale**

35. Which of the following terms describes transformations, such as reflections, rotations, and translations, in which the preimage and image are congruent?

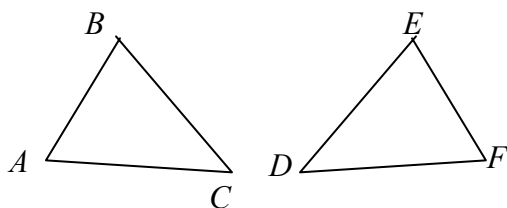
**A** Congruent    **B** Similar    **C** Rigid    **D** Regular

36. Two sides of a triangle measure 6 and 9.

Circle the possible values of the length of the third side.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

37. For each figure below, determine which congruence postulate or theorem can be used to prove the triangles congruent. If the triangles cannot be proven congruent, state that fact.

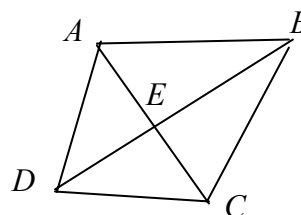


- $\overline{AB} \cong \overline{EF}, \overline{AC} \cong \overline{DF}, \angle A \cong \angle F$
- $\angle A \cong \angle D, \angle B \cong \angle E, \angle C \cong \angle F$
- $\angle A \cong \angle F, \angle B \cong \angle E, \overline{AB} \cong \overline{EF}$
- $\overline{AB} \cong \overline{EF}, \overline{AC} \cong \overline{DF}, \overline{BC} \cong \overline{DE}$
- $\overline{BC} \cong \overline{DE}, \overline{AC} \cong \overline{DF}, \angle B \cong \angle E$
- $\angle C \cong \angle D, \angle A \cong \angle F, \overline{AB} \cong \overline{EF}$

38.

**ECR**

Given:  $\overline{BD}$  is the perpendicular bisector of  $\overline{AC}$ .  
Prove:  $\angle BAC \cong \angle BCA$



39. Polygons  $ABCD$  and  $DEFG$  are congruent. Why is  $\angle C \cong \angle F$ ?
40. What are the undefined terms of geometry?

41. For each group of statements, state whether inductive reasoning or deductive reasoning is used.
- If Mr. Johns was absent on Monday, Tuesday, and Wednesday, I conclude that he will be absent on Thursday.
  - The Cubs have not won a World Series in 96 years. Therefore, they will not win this year.
  - All squares have congruent diagonals. If I construct a square, the diagonals will be congruent.
  - If an animal is a Black bear, it will hibernate in the winter. I spotted a black bear; I concluded that the bear would hibernate this winter.
  - I saw a pattern as follows: Triangle, square, pentagon. I concluded that the next figure in the pattern would be a hexagon.

42. Graph the points  $A(3, 2)$ ,  $B(1, -2)$ ,  $C(2, -5)$ ,  $D(4, -1)$  on the coordinate plane.

**BCR**

- What kind of quadrilateral is  $ABCD$ ? Use mathematics to justify your answer.

43. Points  $A(-3, -1)$ ,  $B(-1, 1)$ , and  $C(1, 1)$  are three vertices of a parallelogram.

- How many parallelograms can be formed using these three points?
- Give the coordinates of the fourth vertex of the other parallelograms.

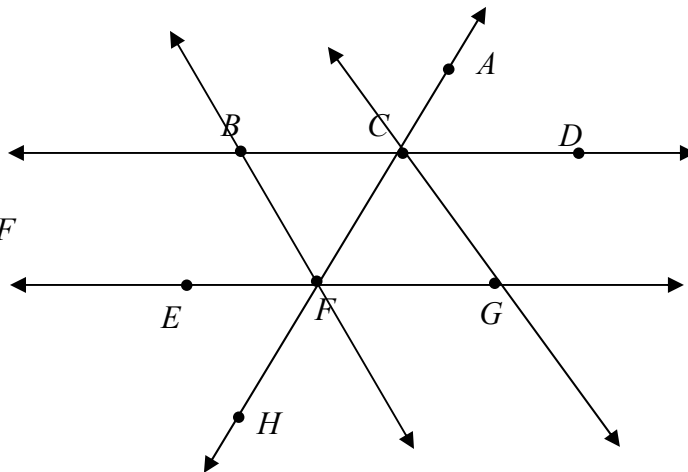
44. A triangle has vertices  $A(-3, 4)$ ,  $B(4, 6)$ ,  $C(-7, 18)$ . Use slopes to determine whether the triangle is a right triangle. Justify your answer using mathematics.

45.

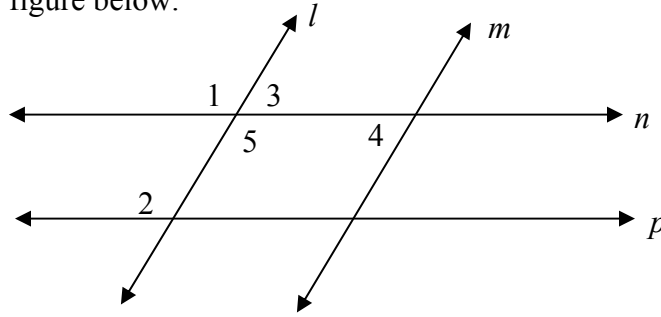
**ECR**

Given:  $\overline{BD} \parallel \overline{EG}$   
 $\overline{BC} \cong \overline{FG}$

Prove:  $\angle CBF \cong \angle CGF$



46. Look at the figure below.



For each of statement below, state which lines can be proven parallel. Justify your answer.

- a.  $\angle 1 \cong \angle 2$
- b.  $\angle 3 \cong \angle 4$
- c.  $\angle 4$  and  $\angle 5$  are supplementary .

47. Place an X in the boxes where the property holds true.

| Property                                     | Parallelogram | Rectangle | Square | Rhombus | Trapezoid |
|--|---------------|-----------|--------|---------|-----------|
| 1. Opposite sides congruent                  |               |           |        |         |           |
| 2. One pair of opposite sides parallel       |               |           |        |         |           |
| 3. Opposite angles congruent                 |               |           |        |         |           |
| 4. Each diagonal forms 2 congruent triangles |               |           |        |         |           |
| 5. Diagonals bisect each other               |               |           |        |         |           |
| 6. Diagonals congruent                       |               |           |        |         |           |
| 7. Diagonals perpendicular                   |               |           |        |         |           |
| 8. A diagonal bisects two angles             |               |           |        |         |           |
| 9. All angles are right angles               |               |           |        |         |           |
| 10. All sides are congruent                  |               |           |        |         |           |

**Honors only:**

48. Complete the following truth table.

| $P$ | $Q$ | $\sim P$ | $P \rightarrow Q$ | $P \wedge Q$ | $P \vee Q$ |
|-----|-----|----------|-------------------|--------------|------------|
| T   | T   |          |                   |              |            |
| T   | F   |          |                   |              |            |
| F   | T   |          |                   |              |            |
| F   | F   |          |                   |              |            |

49. Complete the following truth table:

| P | Q |  |  |  | $[(P \wedge \sim Q) \vee Q] \rightarrow P$ |
|---|---|--|--|--|--|
| T | T |  |  |  |  |
| T | F |  |  |  |  |
| F | T |  |  |  |  |
| F | F |  |  |  |  |

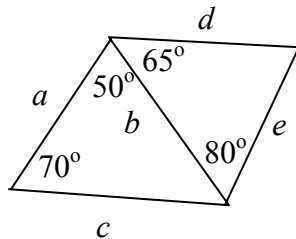
50. Write the function in the form  $F(x, y) = (?, ?)$  for the set of points  $(x, y)$  that are a translation of six units left, then reflected across the  $y$ -axis.

51. How is a truth table used to determine whether two statements are logically equivalent?

52. Which of the following is true about an Euler path?

- A** It has no fewer than 2 odd vertices
- B** It has exactly 2 odd vertices.
- C** It has no more than 2 odd vertices.
- D** It can have any number of odd vertices.

53. Look at the figure below.



**Figure NOT drawn to scale**

Name the sides in order from least to greatest.

54. Let

$p$ : Chris earns \$20

$q$ : Chris buys gas

$r$ : Chris drives to Rockville

Assume the following premises:

$$p \rightarrow q$$

$$q \rightarrow r$$

For each premise below, write the conclusion(s) in words, *if any*, which follows.

a.  $p$

b.  $q$

c.  $\sim p$

d.  $\sim q$

e.  $r$