



Unit 2 Practice Problems

Lesson 1

Problem 1

Rectangle A measures 12 cm by 3 cm. Rectangle B is a scaled copy of Rectangle A . Select **all** of the measurement pairs that could be the dimensions of Rectangle B .

1. 6 cm by 1.5 cm
2. 10 cm by 2 cm
3. 13 cm by 4 cm
4. 18 cm by 4.5 cm
5. 80 cm by 20 cm

Solution

1, 4, 5

Problem 2

Rectangle A has length 12 and width 8. Rectangle B has length 15 and width 10. Rectangle C has length 30 and width 15.

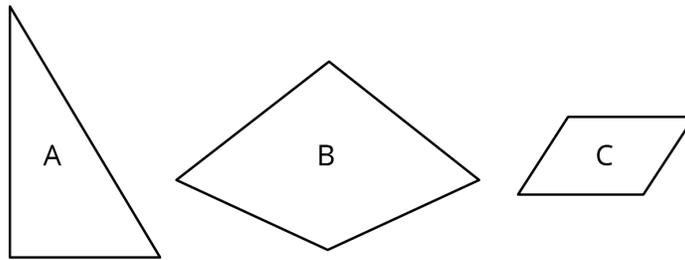
1. Is Rectangle A a scaled copy of Rectangle B ? If so, what is the scale factor?
2. Is Rectangle B a scaled copy of Rectangle A ? If so, what is the scale factor?
3. Explain how you know that Rectangle C is *not* a scaled copy of Rectangle B .
4. Is Rectangle A a scaled copy of Rectangle C ? If so, what is the scale factor?

Solution

1. Yes, the scale factor is $\frac{4}{5}$.
2. Yes, the scale factor is $\frac{5}{4}$.
3. Rectangle C 's length is double that of Rectangle B , but its width is not double.
4. No.

Problem 3

Here are three polygons.



1. Draw a scaled copy of Polygon B with scale factor $\frac{1}{2}$
2. Draw a scaled copy of Polygon B with scale factor 2.
3. Draw a scaled copy of Polygon C with scale factor $\frac{1}{4}$.

Solution

The scaled copy of Polygon A should be a right triangle with each side half as long as the original.

The scaled copy of Polygon B should be a quadrilateral with each side twice as long as the original.

The scaled copy of Polygon C should be a parallelogram with each side one-fourth the length of the original.

Problem 4

(from Unit 1, Lesson 15)

Which of these sets of angle measures could be the three angles in a triangle?

1. $40^\circ, 50^\circ, 60^\circ$
2. $50^\circ, 60^\circ, 70^\circ$
3. $60^\circ, 70^\circ, 80^\circ$
4. $70^\circ, 80^\circ, 90^\circ$

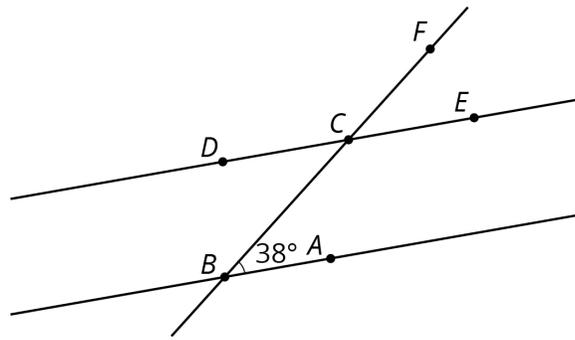
Solution

B

Problem 5

(from Unit 1, Lesson 14)

In the picture lines AB and CD are parallel. Find the measures of the following angles. Explain your reasoning.



1. $\angle BCD$
2. $\angle ECF$
3. $\angle DCF$

Solution

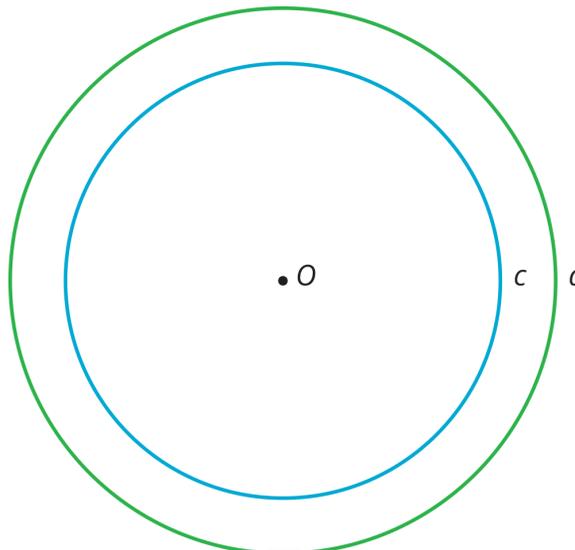
1. 38 degrees. $\angle BCD$ and $\angle ABC$ are alternate interior angles for the parallel lines AB and CD cut by the transversal BC .
2. 38 degrees. $\angle ECF$ and $\angle BCD$ are a pair of vertical angles.
3. 142 degrees. $\angle DCF$ and $\angle ECF$ are supplementary angles.

Lesson 2

Problem 1

Here are Circles c and d . Point O is the center of dilation, and the dilation takes Circle c to Circle d .

1. Plot a point on Circle c . Label the point P . Plot where P goes when the dilation is applied.
2. Plot a point on Circle d . Label the point Q . Plot a point that the dilation takes to Q .



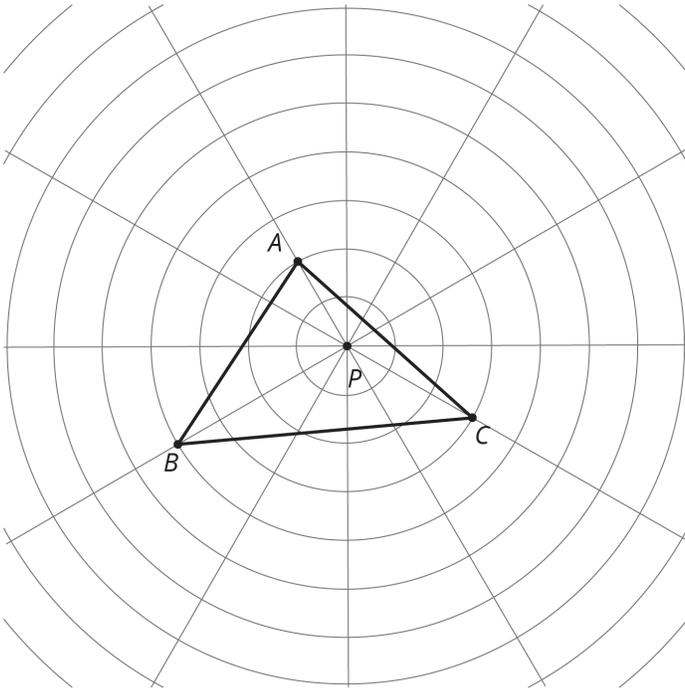
Solution

1. Plot any point P , then draw a ray from O through P . The point where this ray intersects circle d is P' .

2. Plot any point Q , then draw a ray from O through Q . The point where this ray intersects circle c is Q' .

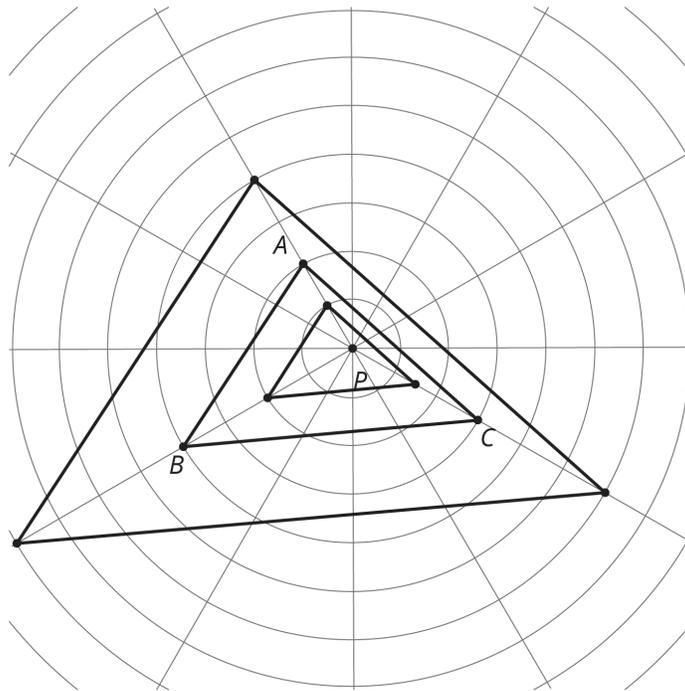
Problem 2

Here is triangle ABC .



1. Dilate each vertex of triangle ABC using P as the center of dilation and a scale factor of 2. Draw the triangle connecting the three new points.
2. Dilate each vertex of triangle ABC using P as the center of dilation and a scale factor of $\frac{1}{2}$. Draw the triangle connecting the three new points.
3. Measure the longest side of each of the three triangles. What do you notice?
4. Measure the angles of each triangle. What do you notice?

Solution

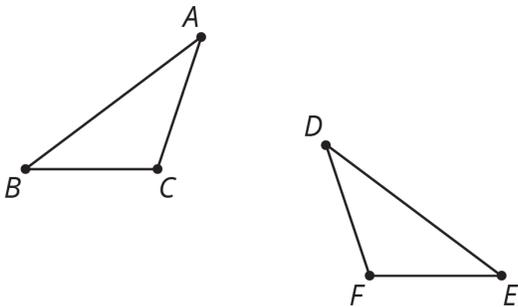


1. Triangle $A'B'C'$ has each respective point at the same ray. A' is 4 units from the origin, B' is 8 units from the origin, and C' is 6 units from the origin.
2. Triangle $A''B''C''$ has each respective point at the same ray. A'' is 1 unit from the origin, B'' is 2 units from the origin, and C'' is 1.5 units from the origin.
3. The longest side of the largest triangle is twice as long as the longest side of triangle ABC , which is twice as long as the smallest triangle.
4. The angles in all three triangles have the same measures.

Problem 3

(from Unit 1, Lesson 12)

Describe a rigid transformation that you could use to show the polygons are congruent.



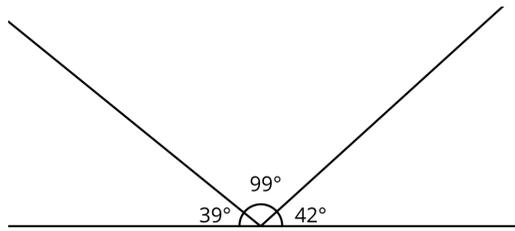
Solution

Reflect triangle ABC in a vertical line and translate so A meets D .

Problem 4

(from Unit 1, Lesson 15)

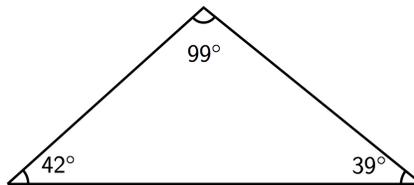
The line has been partitioned into three angles.



Is there a triangle with these three angle measures? Explain.

Solution

Yes



Lesson 3

Problem 1

Segment AB measures 3 cm. Point O is the center of dilation. How long is the image of AB after a dilation with . . .

1. Scale factor 5?
2. Scale factor 3.7?
3. Scale factor $\frac{1}{5}$?
4. Scale factor s ?

Solution

1. 15 cm
2. 11.1 cm
3. $\frac{3}{5}$ cm
4. $3s$ cm

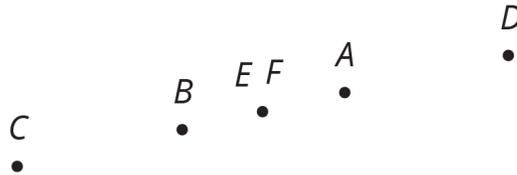
Problem 2

Here are points A and B . Plot the points for each dilation described.



1. C is the image of B using A as the center of dilation and a scale factor of 2.
2. D is the image of A using B as the center of dilation and a scale factor of 2.
3. E is the image of B using A as the center of dilation and a scale factor of $\frac{1}{2}$.
4. F is the image of A using B as the center of dilation and a scale factor of $\frac{1}{2}$.

Solution



Problem 3

Make a perspective drawing. Include in your work the center of dilation, the shape you dilate, and the scale factor you use.

Solution

Answers vary.

Problem 4

(from Unit 2, Lesson 1)

Triangle ABC is a scaled copy of triangle DEF . Side AB measures 12 cm and is the longest side of ABC . Side DE measures 8 cm and is the longest side of DEF .

1. Triangle ABC is a scaled copy of triangle DEF with what scale factor?
2. Triangle DEF is a scaled copy of triangle ABC with what scale factor?

Solution

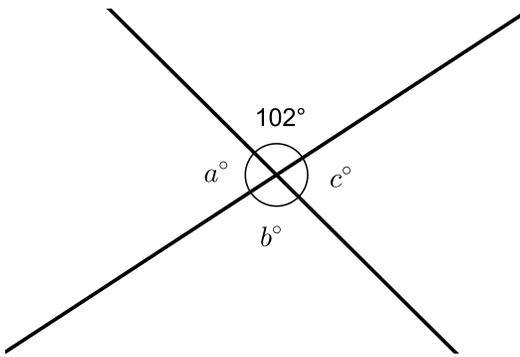
1. $\frac{3}{2}$
2. $\frac{2}{3}$

Problem 5

(from Unit 1, Lesson 14)

The diagram shows two intersecting lines.

Find the missing angle measures.



Solution

$a = 78$

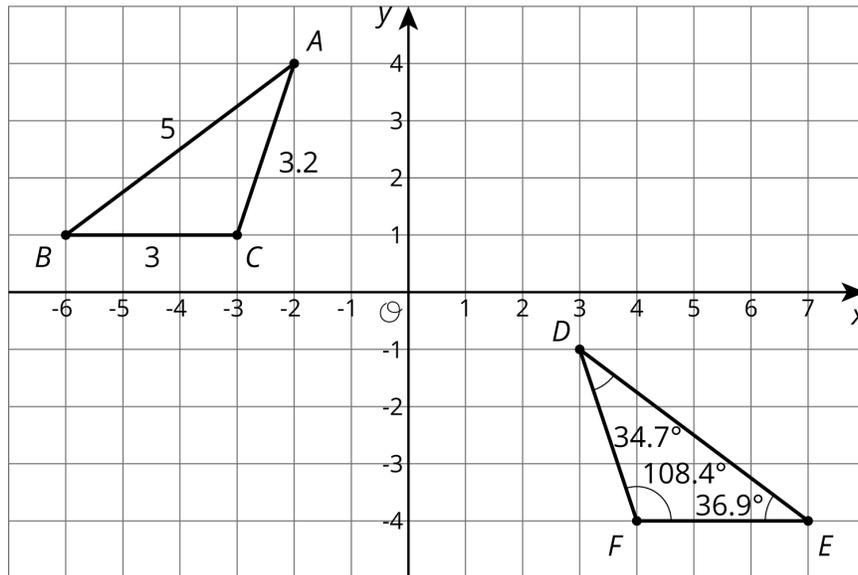
$b = 102$

$c = 78$

Problem 6

(from Unit 1, Lesson 12)

1. Show that the two triangles are congruent.
2. Find the side lengths of DEF and the angle measures of ABC .



Solution

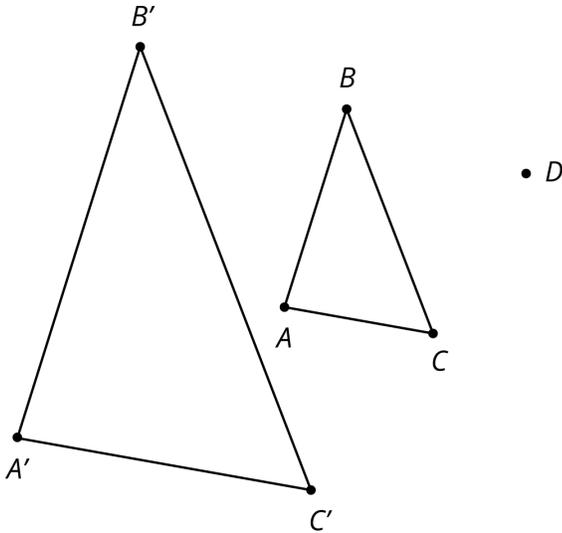
1. Reflect in the y -axis and translate until A meets D .
2. Angle ABC is 36.9 degrees. Angle BCA is 108.4 degrees. Angle CAB is 34.7 degrees. $DE = 5$.
 $EF = 3$. $FD = 3.2$.

Lesson 4

Problem 1

Triangle ABC is dilated using D as the center of dilation with scale factor 2.

The image is triangle $A'B'C'$. Clare says the two triangles are congruent, because their angle measures are the same. Do you agree? Explain how you know.



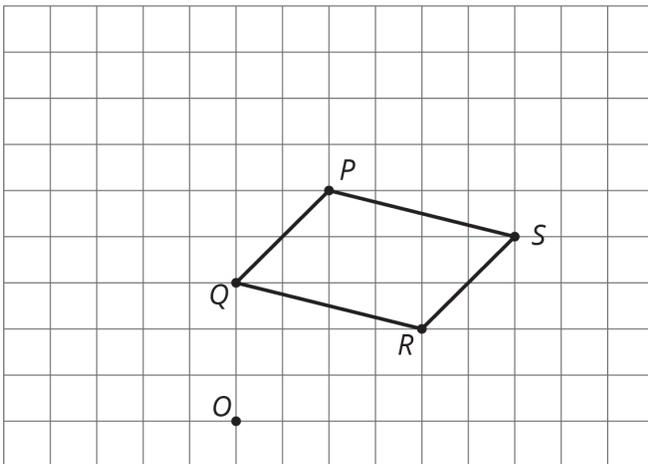
Solution

No. The triangles are not congruent because their side lengths are different.

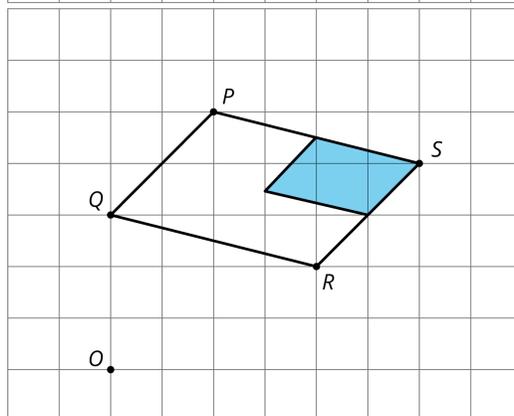
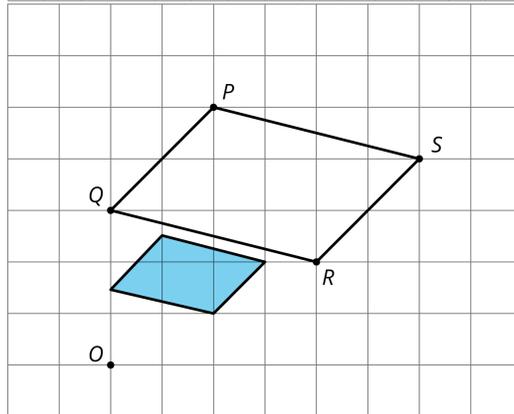
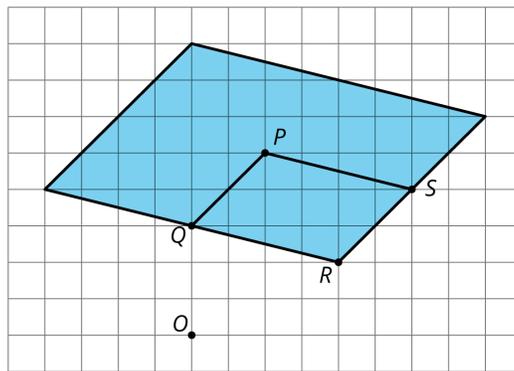
Problem 2

On graph paper, sketch the image of quadrilateral PQRS under the following dilations:

- The dilation centered at R with scale factor 2.
- The dilation centered at O with scale factor $\frac{1}{2}$.
- The dilation centered at S with scale factor $\frac{1}{2}$.



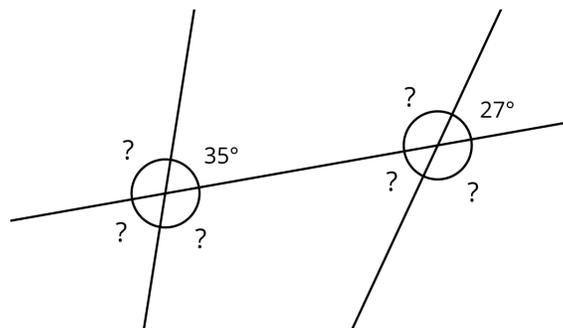
Solution



Problem 3

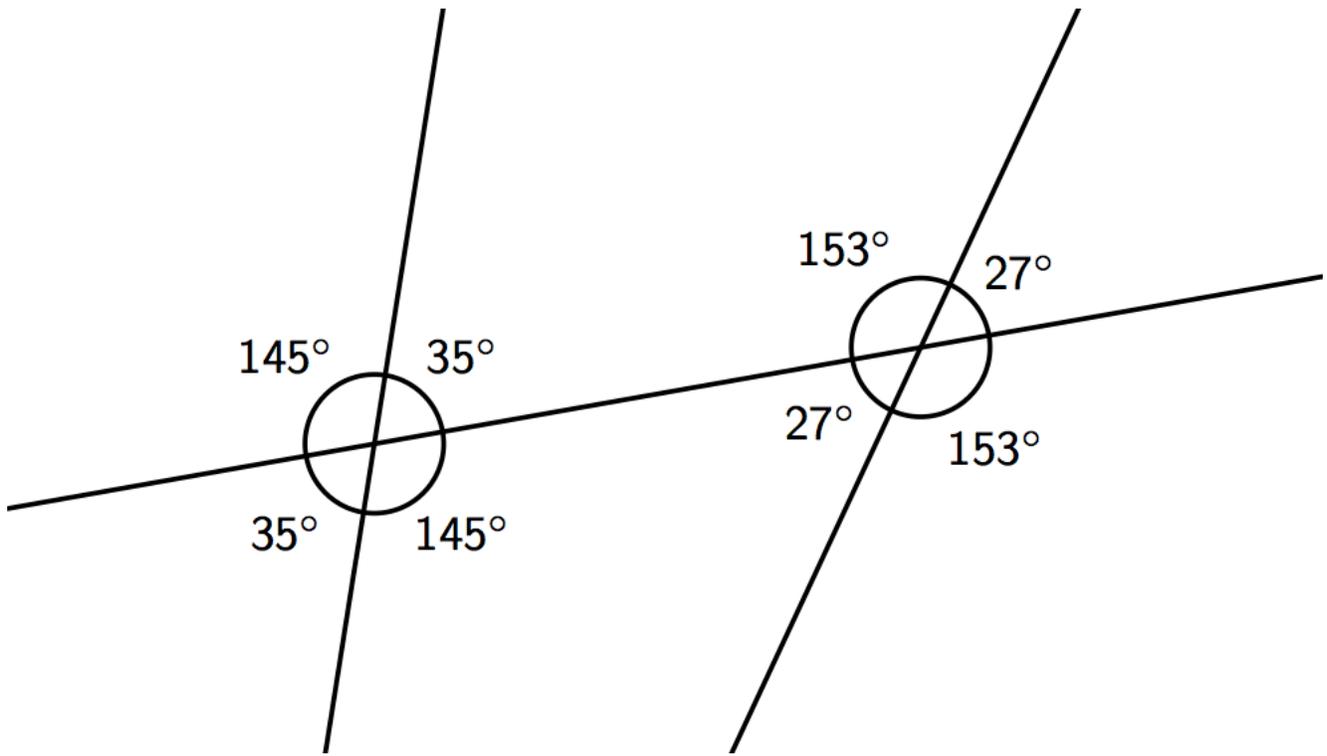
(from Unit 1, Lesson 14)

The diagram shows three lines with some marked angle measures.



Find the missing angle measures marked with question marks.

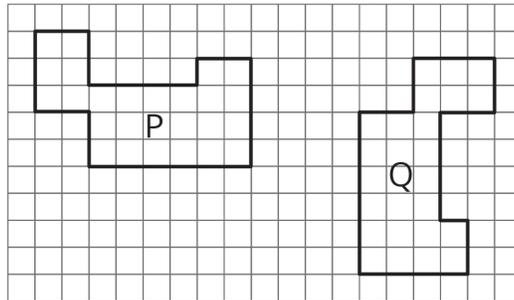
Solution



Problem 4

(from Unit 1, Lesson 4)

Describe a sequence of translations, rotations, and reflections that takes Polygon P to Polygon Q.



Solution

Answers vary. Sample response: P is rotated 90 degrees clockwise and translated until the corresponding vertices match up.

Problem 5

(from Unit 1, Lesson 6)

Point B has coordinates $(-2, -5)$. After a translation 4 units down, a reflection across the y -axis, and a translation 6 units up, what are the coordinates of the image?

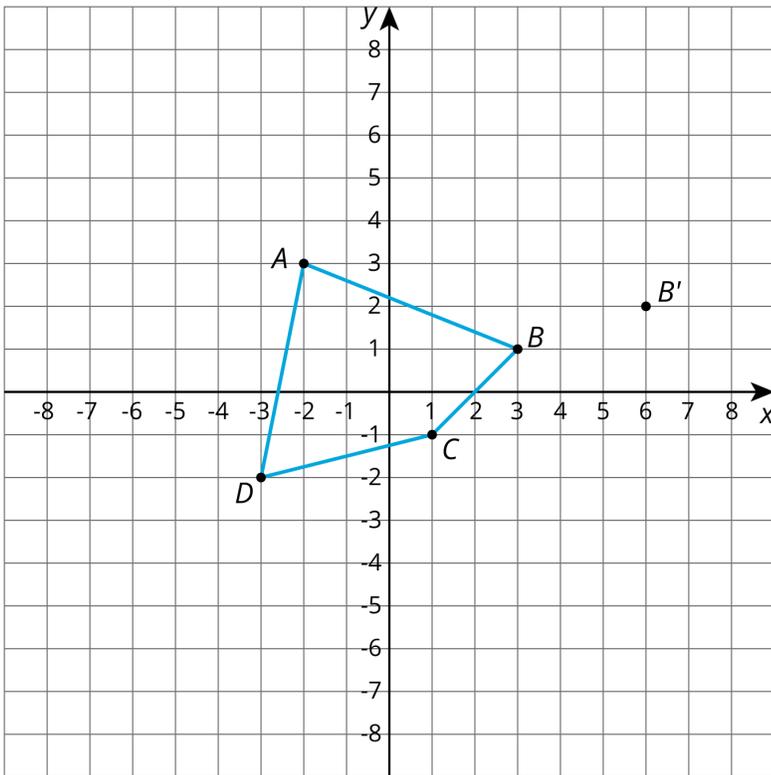
Solution

$(2, -3)$

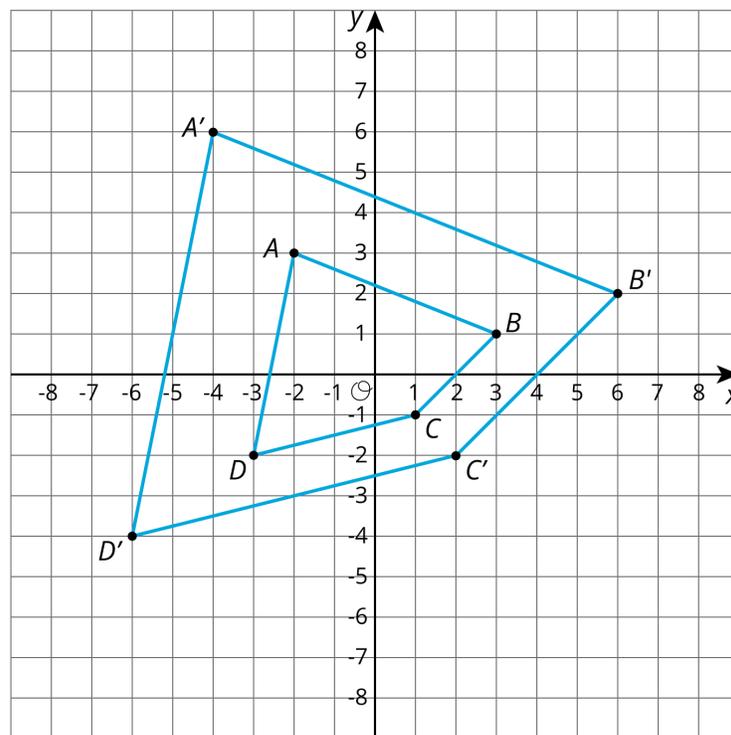
Lesson 5

Problem 1

Quadrilateral $ABCD$ is dilated with center $(0, 0)$, taking B to B' . Draw $A'B'C'D'$.

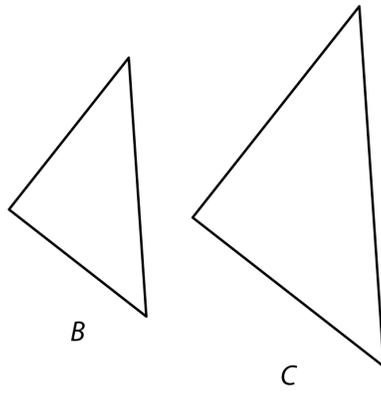


Solution



Problem 2

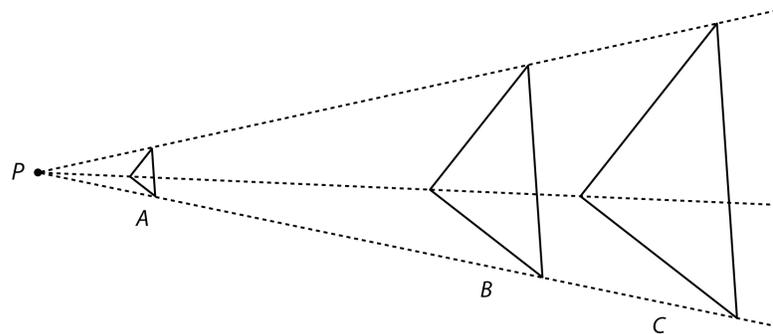
Triangles B and C have been built by dilating Triangle A .



1. Find the center of dilation.
2. Triangle B is a dilation of A with approximately what scale factor?
3. Triangle A is a dilation of B with approximately what scale factor?
4. Triangle B is a dilation of C with approximately what scale factor?

Solution

1. The center of dilation is here:

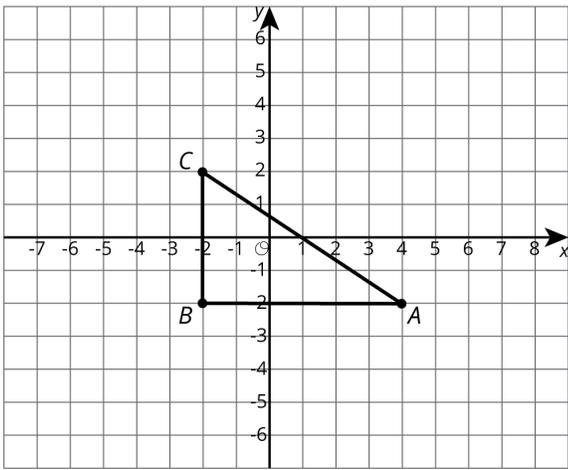


2. 3
3. $\frac{1}{3}$
4. $\frac{2}{3}$

Problem 3

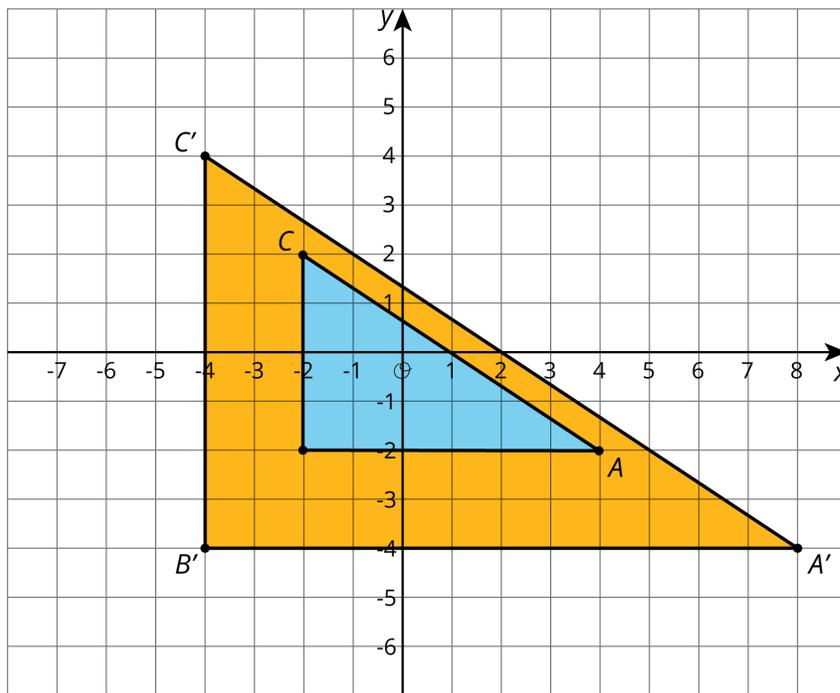
Here is a triangle.

1. Draw the dilation of triangle ABC , with center $(0, 0)$, and scale factor 2. Label this triangle $A'B'C'$.
2. Draw the dilation of triangle ABC , with center $(0, 0)$, and scale factor $\frac{1}{2}$. Label this triangle $A''B''C''$.
3. Is $A''B''C''$ a dilation of triangle $A'B'C'$? If yes, what are the center of dilation and the scale factor?

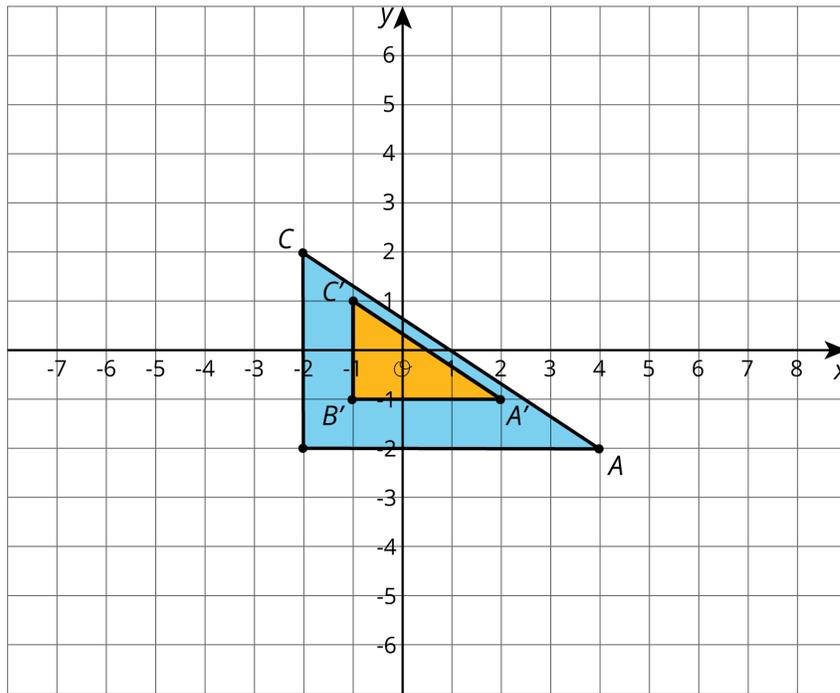


Solution

1.



2.



3. Yes, $A''B''C''$ is a dilation of $A'B'C'$ with center $(0, 0)$ and scale factor $\frac{1}{4}$.

Problem 4

(from Unit 1, Lesson 15)

Triangle ABC is a right triangle, and the measure of angle A is 28° . What are the measures of the other two angles?

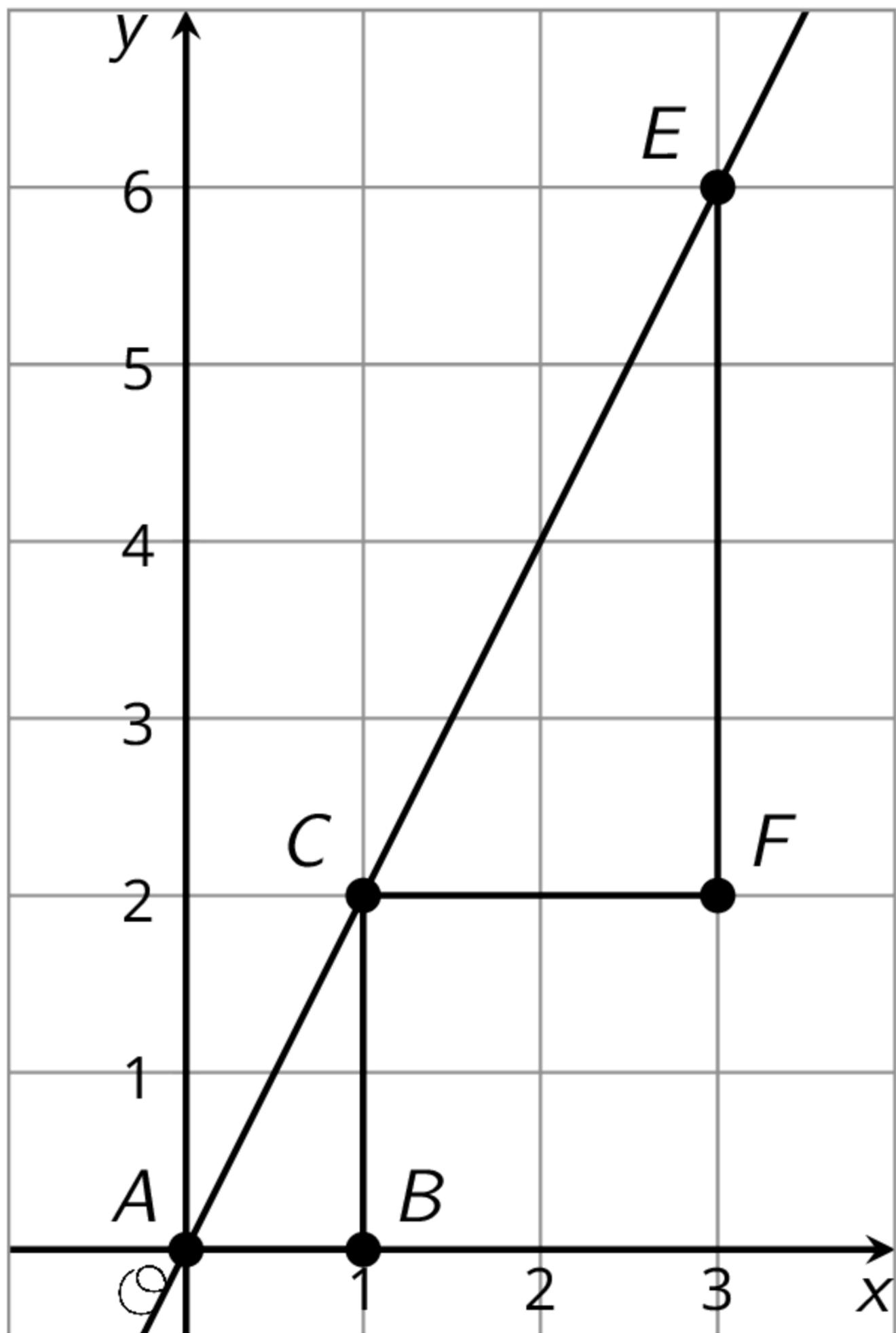
Solution

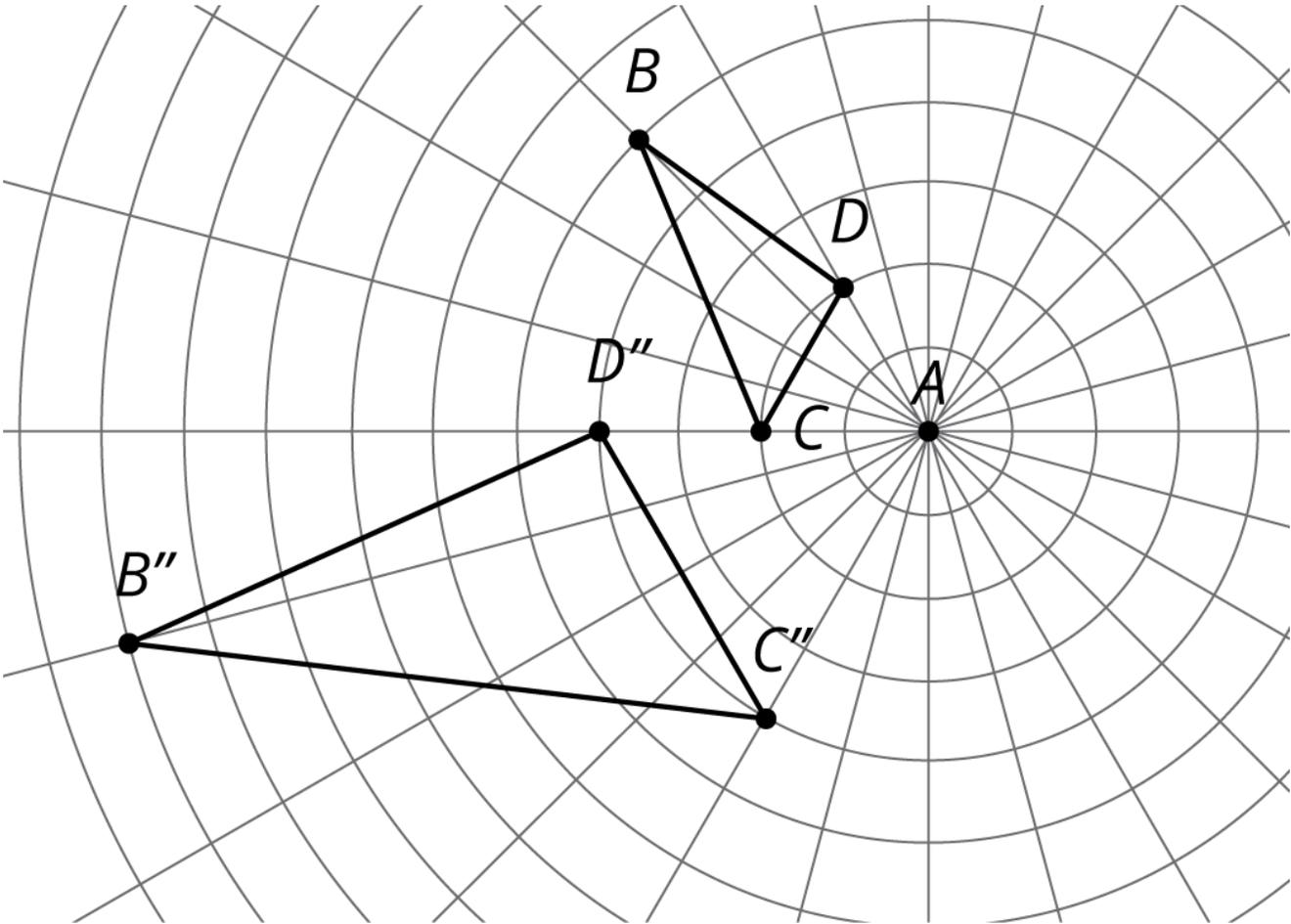
90° and 62°

Lesson 6

Problem 1

Each diagram has a pair of figures, one larger than the other. For each pair, show that the two figures are similar by identifying a sequence of translations, rotations, reflections, and dilations that takes the smaller figure to the larger one.





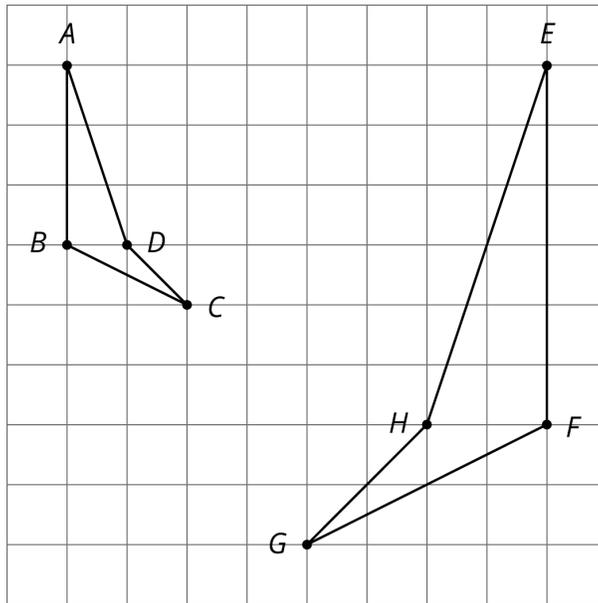
Solution

- Translate A to C , and then dilate with center A by a factor of 2.
- Rotate 60° counter-clockwise with center A , and then dilate using a scale factor of 2 centered at A .

Problem 2

Here are two similar polygons.

Measure the side lengths and angles of each polygon. What do you notice?

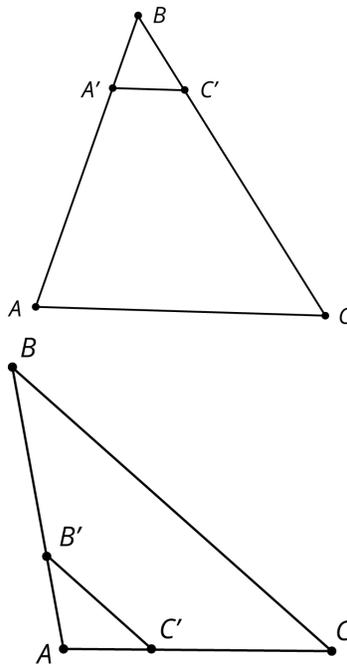


Solution

Answers vary. Sample response: Corresponding side lengths in the larger polygon are double the side lengths of the smaller polygon, while corresponding angles all have the same measure.

Problem 3

Each figure shows a pair of similar triangles, one contained in the other. For each pair, describe a point and a scale factor to use for a dilation moving the larger triangle to the smaller one. Use a measurement tool to find the scale factor.



Solution

Center of dilation: B , scale factor: $\frac{1}{4}$; center of dilation: A , scale factor: $\frac{1}{3}$

Lesson 7

Problem 1

Triangle DEF is a dilation of triangle ABC with scale factor 2. In triangle ABC , the largest angle measures 82° . What is the largest angle measure in triangle DEF ?

1. 41°
2. 82°
3. 123°
4. 164°

Solution

2 or B

Problem 2

Draw two polygons that are similar but could be mistaken for not being similar. Explain why they are similar.

Solution

Answers vary. Sample response: Two polygons with different orientations; two congruent polygons. Another sample response: Two polygons where a reflection is part of the transformation from one to the other.

Problem 3

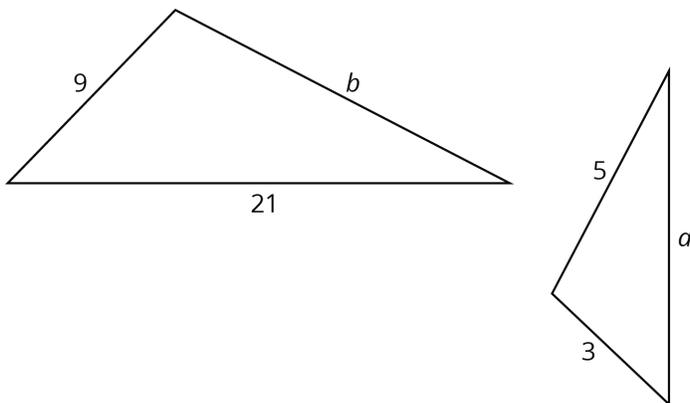
Draw two polygons that are *not* similar but could be mistaken for being similar. Explain why they are not similar.

Solution

Answers vary. Sample response: Two polygons with the same angle measures but side lengths that are not proportional. Another sample response: Two polygons with proportional side lengths but incorrect angle measures.

Problem 4

These two triangles are similar. Find side lengths a and b . Note: the two figures are not drawn to scale.



Solution

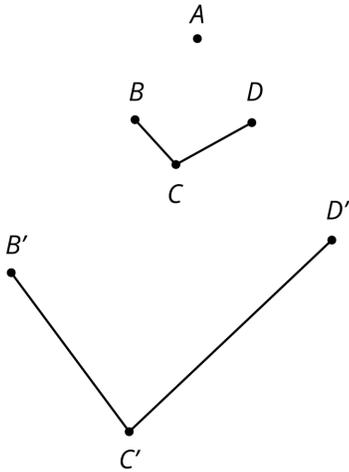
$$a = 7, b = 15$$

Problem 5

(from Unit 2, Lesson 3)

Jada claims that $B'C'D'$ is a dilation of BCD using A as the center of dilation.

What are some ways you can convince Jada that her claim is not true?



Solution

Answers vary. Below is a list of things which would have to be true if $B'C'D'$ is a dilation of BCD using A as the center of dilation. Any measurement which showed any of these to not hold is a complete answer.

- $m\angle BCD = m\angle B'C'D'$
- A , B , and B' should be collinear.
- A , C , and C' should be collinear.
- A , D , and D' should be collinear.
- $B'C'$ should be parallel to BC .
- $C'D'$ should be parallel to CD .

Problem 6

(from Unit 1, Lesson 8)

1. Draw a horizontal line segment AB .
2. Rotate segment AB 90° counterclockwise around point A . Label any new points.
3. Rotate segment AB 90° clockwise around point B . Label any new points.
4. Describe a transformation on segment AB you could use to finish building a square.

Solution

1. Answers vary.
2. The segment is attached at point A and forms a right angle.

- The segment is attached at point B and forms a right angle, parallel and in the same direction as the previous segment.
- Answers vary. Sample response: Translate A to C .

Lesson 8

Problem 1

In each pair, some of the angles of two triangles in degrees are given. Use the information to decide if the triangles are similar or not. Explain how you know.

- Triangle A: 53, 71, ___; Triangle B: 53, 71, ___
- Triangle C: 90, 37, ___; Triangle D: 90, 53, ___
- Triangle E: 63, 45, ___; Triangle F: 14, 71, ___
- Triangle G: 121, ___, ___; Triangle H: 70, ___, ___

Solution

- Similar: They have two pairs of angles with equal measurement.
- Similar: Since the angles in a triangle add up to 180° , the missing angle in Triangle C must be 53° . The two triangles therefore have two pairs of angles with equal measurement, so they are similar.
- Not similar: Similar triangles have equal angle measurements, and there is no way to fill in the blanks so that this is true for these two triangles.
- Not similar: Similar triangles have equal angle measurements, but no triangle can have angles which measure 121 and 70 degrees as these add up to more than 180.

Problem 2

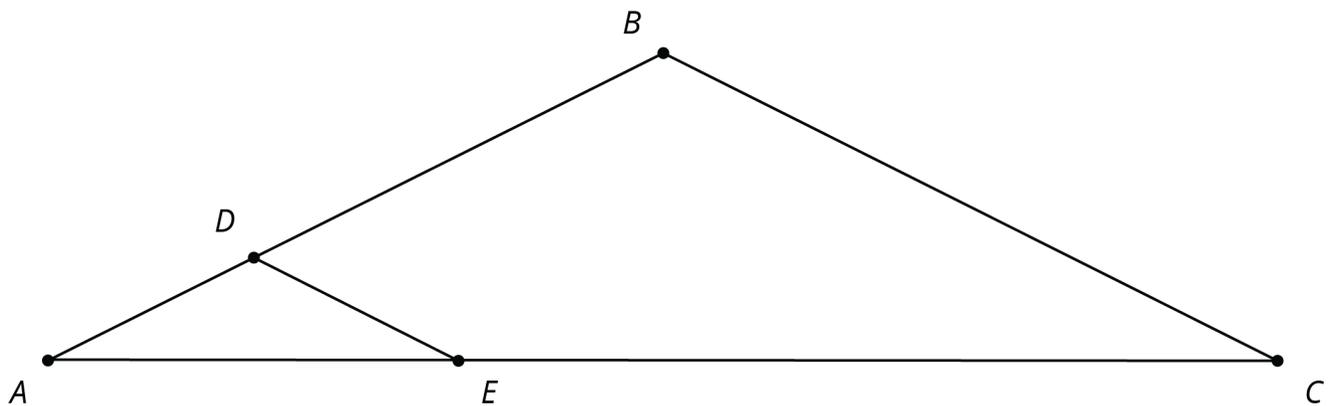
- Draw two equilateral triangles that are not congruent.
- Measure the side lengths and angles of your triangles. Are the two triangles similar?
- Do you think two equilateral triangles will be similar *always*, *sometimes*, or *never*? Explain your reasoning.

Solution

- Answers vary.
- The side lengths in each triangle should be equal, and the angle measures should all be 60° . The triangles are similar, because the angle measures are equal.
- Always. All equilateral triangles have the same angle measures, so they are all similar.

Problem 3

In the figure, line BC is parallel to line DE .



Explain why $\triangle ABC$ is similar to $\triangle ADE$.

Solution

Answers vary.

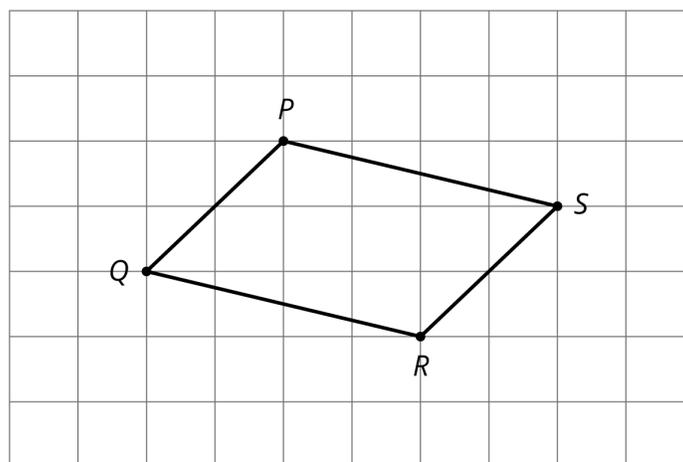
Sample Solution 1: Triangles ABC and ADE share angle A . Line AC is a transversal for parallel lines BC and DE . Therefore, angles $\angle ADE$ and $\angle ABC$ are congruent. Since they share two congruent angles, triangles ABC and ADE are congruent.

Sample Solution 2: A dilation with center A and appropriate scale factor will take triangle ABC to triangle ADE . The scale factor looks like it is about 3.

Problem 4

(from Unit 2, Lesson 4)

The quadrilateral $PQRS$ in the diagram is a parallelogram. Let $P'Q'R'S'$ be the image of $PQRS$ after applying a dilation centered at a point O (not shown) with scale factor 3.



Which of the following is true?

1. $P'Q' = PQ$
2. $P'Q' = 3PQ$
3. $PQ = 3P'Q'$
4. Cannot be determined from the information given

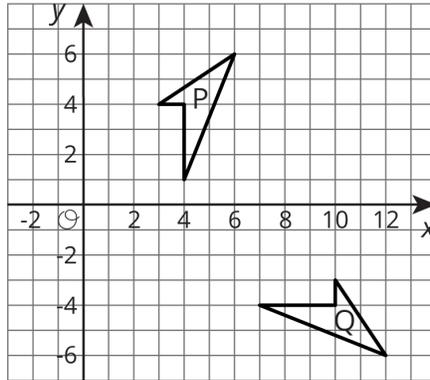
Solution

2 or B

Problem 5

(from Unit 1, Lesson 6)

Describe a sequence of transformations for which Quadrilateral P is the image of Quadrilateral Q.



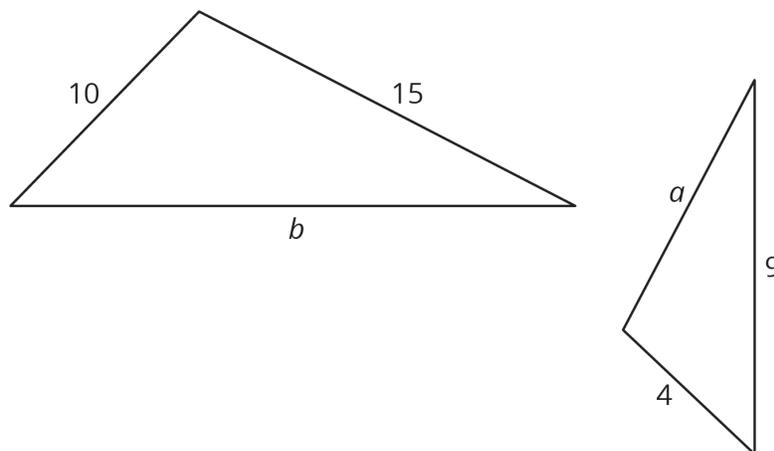
Solution

Answers vary. Sample response: B is the image of A under a reflection over the y-axis, then a translation 2 units to the right and 3 units up.

Lesson 9

Problem 1

These two triangles are similar.



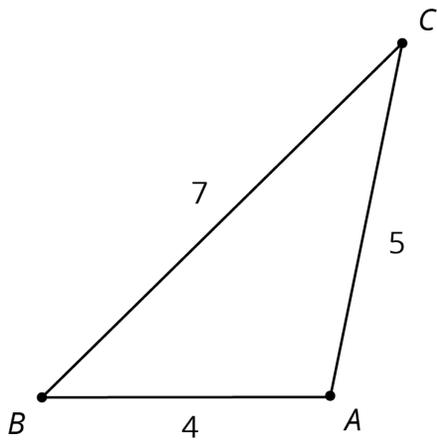
What are a and b ? Note: the two figures are not drawn to scale.

Solution

$a = 6$, $b = 22.5$ (the scale factor between the triangles is 2.5)

Problem 2

Here is triangle ABC . Triangle XYZ is similar to ABC with scale factor $\frac{1}{4}$.



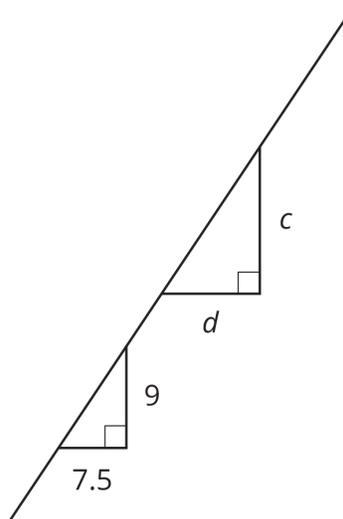
1. Draw what triangle XYZ might look like.
2. How do the angle measures of triangle XYZ compare to triangle ABC ? Explain how you know.
3. What are the side lengths of triangle XYZ ?
4. For triangle XYZ , calculate (long side) \div (medium side), and compare to triangle ABC .

Solution

1. Answers vary.
2. The angle measures are the same, because in similar polygons, corresponding angles are congruent.
3. The side lengths are 1, $\frac{5}{4}$, and $\frac{7}{4}$.
4. The result is $\frac{7}{5}$, the same as the corresponding result for triangle ABC .

Problem 3

The two triangles shown are similar. Find the value of $\frac{d}{c}$.



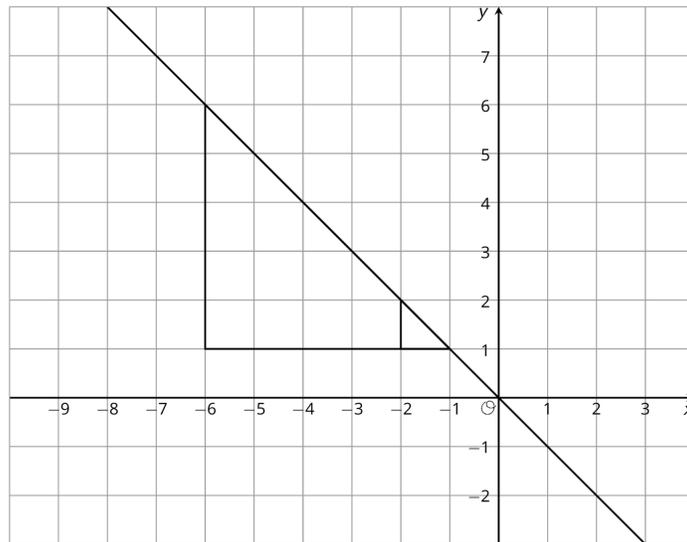
Solution

$\frac{5}{6}$ (or equivalent)

Problem 4

(from Unit 2, Lesson 5)

The diagram shows two nested triangles that share a vertex. Find a center and a scale factor for a dilation that would move the larger triangle to the smaller triangle.



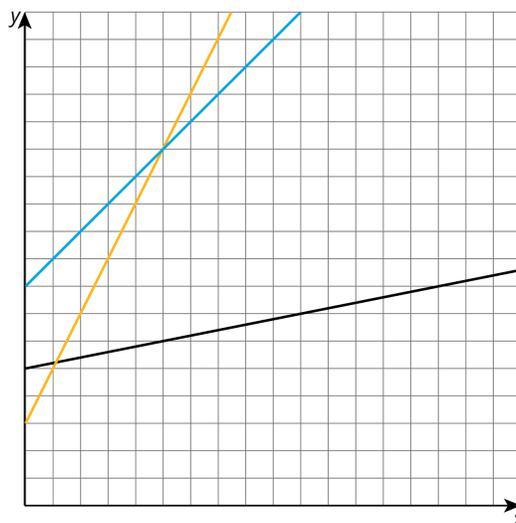
Solution

Center: $(-1, 1)$, scale factor: $\frac{1}{5}$

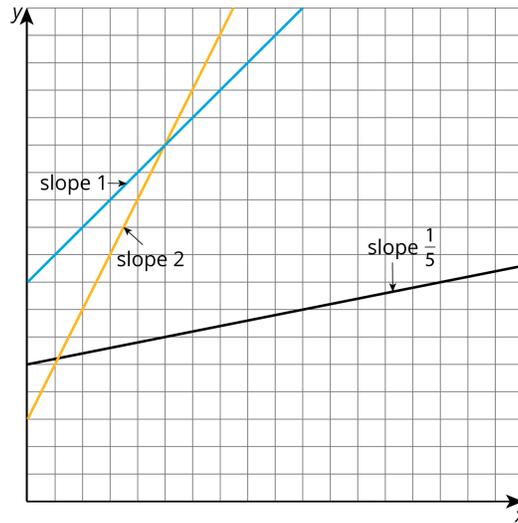
Lesson 10

Problem 1

Of the three lines in the graph, one has slope 1, one has slope 2, and one has slope $\frac{1}{5}$. Label each line with its slope.



Solution



Problem 2

Draw three lines with slope 2, and three lines with slope $\frac{1}{3}$. What do you notice?

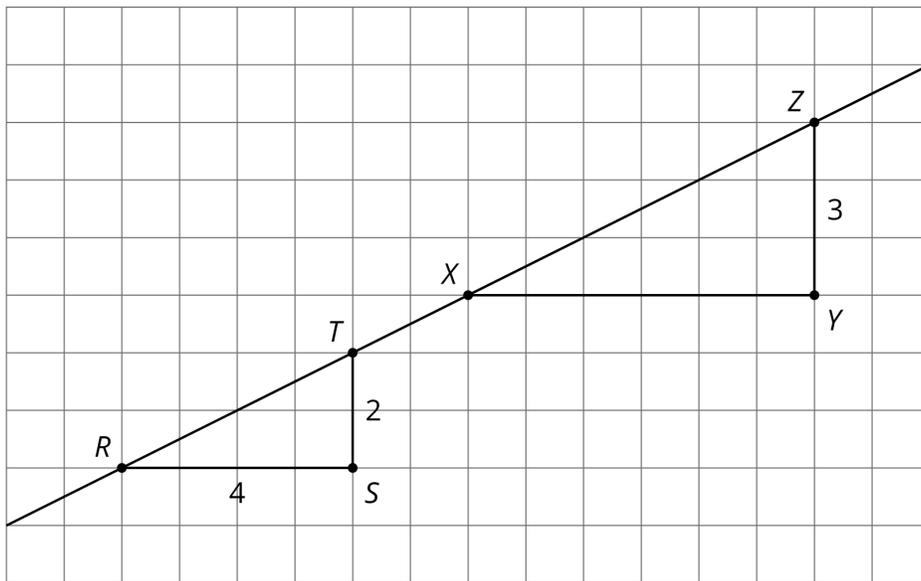


Solution

Answers vary. The three lines in each set should be parallel.

Problem 3

The figure shows two right triangles, each with its longest side on the same line.



1. Explain how you know the two triangles are similar.
2. How long is XY ?
3. For each triangle, calculate (vertical side) \div (horizontal side).
4. What is the slope of the line? Explain how you know.

Solution

1. Explanations vary. Sample explanation: translating R to X and dilating shows there is a sequence of translations, rotations, reflections, and dilations taking one triangle to the other.
2. 6 units
3. For both triangles, the result is $\frac{1}{2}$.
4. The slope of the line is $\frac{1}{2}$. It is the quotient of the vertical side length of a slope triangle and the horizontal side length of a slope triangle. These all give the same value because the slope triangles are similar.

Problem 4

(from Unit 2, Lesson 9)

Triangle A has side lengths 3, 4, and 5. Triangle B has side lengths 6, 7, and 8.

1. Explain how you know that Triangle B is *not* similar to Triangle A .
2. Give possible side lengths for Triangle B so that it is similar to Triangle A .

Solution

1. Explanations vary. Sample explanation: the shortest side in Triangle B is twice as long, but the longest side is only 1.6 times as long. These different ratios mean the triangles cannot be similar.
2. Answers vary. Sample response: 6, 8, and 10

Lesson 11

Problem 1

For each pair of points, find the slope of the line that passes through both points. If you get stuck, try plotting the points on graph paper and drawing the line through them with a ruler.

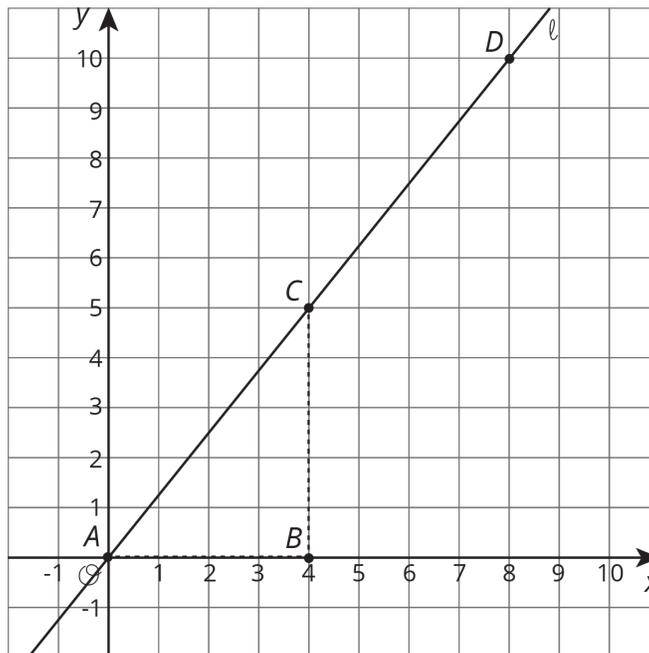
1. (1, 1) and (7, 5)
2. (1, 1) and (5, 7)
3. (2, 5) and (-1, 2)
4. (2, 5) and (-7, -4)

Solution

1. $\frac{2}{3}$
2. $\frac{3}{2}$
3. 1
4. 1

Problem 2

Line ℓ is shown in the coordinate plane.



1. What are the coordinates of B and D ?
2. Is the point (16, 20) on line ℓ ? Explain how you know.

- Is the point $(20, 24)$ on line ℓ ? Explain how you know.
- Is the point $(80, 100)$ on line ℓ ? Explain how you know.
- Write a rule that would allow you to test whether (x, y) is on line ℓ .

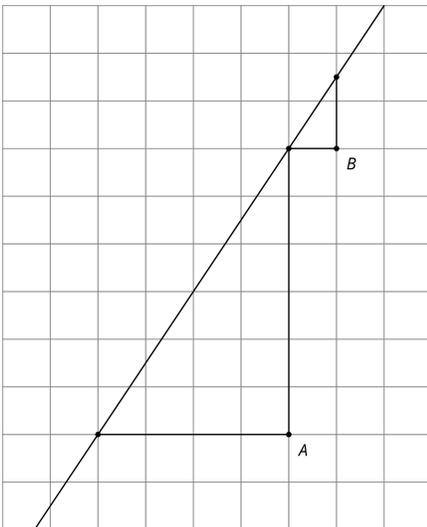
Solution

- $B = (4, 0)$ and $D = (8, 10)$
- Yes, because $\frac{20}{16} = \frac{5}{4}$. The slopes are the same.
- No, because $\frac{24}{20} \neq \frac{5}{4}$.
- Yes, because $\frac{100}{80} = \frac{5}{4}$.
- Answers vary. Sample response: $\frac{y}{x} = \frac{5}{4}$

Problem 3

Consider the graphed line.

Mai uses Triangle A and says the slope of this line is $\frac{6}{4}$. Elena uses Triangle B and says no, the slope of this line is 1.5. Do you agree with either of them? Explain.



Solution

They are both correct. The slope of a line can be found using any right triangle with legs parallel to the axes and longest side on the line, as any two such triangles are similar. Numerically, this checks out as $\frac{6}{4}$ and 1.5 represent the same value.

Problem 4

(from Unit 2, Lesson 7)

A rectangle has length 6 and height 4.

Which of these would tell you that quadrilateral $ABCD$ is definitely *not* similar to this rectangle? Select **all** that apply.

1. $AB = BC$
2. $m\angle ABC = 105^\circ$
3. $AB = 8$
4. $BC = 8$
5. $BC = 2 \cdot AB$
6. $2 \cdot AB = 3 \cdot BC$

Solution

A, B, E

Lesson 12

Problem 1

Select **all** the points that are on the line through $(0, 5)$ and $(2, 8)$.

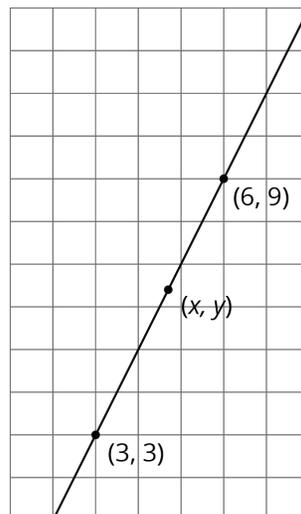
1. $(4, 11)$
2. $(5, 10)$
3. $(6, 14)$
4. $(30, 50)$
5. $(40, 60)$

Solution

A, C, D

Problem 2

All three points displayed are on the line. Find an equation relating x and y .

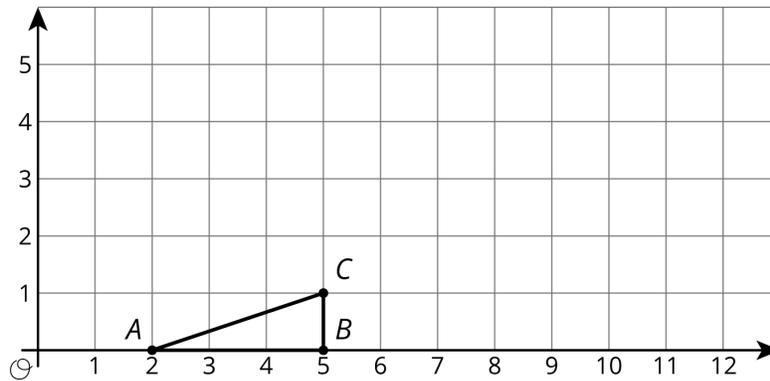


Solution

Answers vary. Sample response: $\frac{y-3}{x-3} = 2$ (or $y = 2x - 3$)

Problem 3

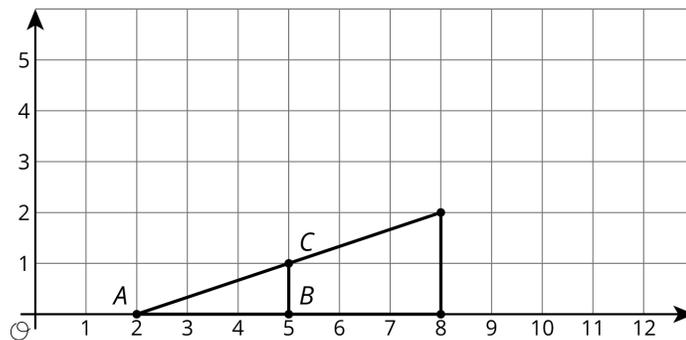
Here is triangle ABC .



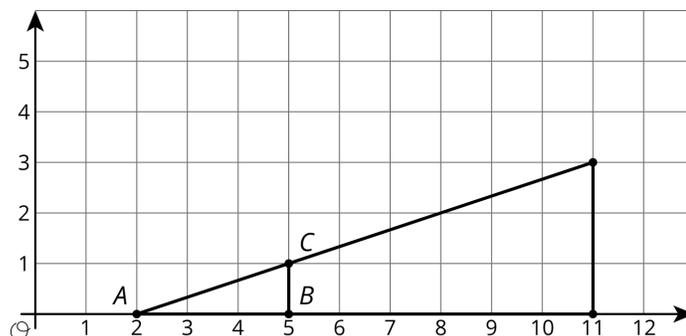
1. Draw the dilation of triangle ABC with center $(2, 0)$ and scale factor 2.
2. Draw the dilation of triangle ABC with center $(2, 0)$ and scale factor 3.
3. Draw the dilation of triangle ABC with center $(2, 0)$ and scale factor $\frac{1}{2}$.
4. What are the coordinates of the image of point C when triangle ABC is dilated with center $(2, 0)$ and scale factor s ?
5. Write an equation for the line containing all possible images of point C .

Solution

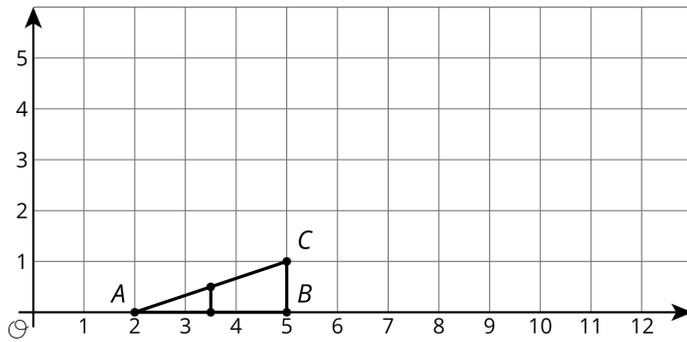
1.



2.



3.



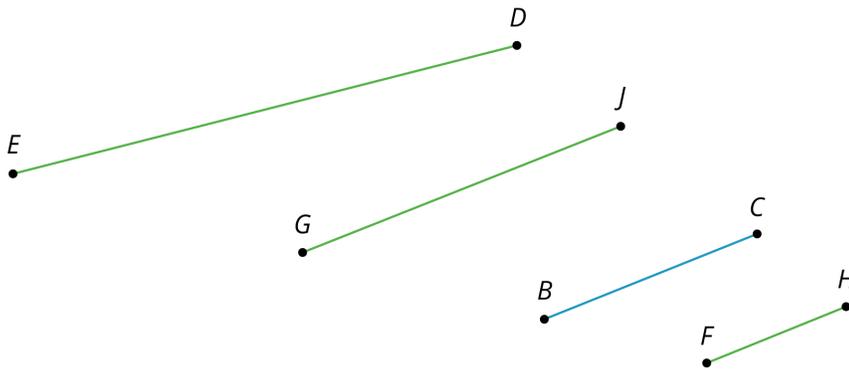
4. $(2 + 3s, s)$

5. $\frac{y}{x-2} = \frac{1}{3}$ (or equivalent)

Problem 4

(from Unit 2, Lesson 4)

Here are some line segments.



1. Which segment is a dilation of \overline{BC} using A as the center of dilation and a scale factor of $\frac{2}{3}$?
2. Which segment is a dilation of \overline{BC} using A as the center of dilation and a scale factor of $\frac{3}{2}$?
3. Which segment is not a dilation of \overline{BC} , and how do you know?

Solution

1. Segment \overline{FH} (A scale factor of $\frac{2}{3}$ produces a parallel line segment with shorter length.)
2. Segment \overline{GJ} (A scale factor of $\frac{3}{2}$ will produce a parallel line segment with longer length.)
3. Segment \overline{DE} (Dilations take lines to parallel lines, and \overline{DE} is not parallel to \overline{BC} .)