Mathematics II Resources for EOC Remediation

G-CO Congruence Cluster:

G-CO.A.3

G-CO.A.5

G-CO.C.10

G-CO.C.11

The information in this document is intended to demonstrate the depth and rigor of the Nevada Academic Content Standards. The items are **not** to be interpreted as indicative of items on the EOC exam. These are a collection of standard-based items for students and **only** include those standards selected for the Math II EOC examination.

Initial Draft: Dec. 2016

G-CO.A.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

1. Given an equilateral triangle, a square and a regular hexagon, which of the following will carry each of the figures onto themselves?

1. a rotation of 90° about its center.
2. a rotation of 180° about its center.
3. a rotation of 120° about its center.
4. a reflection across a line of symmetry.
5. a reflection across any diagonal

Select the four statements that are true.

A. All the transformations will carry all three figures onto themselves.

B. 2 and 3 will carry two of the shapes onto itself.

C. 4 will carry all three shapes onto themselves.

D. All 5 transformations will carry one shape onto itself.

E. 5 will carry two shapes onto themselves.

F. 1 and 5 will carry one shape onto itself.

Answer: B, C, E, F

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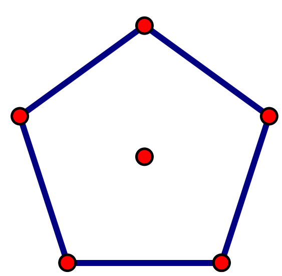
2. A regular pentagon is shown in the diagram below.



If the pentagon is rotated clockwise around its center, find the minimum number of degrees it must be rotated to carry the pentagon onto itself.

A. 54° B. 72° C. 108° D. 360°

Answer: B

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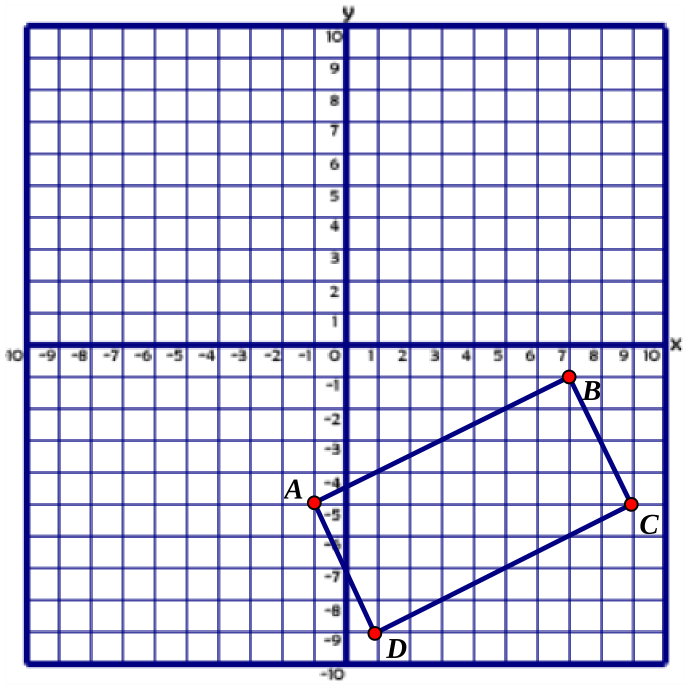
3. Given rectangle *ABCD*, determine the equations that represent its two lines of symmetry.



Answer: $y = \frac{1}{2}x - 7$, $y = -2x + 3$

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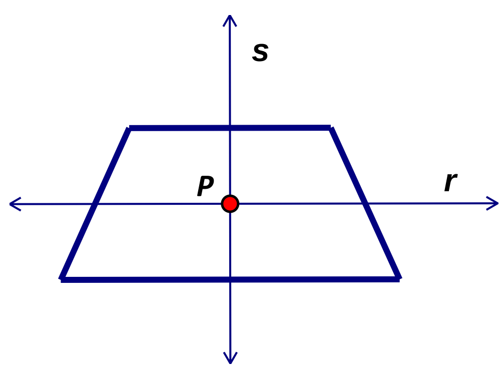
4. The figure shows two perpendicular lines *s* and *r* intersecting at point *P* in the interior of an isosceles trapezoid. Line *r* is parallel to the bases and bisects both legs of the trapezoid. Line *s* bisects both bases of the trapezoid.

Which transformation will always carry the figure onto itself?



A. a reflection across line *r*

B. a reflection across line *s*

C. a rotation of 90° clockwise about point *P*

D. a rotation of 180° clockwise about point *P*

Answer: B

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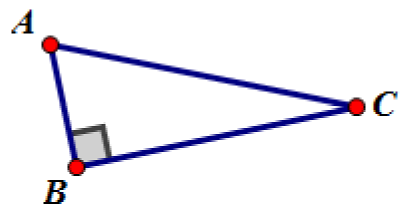
5. A quadrilateral is formed through two reflections. The first reflection takes ΔABC over $\overleftrightarrow{BC}$ to create the image Δ*A'BC*. The second reflection takes the double Δ*ACA'* over $\overleftrightarrow{AA'}$. The quadrilateral *ACA'C'* is formed. How many lines of reflection does this quadrilateral have?



A. 0   B. 1   C. 2   D. 4

Answer: C

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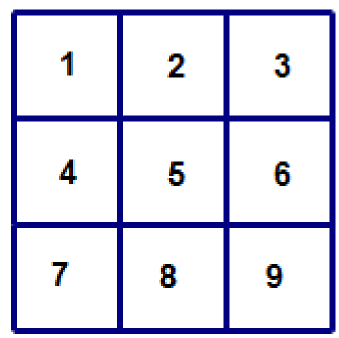
6. A square has 9 smaller congruent squares inside it. Which of the following shadings would produce exactly 2 lines of symmetry in the larger square?



A. Shade 1, 3, 7 and 9   B. Shade 4, 6, 7 and 9

C. Shade 2, 5, 7 and 9   D. Shade 1, 2, 3, 7, 8 and 9

Answer: D

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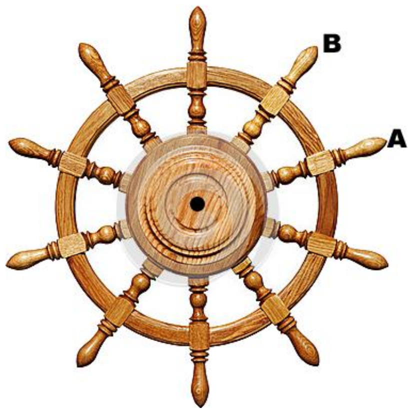
7. A regular polygon has rotational symmetry with angle of 24°, how many side could this figure have?

A. 24   B. 20   C. 15   D. 12

Answer: C

G-CO Congruence Cluster

8. Answer the following questions using this ship's steering wheel, the helm.



Part 1: What is the smallest degree of rotation so that a handle **A** will map onto the next handle **B**?

A. 24° B. 30° C. 36° D. 45°

Part 2: What is the order of rotational symmetry for the helm?

A. 12 B. 10 C. 8 D. 6

Part 3: How many lines of symmetry does this helm have?

A. 5 B. 8 C. 10 D. 12

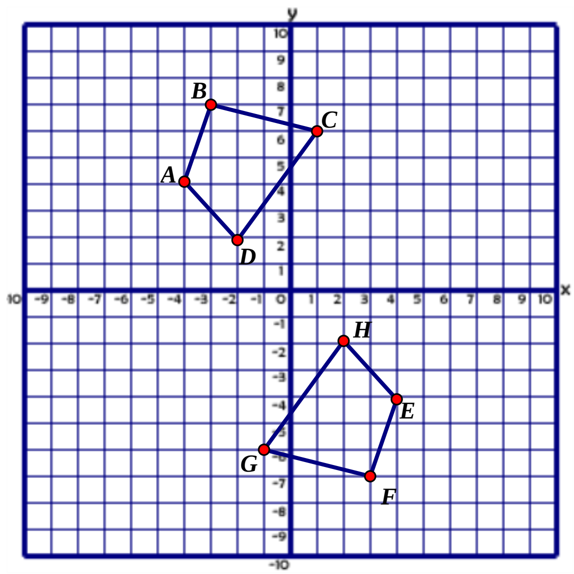
Answer: Part 1: C

Part 2: B

Part 3: C

G-CO.A.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

1. Congruent quadrilaterals *ABCD* and *EFGH* are shown in the coordinate plane.



PART A:
Which could be the transformation or sequence of transformations that maps quadrilateral *ABCD* to quadrilateral *EFGH*?

Select the two statements that apply.

A. a translation of 3 units to the right, followed by a reflection across the *x*-axis.

B. a rotation of 180° about the origin

C. a translation of 12 units downward, followed by a reflection across the *y*-axis.

D. a reflection across the *y*-axis, followed by a reflection across the *x*-axis.

E. a reflection across the line with equation $y = x$

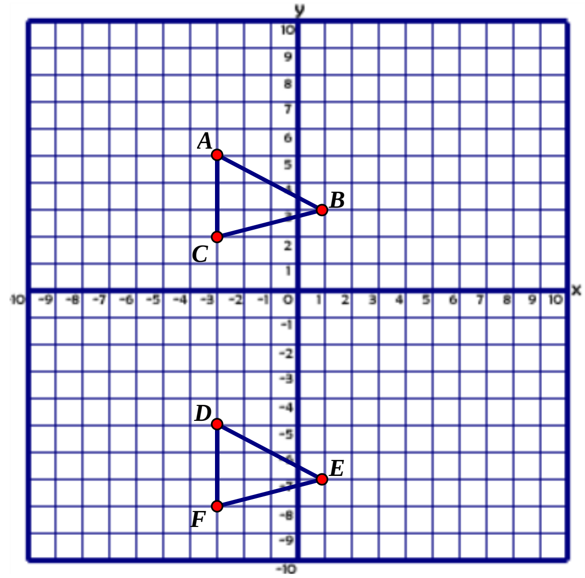
PART B:

Quadrilateral *ABCD* will be reflected across the *x*-axis and then rotated 90° clockwise about the origin to create quadrilateral *A'B'C'D'*. What will be the *y*-coordinate of *B'*?

Answer: Part A: B, D

Part B: 3, B(-7, 3)

2. Congruent triangles *ABC* and *DEF* are shown in the coordinate plane.



Which could be the transformation or sequence of transformations that map triangle *ABC* onto triangle *DEF*?

Select the two statements that apply.

A. a translation 10 units down.

B. a reflection across *y* = 2 followed by a reflection across *y* = -3.

C. a reflection across *y* = -5 and followed by a reflection across the *x*-axis.

D. a reflection across the *x*-axis.

E. a rotation of 180° about the origin followed by a reflection across the *y*-axis.

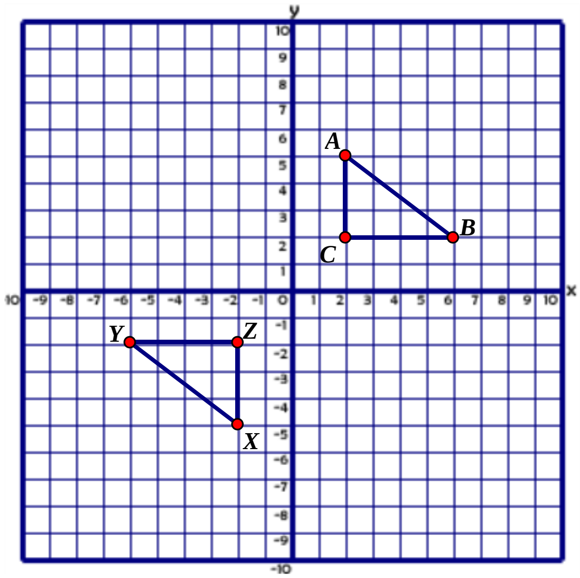
F. a reflection across *y* = 2.5 followed by a reflection across *y* = 0 followed by a reflection across *y* = - 2.

Answer: A & B

G-CO Congruence Cluster

3. In the diagram to the right, $\triangle ABC$ and $\triangle XYZ$ are graphed.

Use the properties of rigid motions to explain why $\triangle ABC \cong \triangle XYZ$. Provide three different ways to transform triangle *ABC* onto triangle *XYZ* through a single or series of transformations.



Answer: 1. 180° clockwise rotation about the origin

2. 180° counterclockwise rotation about the origin

3. Reflect over $y = x$, and then reflect over the $y = -x$

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4. $\triangle ABC$ located at *A*(-1,3), *B*(2,1) and *C*(1,5) is mapped onto $\triangle DEF$, *D*(1,-3), *E*(-2,-1) and *F*(-1,-5).

A. Provide a single transformation that could have done this.

B. Provide a double transformation that could have done this.

C. What can you conclude about $\triangle ABC$ and $\triangle DEF$? Explain.

Answer: A. $R_{Origin,180^\circ}$

B. reflection across the *y*-axis and across the *x*-axis

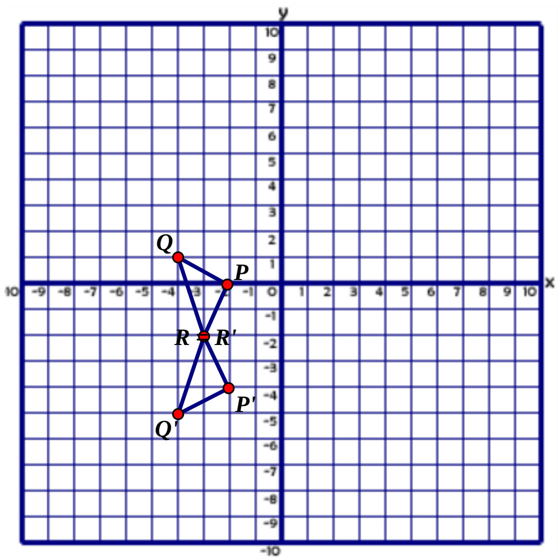
C. The triangles are congruent because they have isometric mappings.

G-CO Congruence Cluster

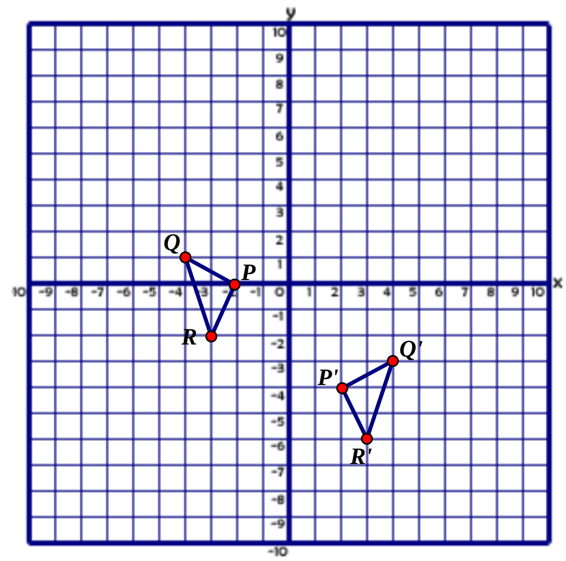
5. On a coordinate grid, triangle *PQR* is translated 4 units up and then reflected over the *y*-axis to form triangle *P'Q'R'*.

Which diagram could show triangle *PQR*, and the location of triangle *P'Q'R'* after the transformations?

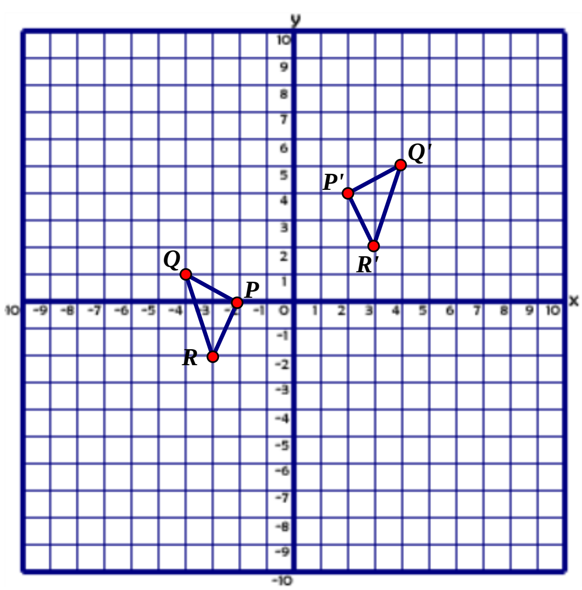
A.



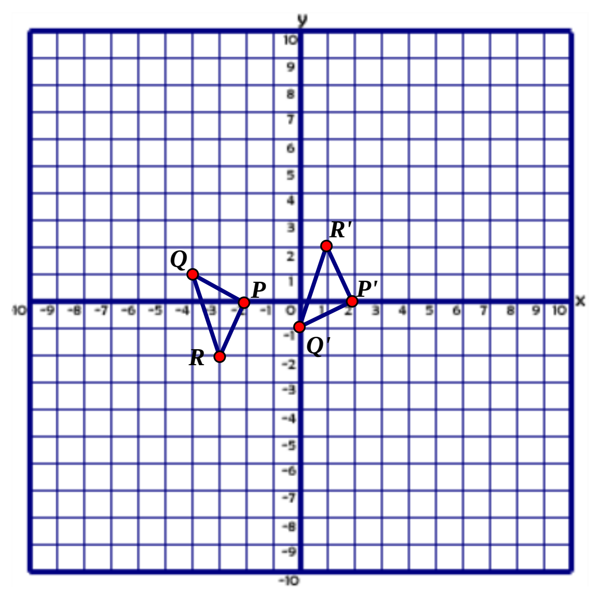
B.



C.



D.

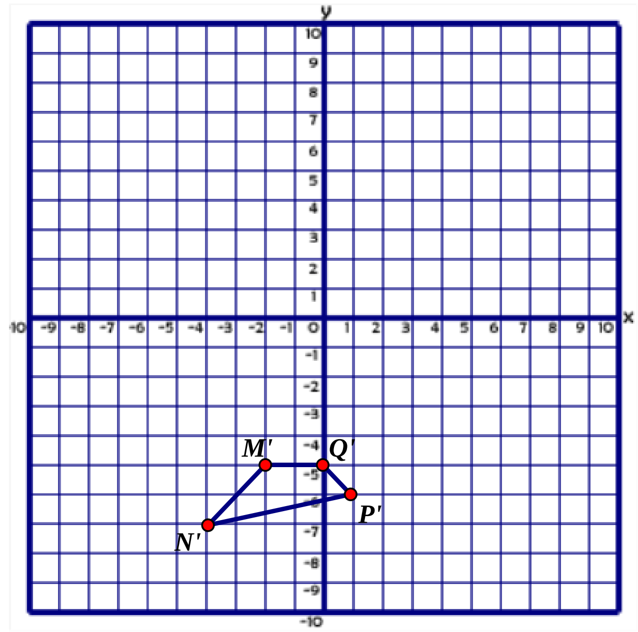


Answer: C

6. Nancy drew a quadrilateral on a coordinate grid.

Nancy reflected the quadrilateral over the line *y* = -2 and then translated it left 4 units and obtained quadrilateral *M'N'P'Q'*.

What are the coordinates of *M*?



Answer: *M*(2,1); the *y*-coordinate is 1

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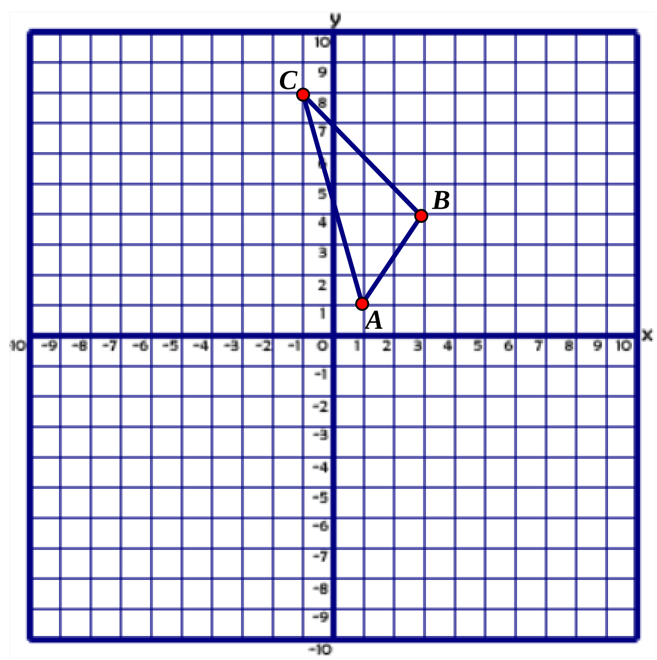
7. Triangle *ABC* is graphed in the *xy*-coordinate plane with vertices *A*(1,1), *B*(3,4), and *C*(-1,8) as shown in the figure.



PART A
Δ*ABC* will be reflected across the line *y* = 1 to form Δ*A'B'C'*.

Which quadrant will NOT contain any vertex of Δ*A'B'C'*?

A. First   B. Second
C. Third   D. Fourth

PART B
What is the *y*-coordinate of *B'*?

Answer: Part A: B

Part B: *B'*(3,-2)

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8. Given a triangle with vertices *A*(1,6), *B* (3,4), *C*(3,7) reflect it across the line *y* = *x* followed by a reflection over the *x*-axis.

PART A:

What are the coordinates of the final image, $\Delta A'B'C'$?

PART B:

What other transformations can be applied to get the pre-image onto the image?

A. a 90° clockwise rotation about point *A*, followed by a translation $\langle 5, -7 \rangle$.

B. a clockwise rotation of 180° about the origin, followed by a reflection across the *y*-axis.

C. a reflection across the *x*-axis, followed by a reflection across *x* = 4.

D. a 90° counterclockwise rotation about the origin, followed by a reflection across *y* = *x*.

PART C:

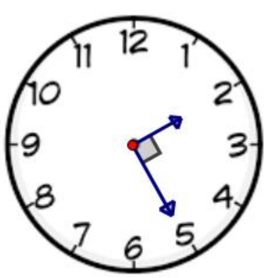
Is there a single transformation that can be applied to get the pre-image to the image? If so, what is the transformation?

Answer: Part A: *A'*(6,-1) *B'*(4,-3) *C*('7,-3)

Part B: A

Part C: yes, rotate 90° clockwise

9. What number does the hour hand (the short arm) point to when it is rotated 150° clockwise?

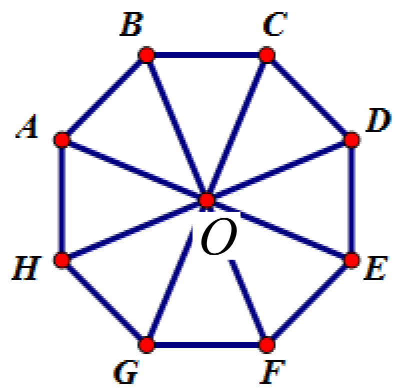


A. 6 B. 7 C. 8 D. 9

Answer: B

G-CO Congruence Cluster

10. Given regular octagon *ABCDEFGH*, answer the following.



Part A: What is the image of B, when reflected across $\overline{CG}$?

A. Point *D* B. Point *E* C. Point *F* D. Point *G*

Part B: What is the pre-image of G after a reflection across $\overline{AE}$?

A. Point *B* B. Point *C* C. Point *D* D. Point *E*

Part C: What is the image of E, when rotated 135° about point *O* clockwise?

A. Point *H* B. Point *G* C. Point *B* D. Point *A*

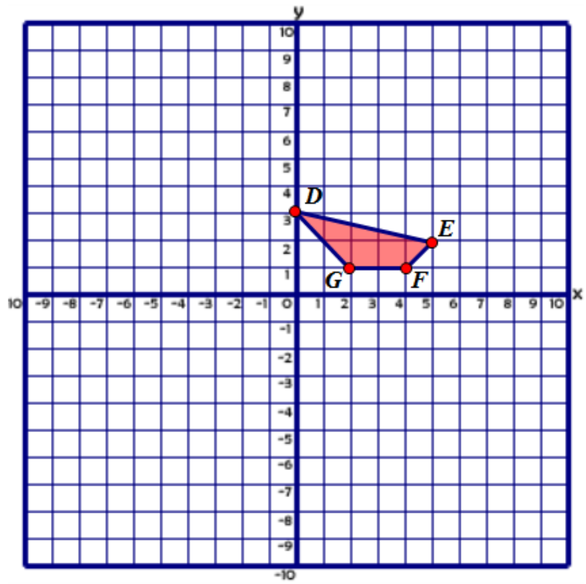
Answer: Part A: A

Part B: B

Part C: C

11. Rickie drew a quadrilateral on a coordinate grid.

Rickie reflected the quadrilateral over the line *y* = -2 and then translated it 4 units to the left. What are the coordinates of the image of point *G′*?



A. (-6,1)

B. (-2,-5)

C. (-2,1)

D. (2,-5)

Answer: B

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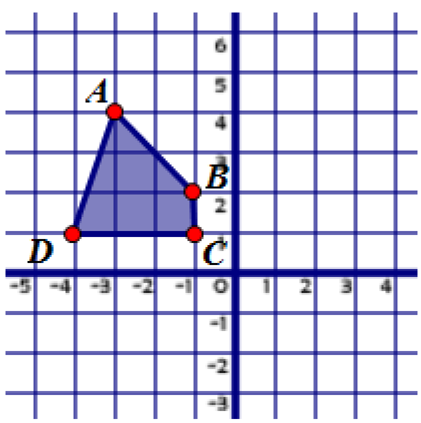
12. Figure *ABCD* is shown below on the coordinate plane.



Which two of the following transformations will produce an image with a vertex at (-3,-4)?

A. Translate figure *ABCD* 2 units to the left and 4 units down.

B. Translate figure *ABCD* 1 units to the right and 6 units down.

C. Reflect figure *ABCD* across the *x*-axis.

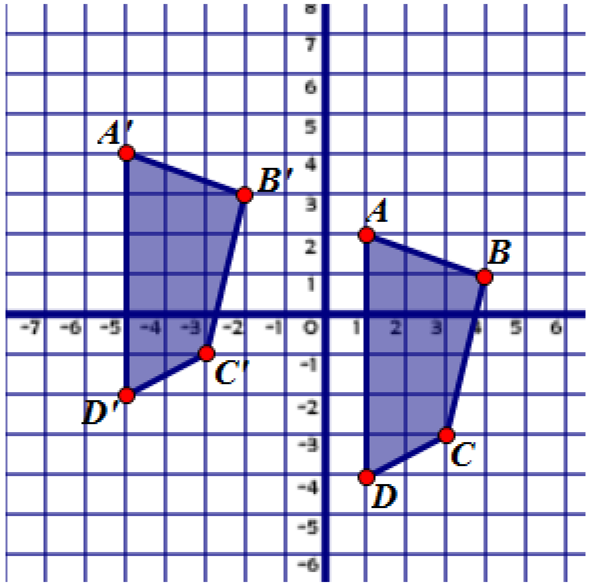
D. Reflect figure *ABCD* across the *y*-axis.

E. Translate figure ABCD 6 units to the right and rotate 180° about the origin.

Answer: C, E

G-CO Congruence Cluster

13. What is the coordinate rule that describes the translation *ABCD* → *A'B'C'D'*?



A. $(x,y) \rightarrow (x - 6, y + 2)$

B. $(x,y) \rightarrow (x - 2, y + 6)$

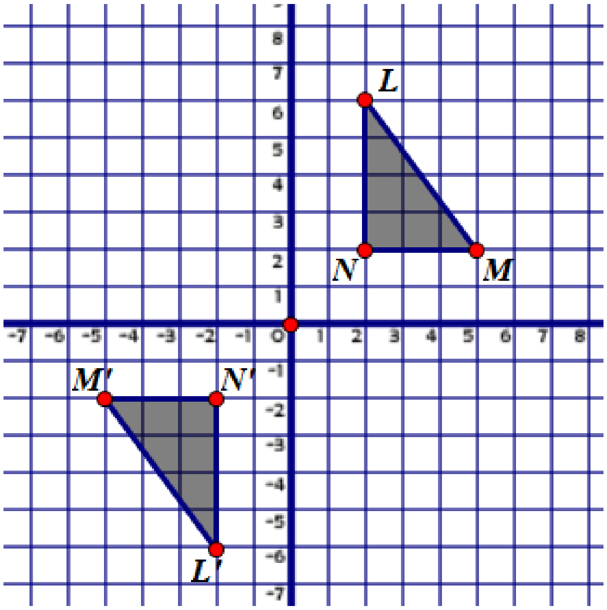
C. $(x,y) \rightarrow (x + 2, y - 6)$

D. $(x,y) \rightarrow (x + 6, y - 2)$

Answer: A

G-CO Congruence Cluster

14. As shown on the graph below, $\Delta L'M'N'$ is the image of ΔLMN under a single transformation.



Which transformation does this graph represent?

A. Line Reflection

B. Glide Reflection

C. Rotation

D. Translation

Answer: C

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15. The point A (5,8) is reflected about the line $x = 2$, then about the line $x = k$. The final image is A'' (3,8). What is the value of k?

A. $k = -1$ B. $k = 1$ C. $k = 2$ D. $k = 4$

Answer: B

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16. A positive angle of rotation turns a figure

A. Clockwise B. Counter-Clockwise

Answer: B

G-CO Congruence Cluster

17. You ride an elevator from the ground floor to the 12th floor. What type of transformation is this?

A. Rotation B. Translation C. Dilation D. Reflection

Answer: B

18. Given ΔQRS where *Q*(-5,3), *R*(-1,4) and *S*(-2,7).

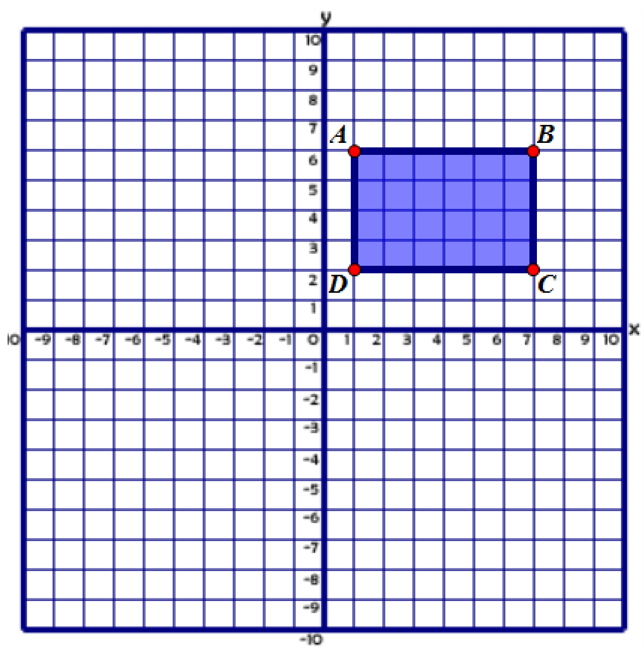
Part A: Determine *Q"*, *R"* and *S"* after a reflection over the *y*-axis followed by the *x*-axis.

Part B: Describe this resultant motion as a rotation, be specific.

Answer: Part A: *Q"*(5,-3), *R"*(1,-4), *S*(2,-7)

Part B: A rotation of 180° about the origin

19. Hailey drew rectangle *ABCD* on the grid below



Part A: What line(s) would map the rectangle onto itself? Provide their equations.

Part B: She moves the rectangle by using the translation $T(x,y) \rightarrow (x-5, y-7)$ and then follows that motion with a reflection over the *x*-axis. What are the coordinates of the final location?

A(____ , ____) *B*(____ , ____)

C(____ , ____) *D*(____ , ____)

Answer: Part A: *x* = 4, *y* = 4

Part B: *A''*(-4,1), *B''*(2,1), *C''*(2,5), *D''*(-4,5)

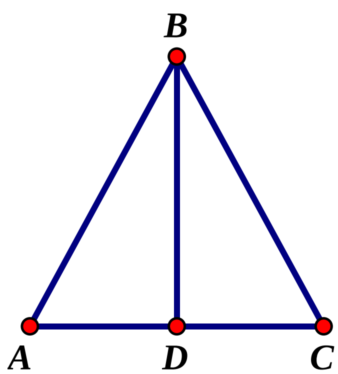
G-CO Congruence Cluster

G-CO.C.10 Prove theorems about triangles. ***Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining the midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.***

1. Given:
D is the midpoint of $\overline{AC}$ and
$\angle ADB \cong \angle CDB$

Statements 1, 2, 3 and 4 are given with reasons.

Prove: ΔABC is an isosceles triangle



STATEMENTS	REASONS
1. *D* is the midpoint of $\overline{AC}$	1. Given
2. $\overline{AD} \cong \overline{CD}$	2. Definition of Midpoint
3. $\angle ADB \cong \angle CDB$	3. Given
4. $\overline{BD} \cong \overline{BD}$	4. Reflexive Property
5.	5.
6.	6.
7.	7.
8.	8.

Complete the proof by providing the statements and reasons for steps 5, 6, 7 and 8.

Answer:

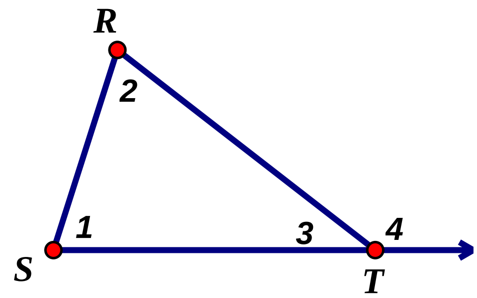
5. $\Delta ADB \cong \Delta CDB$	5. SAS
6. $\overline{AB} \cong \overline{BC}$	6. CPCTC
7. AB = BC	7. Definition of Congruence
8. ΔABC is an isosceles	8. Definition of Isosceles Δ

G-CO Congruence Cluster

2. Complete the proof by providing the missing statement and reasons.

Given: ΔRST

Prove: $m\angle 4 = m\angle 1 + m\angle 2$



STATEMENTS	REASONS
1. ΔRST	1. Given
2.	2. Triangle Sum Theorem
3. $\angle 3$ and $\angle 4$ are supplementary	3. Linear Pair Theorem
4. $m\angle 3 + m\angle 4 = 180$	4.
5. $m\angle 3 + m\angle 4 = m\angle 1 + m\angle 2 + m\angle 3$	5. Substitution Property
6. $m\angle 4 = m\angle 1 + m\angle 2$	6.

Answer:

2. $m\angle 1 + m\angle 2 + m\angle 3 = 180$	2.
4.	4. Definition of Supplementary
6.	6. Addition/Subtraction Prop.

3. How many different isosceles triangles can you find that have sides that are whole-number lengths and that had a perimeter of 18?

Answer:

Triangles with sides of lengths 5, 5, 8; 6, 6, 6; 7, 7, 4; and 8, 8, 2 can be created.

So it would be 4 triangles.

G-CO Congruence Cluster

4. Given *A* is the vertex of an isosceles triangle. The measure of $\angle B$ is twice the measure in centimeters of $\overline{BC}$. The measure of $\angle C$ is three times the measure in centimeters of $\overline{AB}$.

$m\angle B = (x+6)^\circ$, $m\angle C = (2x-54)^\circ$. Find the perimeter of Δ*ABC.*

Answer:

$x + 6 = 2x - 54$
$x = 60$
$m\angle B = m\angle C = 66^\circ$
Therefore, *AB* = *AC* = 22 and *BC* = 33, so the perimeter is 77.

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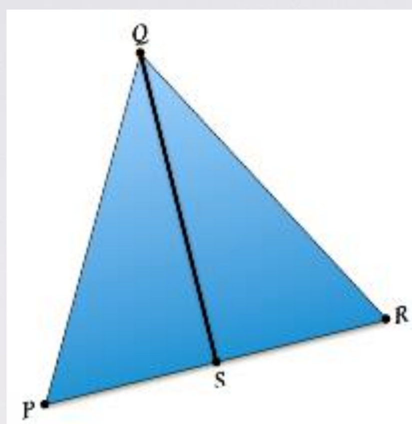
5. Ming and Juan submitted the following to prove that the base angles of an isosceles triangle are congruent.



We drew isosceles $\triangle PQR$ with $\overline{PQ} \cong \overline{RQ}$. We constructed the midpoint of $\overline{PR}$ and labeled it *S.* Then we constructed the perpendicular bisector of $\overline{PR}$, $\overline{SQ}$. Then $\Delta PQS \cong \Delta RQS$ and $\angle QPS \cong \angle QRS$ by CPCTC.

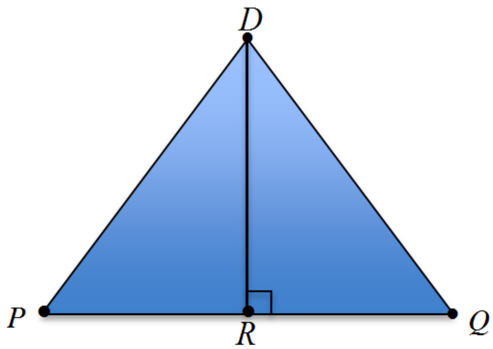
$m_{RQ} = \frac{4}{3}$

Several students in your class have questions about this solution. How would you answer their questions and help them understand this solution?
How do we know that line *QS* is the perpendicular bisector of segment *PR*?
How do we know that triangle *PQS* is congruent to triangle *RQS*?

Answer: Since segment *PQ* is congruent to segment *RQ* we know that point *S* is on the perpendicular bisector of segment *PR*. So line *QS* is the perpendicular bisector of segment *PR*.
Triangle *PQS* is congruent to triangle *RQS* by SSS.

G-CO Congruence Cluster

6. Isosceles ΔPDQ with base $\overline{PQ}$ are given. $\overline{DR}$ is the perpendicular bisector of $\overline{PQ}$.



$PR = n+1$; $RQ = 2n-4$; $DR = n+3$. Find *AB*.

A. 16 B. 14 C. 12 D. 10

Answer: D

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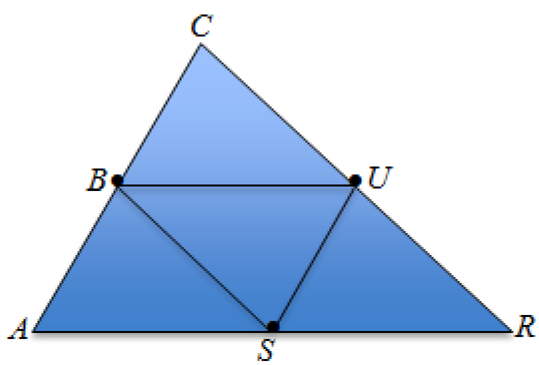
7. *B*, *U* and *S* are the midpoints of the sides of ΔCAR. *CA* = 5, *CR* = 9, and *AR* = 11.



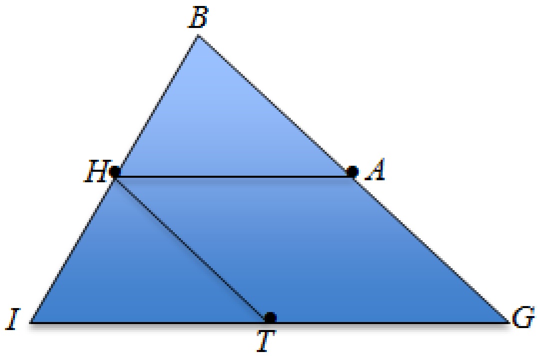
What is the perimeter of parallelogram *BUSA*?

A. 10.5 B. 12.5 C. 16 D. 20

Answer: C

G-CO Congruence Cluster

8. *H*, *A*, and *T* are midpoints of ΔBIG. $IG = 7n - 3$ and $HA = 3n + 1$.



Determine *TG*.

A. 5 B. 13 C. 16 D. 32

Answer: C

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9. In ΔABC, the measure of angle *A* is fifteen less than twice the measure of angle *B*. The measure of angle *C* equals the sum of the measures of angle *A* and angle *B*. Determine the measure of angle *A*.

A. 90° B. 55° C. 35° D. 25°

Answer: B

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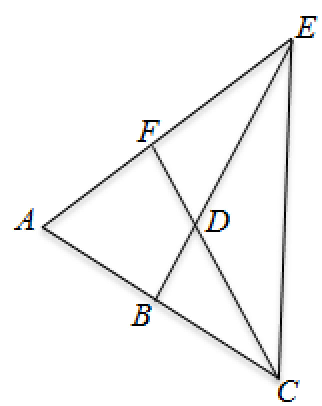
10. Irshaad has ΔACE with segments drawn from E to B and from F to C as shov
$m\angle AEB = 27°$, $m\angle ACF = 31°$, and $m\angle FDB = 130°$. Find $m\angle A$.



A. 72° B. 82° C. 100° D. 121°

Answer: A

G-CO Congruence Cluster

11. Two sides of an isosceles triangle measure 6 and 12. Which of the following choices could be the measure of the third side?

A. 6 B. 9 C. 12 D. 15

Answer: C

---

12. In ΔDOG an exterior angle at vertex *D* measures $130°$, and $m\angle G = 45°$. Which side of the triangle is the longest side?

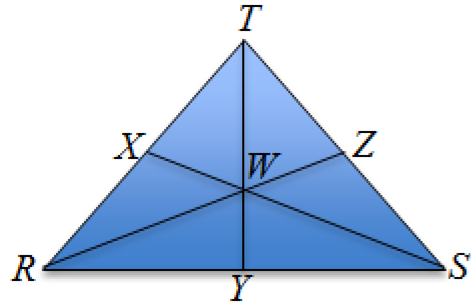
A. $\overline{DO}$ B. $\overline{DG}$ C. $\overline{OG}$

Answer: B

---

13. $\overline{RZ}$, $\overline{SX}$, and $\overline{TY}$ are medians of ΔRST. *RX* = 12.4 and *RY* = 19. ΔRST is isosceles with *RT* = *TS*. Find the perimeter of ΔRST.

A. 43.8 B. 62.8 C. 87.6 D. 90

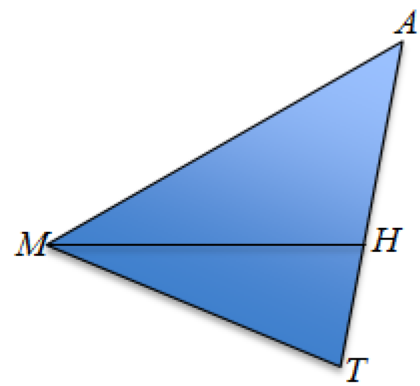


Answer: C

---

14. $\overline{MH}$ is the altitude of ΔMAT. $m\angle MHA = (6y - 6)°$ and $m\angle MAT = (3y - 7)°$. Find $m\angle MAT$.

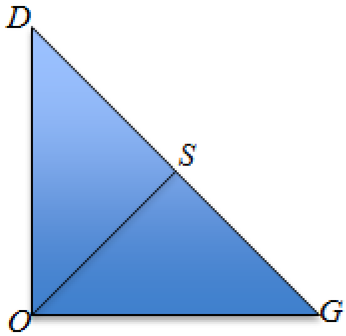
A. 16° B. 41° C. 48° D. 54°



Answer: B

G-CO Congruence Cluster

15. Given right ΔDOG with $\overline{OS}$ bisecting $\angle DOG$ and $m\angle D = 32°$, find $m\angle OSG$.

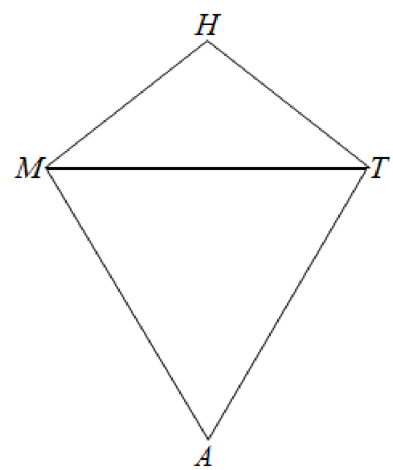


A. 58° B. 77° C. 103° D. 122°

Answer: B

---

16. ΔMAT and ΔMHT are isosceles triangles. $m\angle MHT = 88°$ and $m\angle MAT = 64°$. Find $m\angle AMH$.

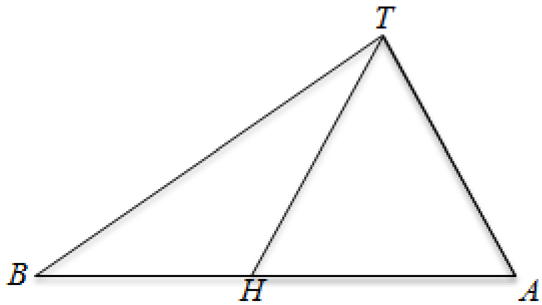


A. 114° B. 104° C. 58° D. 46°

Answer: B

G-CO Congruence Cluster

17. In ΔBAT, *TH* = *TA*, $m\angle B=(2y-10)^\circ$, $m\angle BTH=(y+10)^\circ$ and $m\angle BHT=(6y)^\circ$.



Part A: Find $m\angle B$.

Part A: Find $m\angle THA$.

Part C: Let *HT* = 3*x* + 6 and *TA* = 5*x* – 8. Find *TA*.

Part D: Find *BA*.

Answer: Part A: 30°

Part B: 60°

Part C: 27

Part D: 54

G-CO Congruence Cluster

G-CO.C.11 Prove the theorems about parallelograms. ***Theorems include: opposite sides are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.***

1. Quadrilateral *QRST* has diagonals $\overline{QS}$ and $\overline{RT}$. Which of the following will NOT prove *QRST* is a parallelogram?

A. $\overline{QS}$ and $\overline{RT}$ bisect each other.

B. $\overline{QR} \cong \overline{ST}$ and $\overline{RS} \cong \overline{QT}$

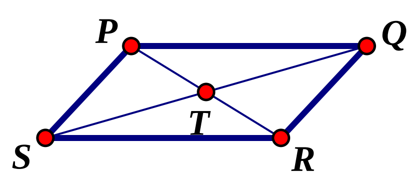
C. $\overline{QR} \cong \overline{ST}$ and $\overline{QR} \parallel \overline{ST}$

D. $\overline{QR} \cong \overline{ST}$ and $\overline{RS} \parallel \overline{QT}$

Answer: D

---

2. One method that can be used to prove that the diagonals of a parallelogram bisect each other is shown in the given partial proof.



Given: Quadrilateral *PQRS* is a parallelogram

Prove: *PT* = *RT* and *ST* = *QT*

STATEMENTS	REASONS
1. Quadrilateral *PQRS* is a parallelogram	1. Given
2. $\overline{PQ} \parallel \overline{SR}$ $\overline{PS} \parallel \overline{QR}$	2. Definition of a parallelogram
3. $\angle PQS \cong \angle RSQ$ $\angle QPR \cong \angle SRP$	3.
4.	4. Opposite sides of a parallelogram are congruent.
5. $\Delta SRT \cong \Delta QPT$	5.
6. $\overline{PT} \cong \overline{RT}$ $\overline{ST} \cong \overline{QT}$	6. Corresponding Parts of Congruent Triangles are Congruent (CPCTC)
7. *PT* = *RT* *ST* = *QT*	7. Definition of congruent line segments

PART A:

Which reason justifies the statement for step 3 in the proof?

A. When two parallel lines are intersected by a transversal, same side interior angles are congruent.

B. When two parallel lines are intersected by a transversal, alternate interior angles are congruent.

C. When two parallel lines are intersected by a transversal, same side interior angles are supplementary.

D. When two parallel lines are intersected by a transversal, alternate interior angles are supplementary.

PART B:

Which statement is justified by the reason for step 4 in the proof?

A. $\overline{PQ} \cong \overline{RS}$

B. $\overline{PQ} \cong \overline{SP}$

C. $\overline{PT} \cong \overline{TR}$

D. $\overline{SQ} \cong \overline{PR}$

PART C:

Which reason justifies the statement for step 5 in the proof?

A. side-side-side triangle congruence

B. side-angle-side triangle congruence

C. angle-side-angle triangle congruence

D. angle-angle-side triangle congruence

Answer: Part A: B

Part B: A

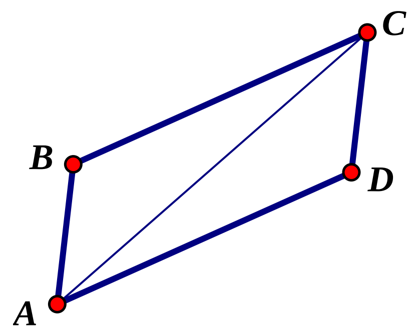
Part C: C

G-CO Congruence Cluster

3. Prove the theorem. *If one pair of opposite sides of a quadrilateral are both parallel and congruent, the quadrilateral is a parallelogram.*
(Remember: when attempting to prove a theorem to be true, you cannot use the theorem as a reason in your proof)

Given: $\overline{BC} \cong \overline{AD}$ and $\overline{BC} \parallel \overline{AD}$

Prove: *ABCD* is a parallelogram



STATEMENTS	REASONS
1. $\overline{BC} \cong \overline{AD}$	1. Given
2. $\overline{BC} \parallel \overline{AD}$	2. Given
3. $\angle BCA \cong \angle DAC$	3.
4. $\overline{AC} \cong \overline{AC}$	4.
5. $\Delta ABC \cong \Delta CDA$	5.
6. $\overline{AB} \cong \overline{CD}$	6.
7. *ABCD* is a parallelogram	7.

Answer: 3. Two parallel lines cut by a transversal, alternate interior $\angle$'s $\cong$

4. Reflexive Property

5. SAS

6. CPCTC

7. 2 sets of opposite $\cong$ sides

4. Given quadrilateral *PQRS*, *P* = (-10, 7), *Q* = (4,3), *R*=(-2,-5), *S*=(-16,1)
   a) Prove that quadrilateral *PQRS* is not a parallelogram.
   b) Prove that the quadrilateral formed by joining consecutive midpoints of the sides of *PQRS* is a parallelogram.

Answer: Part A: $m_{\overline{PS}} = \frac{1}{10}$, $m_{\overline{RQ}} = \frac{4}{3}$ Since the slopes are not equal, the sides are not parallel and quadrilateral *PQRS* is not a parallelogram.

Part B: The midpoints of each side; (-13, 4), (-3, 5), (1, -1), and (-9, -2), form a quadrilateral. By finding the slopes of the opposite sides of this new quadrilateral, we can show that the slopes of the opposite sides are equivalent and therefore this new quadrilateral is a parallelogram.

---

5. Julius is proving that opposite sides of a parallelogram are congruent. He begins as shown. Which reason should he use for step 3?

Given: *ABCD* is a parallelogram

Prove: $\overline{AB} \cong \overline{DC}$ and $\overline{AD} \cong \overline{BC}$

Statements	Reasons
1. ABCD is a parallelogram	1. Given
2. Draw	2. Through 2 points there is exactly one line.
3. $\overline{AB} \parallel \overline{DC}; \overline{AD} \parallel \overline{BC}$	3. ?

A. Definition of parallelogram

B. Alternate Interior Angles Theorem

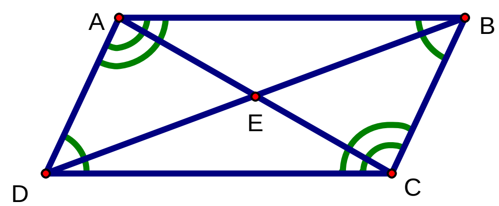
C. Reflexive Property

D. CPCTC

Answer: A

G-CO Congruence Cluster

6.



Part A: Which theorem(s)/postulate(s) can be used to prove that opposite angles of parallelograms are congruent?

Part B: What postulate would allow us to claim $\Delta ADB \cong \Delta CBD$?

Answer:

Part A: Alternate Interior Angles Theorem, Angle Addition Postulate

Part B: *answers may vary*; possible solution: ASA Postulate

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7. *S*(3, 3), *T*(6, -1), *A*(10, 2), and *R*(7, 6) are four points on the coordinate grid. Selena and Taylor joined the points using straight lines to draw a quadrilateral *STAR*.

- Selena is trying to prove that *STAR* is a parallelogram that is not a rhombus so she figured out the slope of *ST*, *TA*, *AR*, and *SR*.
- Taylor is trying to prove that *STAR* is a rhombus so she figured out the distance between *ST*, *TA*, *AR*, and *SR*.

Who will successfully complete their task? Explain why she is correct and what the other student must do to complete her task?

Answer: Taylor is correct because determining the distance between *ST*, *TA*, *AR*, and *SR* will show that the four sides of the quadrilateral are equal. Determining the slope will show that that opposite sides are parallel proving that the figure is a parallelogram, but a rhombus is also a parallelogram.

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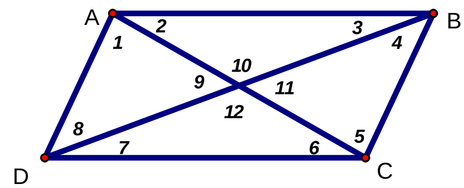
8. *ABCD* is a parallelogram.



Part A: Which of the following equations must be true? Select all that apply.

A) $AB = DC$
B) $m\angle 2 = m\angle 9$
C) $m\angle 10 = m\angle 12$
D) $AD = DC$
E) $m\angle 1 = m\angle 5$
F) $AC = BD$
G) $m\angle 1 = m\angle 4$
H) $m\angle 10 + m\angle 11 = 180$

Part B: For each of the equations that you selected as true, state the postulate, theorem, or definition that allows you to make that claim.

Answer: Part A: A, C, E, H

Part B:

A) Opposite sides of a parallelogram are congruent.

C) Vertical angles are congruent.

E) Parallel lines cut by a transversal, Alternate Interior Angles are congruent.

H) Linear pairs are supplementary, Definition of supplementary.

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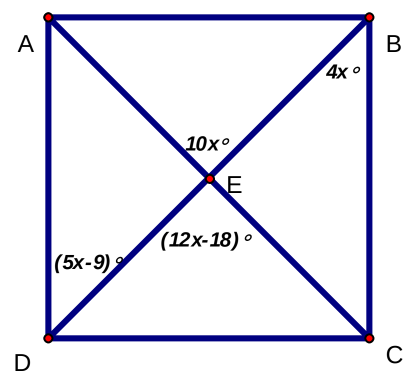
9. Given the following diagram:



Part A: Write and solve an equation to find the value of *x*.

Part B: Is *ABCD* a parallelogram? Explain.

Part C: Is *ABCD* a rectangle? Explain.

Part D: Is *ABCD* a rhombus? Explain.

Answer: Part A:

$$10x = 12x - 18 \quad \text{(vertical angles are congruent)}$$
$$18 = 2x$$
$$9 = x$$

So,
$m\angle AEB = 10x = 90°$,
$m\angle DEC = 12x - 18 = 90°$,
$m\angle ADE = 5x - 9 = 36°$,
$m\angle CBD = 4x = 36°$
Therefore diagonals are perpendicular $\left(\overline{AC} \perp \overline{DB}\right)$. Only squares and rhombi have perpendicular diagonals. Since $m\angle ADE = m\angle CBD$, then $\overline{AD} \parallel \overline{BC}$ by the Alternate Interior Angles Converse and by Alternate Interior Angles Theorem we can find that $m\angle ABD = m\angle CDB = m\angle ADE = m\angle CBD = 36°$.

Part B: *ABCD* must be a parallelogram because all rhombi are parallelograms.

Part C: *ABCD* cannot be a rectangle because the adjacent sides are not perpendicular. Recall that, in parallelograms, opposite angles are bisected by the diagonals. We found $m\angle ADE = 36°$ and $m\angle CBD = 36°$, then $m\angle ADC = 72°$ and $m\angle CBA = 72°$.

Part D: *ABCD* must be a rhombus because: the diagonals are perpendicular, the opposite angles are congruent, and the diagonals are angle bisectors.