Geometry 1-2 Geometric Constructions	**UNIT 3**	Name:____________________ Teacher: ____________ Per:____

My academic goal for this unit is...

Check for Understanding Key:

- ● Understanding at start of the unit
- | Understanding after practice
- ▲ Understanding before unit test

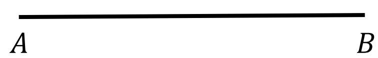
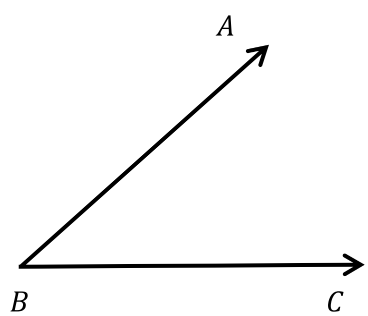
LEARNING TARGETS		How is my understanding?	Test Score	Retake?
3a	I can duplicate line segments and angles using the tools of geometry.	1 2 3 4		
3b	I can construct perpendicular lines and bisectors using the tools of geometry.	1 2 3 4		
3c	I can construct angle bisectors using the tools of geometry.	1 2 3 4		
3d	I can construct parallel lines using the tools of geometry.	1 2 3 4		
3e	I can construct medians, midsegments and altitudes in triangles using the tools of geometry	1 2 3 4		
3f	I can locate centers of triangles by constructing concurrent lines.	1 2 3 4		

Why is a right angle 90 degrees?

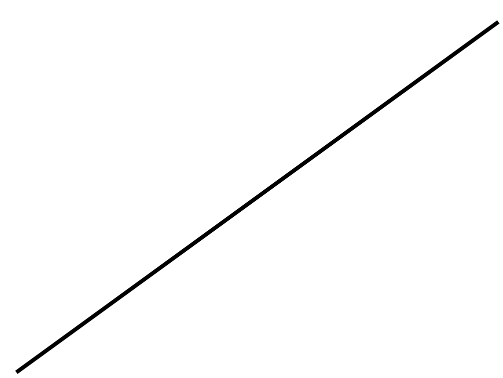
Where was geometry first developed?

DP/1 **Developing Proficiency** Not yet, Insufficient	CP/2 **Close to Proficient** Yes, but..., Minimal	PR/3 **Proficient** Yes, Satisfactory	HP/4 **Highly Proficient** WOW, Excellent
I can't do it and am not able to explain process or key points	I can sort of do it and am able to show process, but not able to identify/explain key math points	I can do it and able to both explain process and identify/explain math points	I'm great at doing it and am able to explain key math points accurately in a variety of problems

Unit 3 Definitions and Examples

Term	*Example*
Copying Segments	Construct $\overline{XY}$ so that $\overline{XY} \cong \overline{AB}$ 
Copying Angles	Construct $\angle XYZ$ so that $\angle XYZ \cong \angle ABC$ 

Term	*Definition*
Perpendicular Bisector	

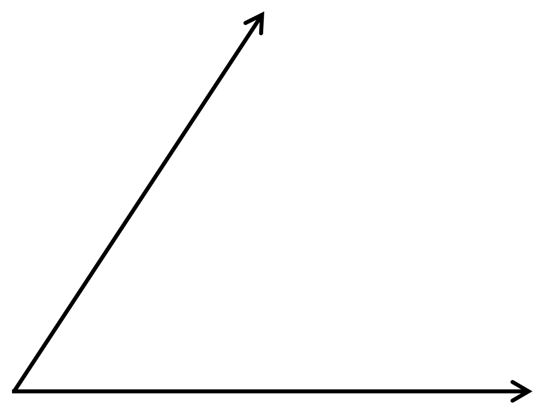
Sketch:	***Construct:***
	
Draw:	

Unit 3 Definitions and Examples

Term	***Definition***
Angle Bisector	

Sketch:

Construct:

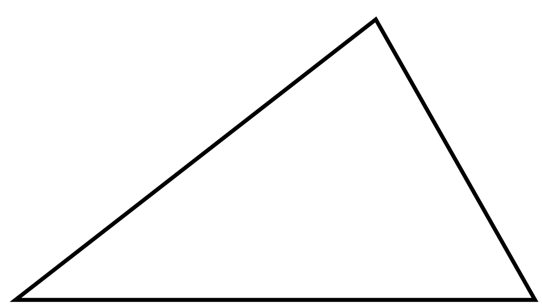


Draw:

Term	***Definition***
Midsegment	

Sketch:

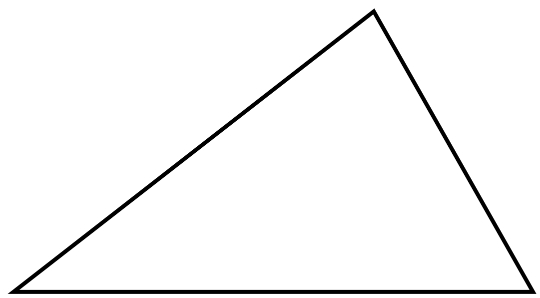
Construct:



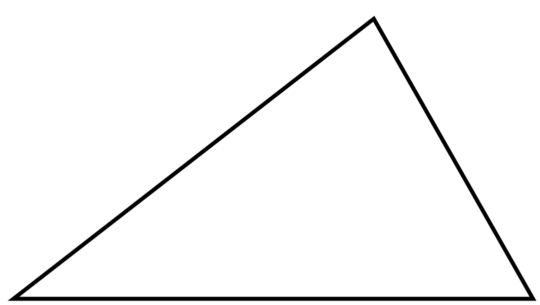
Draw:

Unit 3 Definitions and Examples

Term	***Definition***
Median	

Sketch:	***Construct:***
	
Draw:	

Term	***Definition***
Altitude	

Sketch:	***Construct:***
	
Draw:	

Unit 3 Definitions and Examples

Term	***Definition***
Parallel Lines	

Sketch:	***Construct:***
Draw:	

Term	***Definition***	***Diagram***
Concurrent Lines		
Point of Concurrency		

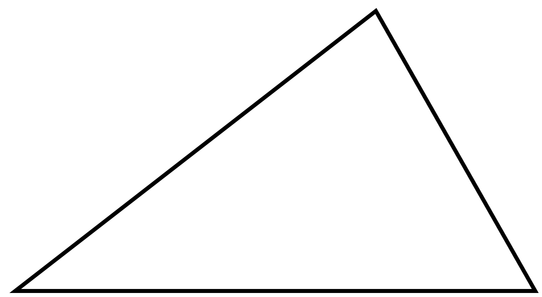
Unit 3 Definitions and Examples

Term	***Definition***
Circumcenter	The ______________________________ is the point of concurrency that is located by constructing ____. The circumcenter can be located _______________________, _____________________ or _____________________ the triangle.

Sketch:

Draw:

Construct:

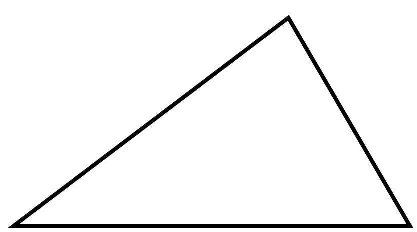


Term	***Definition***
Circumscribed Circle	

Sketch:

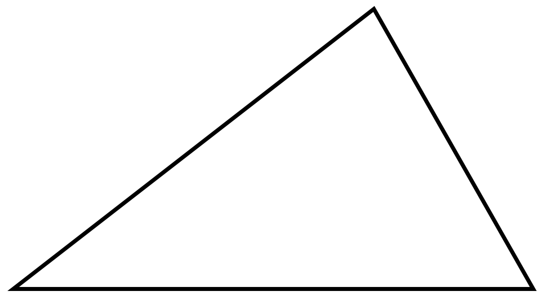
Draw:

Construct:

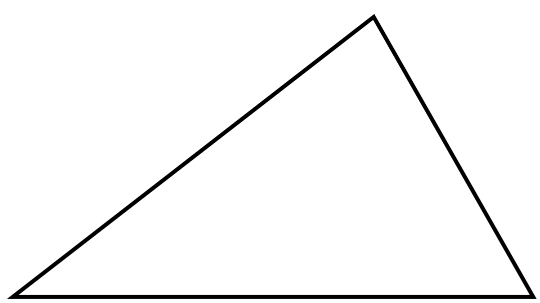


Unit 3 Definitions and Examples

Term	Definition
Incenter	The ______________________________ is the point of concurrency that is located by constructing ____. The incenter will always be located ____________________________ the triangle.

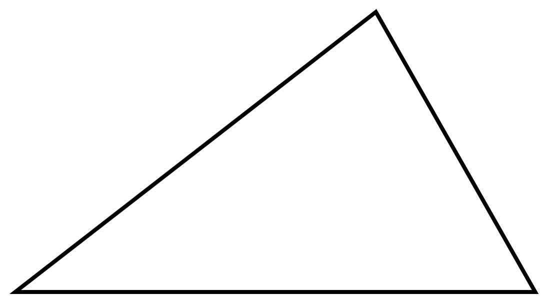
Sketch:	Construct:
	
Draw:	

Term	Definition
Inscribed Circle	

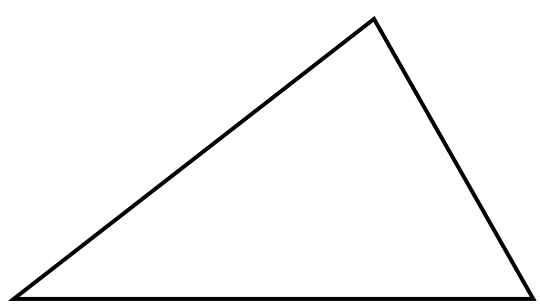
Sketch:	Construct:
	
Draw:	

Unit 3 Definitions and Examples

Term	*Definition*
Orthocenter	The ______________________________ is the point of concurrency that is located by constructing ____. The orthocenter can be located _________________________, ____________________, or ____________________ the triangle.

Sketch:	***Construct:***
	
Draw:	

Term	*Definition*
Centroid	The ______________________________ is the point of concurrency that is located by constructing ____. The centroid will always be located ____________________________ the triangle.

Sketch:	***Construct:***
	
Draw:	

Unit 3 Conjectures

Title	***Conjecture***	***Diagram***
Perpendicular Bisector Conjecture	If a point is on the perpendicular bisector of a segment, then it is ______________________________ from the endpoints.	
Converse of Perp. Bisector Conjecture	If a point is equidistant from the endpoints of a segment, then it is on the ________________________ ______________________of the segment.	
Shortest Distance Conjecture	The shortest distance from a point to a line is measured along the ____________________________ ______________________from the point to the line.	
Angle Bisector Conjecture	If a point is on the bisector of an angle, then it is ___________________________ from the sides of the angle.	
Angle Bisector Concurrency Conjecture	The three angle bisectors of a triangle ____________ ____, or ____.	
Perp. Bisector Concurrency Conjecture	The three perpendicular bisectors of a triangle ____.	
Altitude Concurrency Conjecture	The three altitudes (or lines containing the altitudes) of a triangle ___________________________ ____.	
Circumcenter Conjecture	The circumcenter of a triangle __________________ ____ ____.	

Unit 3 Conjectures

Title	*Conjecture*	*Diagram*
Incenter Conjecture	The incenter of a triangle ____________________________ ____ ____.	
Median Concurrency Conjecture	The three medians of a triangle _____________________ ____.	
Centroid Conjecture	The centroid of a triangle divides each median into two parts so that the distance from the centroid to the vertex is _________________________ the distance from the centroid to the midpoint of the opposite side.	
Center of Gravity Conjecture	The _____________________________________ is the center of gravity of the triangular region.	
BONUS Euler Line Conjecture	The __________________________, ________________________, and ____________________________ are three points of concurrency that always lie on a line.	
BONUS Euler Segment Conjecture	The __________________________ divides the Euler segment into two parts so that the smaller part is ________________ the larger part.	

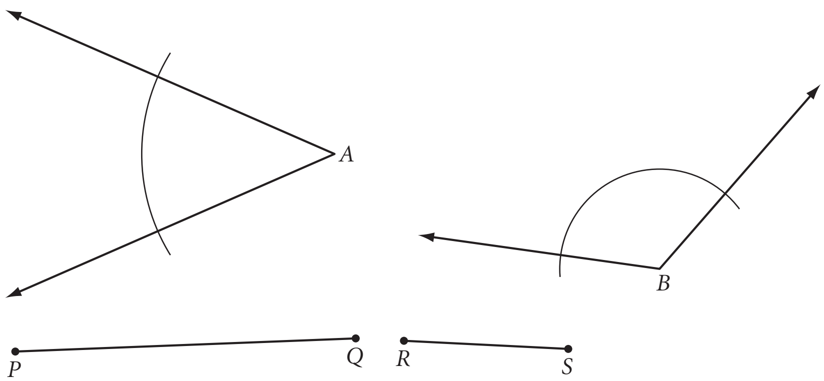
Notes

Notes

Lesson 3.1 • Duplicating Segments and Angles

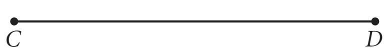
Name ______________________________ **Period** __________ **Date** ____________

In Exercises 1–3, use the segments and angles below. Complete the constructions on a separate piece of paper.



1. Using only a compass and straightedge, duplicate each segment and angle. There is an arc in each angle to help you.
2. Construct a line segment with length $3PQ - 2RS$.
3. Duplicate the two angles so that the angles have the same vertex and share a common side, and the nonshared side of one angle falls inside the other angle. Then use a protractor to measure the three angles you created. Write an equation relating their measures.
4. Use a compass and straightedge to construct an isosceles triangle with two sides congruent to $\overline{AB}$ and base congruent to $\overline{CD}$.

5. Repeat Exercise 4 with patty paper and a straightedge.
6. Construct an equilateral triangle with sides congruent to $\overline{CD}$.



Lesson 3.2 • Constructing Perpendicular Bisectors

Name ______________________ **Period** ________ **Date** __________

For Exercises 1–6, construct the figures on a separate sheet of paper using only a compass and a straightedge.

1. Draw a segment and construct its perpendicular bisector.

2. Construct two congruent segments that are the perpendicular bisectors of each other. Form a quadrilateral by connecting the four endpoints. What type of quadrilateral does this seem to be?

3. Duplicate $\overline{AB}$. Then construct a segment with length $\frac{5}{4}AB$.

4. Draw a segment; label it $\overline{CM}$. $\overline{CM}$ is a median of $\triangle ABC$. Construct $\triangle ABC$. Is $\triangle ABC$ unique? If not, construct a different triangle, $\triangle A'B'C$, also having $\overline{CM}$ as a median.

5. Draw a segment; label it $\overline{PQ}$. $\overline{PQ}$ is a midsegment of $\triangle ABC$. Construct $\triangle ABC$. Is $\triangle ABC$ unique? If not, construct a different triangle, $\triangle A'B'C'$, also having $\overline{PQ}$ as a midsegment.

6. Construct a right triangle. Label it $\triangle ABC$ with right angle B. Construct median $\overline{BD}$. Compare BD, AD, and CD.

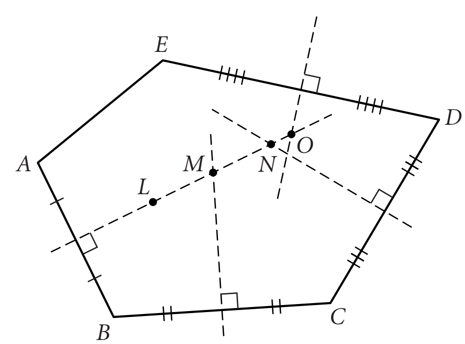
7. Complete each statement as fully as possible.

a. L is equidistant from ______________.

b. M is equidistant from ______________.

c. N is equidistant from ______________.

d. O is equidistant from ______________.



Lesson 3.3 • Constructing Perpendiculars to a Line

Name ________________________________ **Period** __________ **Date** ____________

For Exercises 1–5, decide whether each statement is true or false. If the statement is false, explain why or give a counterexample.

1. In a triangle, an altitude is shorter than either side from the same vertex.

2. In a triangle, an altitude is shorter than the median from the same vertex.

3. In a triangle, if a perpendicular bisector of a side and an altitude coincide, then the triangle is isosceles.

4. Exactly one altitude lies outside a triangle.

5. The intersection of the perpendicular bisectors of the sides lies inside the triangle.

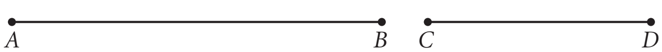
For Exercises 6 and 7, use patty paper. Attach your patty paper to your worksheet.

6. Construct a right triangle. Construct the altitude from the right angle to the opposite side.

7. Mark two points, P and Q. Fold the paper to construct square $PQRS$.

Use your compass and straightedge and the definition of distance to complete Exercises 8 and 9 on a separate sheet of paper.

8. Construct a rectangle with sides equal in length to $\overline{AB}$ and $\overline{CD}$.



9. Construct a large equilateral triangle. Let P be any point inside the triangle. Construct $\overline{WX}$ equal in length to the sum of the distances from P to each of the sides. Let Q be any other point inside the triangle. Construct $\overline{YZ}$ equal in length to the sum of the distances from Q to each side. Compare WX and YZ.

Lesson 3.4 • Constructing Angle Bisectors

Name ______________________________ **Period** __________ **Date** ______________

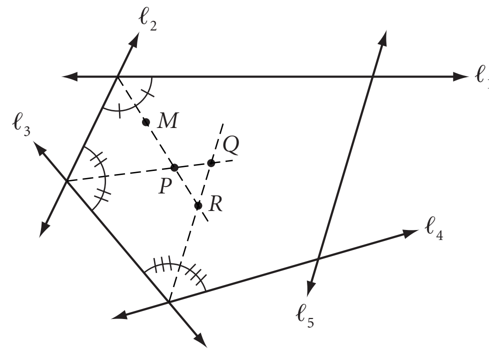
1. Complete each statement as fully as possible.

a. *M* is equidistant from ______________.

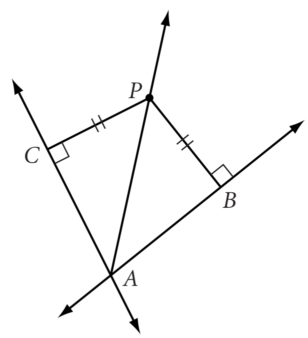
b. *P* is equidistant from ______________.

c. *Q* is equidistant from ______________.

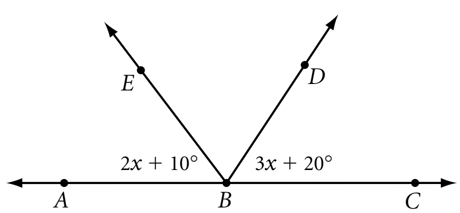
d. *R* is equidistant from ______________.



2. If the converse of the Angle Bisector Conjecture is true, what can you conclude about this figure?



3. If *BE* bisects $\angle ABD$, find *x* and $m\angle ABE$.



4. Draw an obtuse angle. Use a compass and straightedge to construct the angle bisector. Draw another obtuse angle and fold to construct the angle bisector.

5. Draw a large triangle on patty paper. Fold to construct the three angle bisectors. What do you notice?

For Exercises 6 and 7, construct a figure with the given specifications using a straightedge and compass or patty paper. Use additional sheets of paper to show your work.

6. Using only your compass and straightedge, construct an isosceles right triangle.

7. Construct right triangle *RGH* with right angle *R*. Construct median $\overline{RM}$, perpendicular $\overline{MN}$ from *M* to $\overline{RG}$, and perpendicular $\overline{MO}$ from *M* to $\overline{RH}$. Compare *RN* and *GN*, and compare *RO* and *HO*.

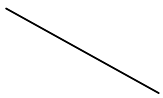
Geometry 1-2 Name: ______________________________

Constructions

Date: ________________________ Period: ______

Construct a line segment congruent to each given line segment.

1)



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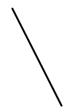
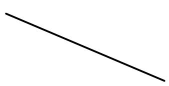
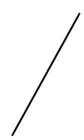


3)

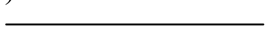


4)

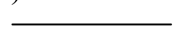


Construct a line segment whose length is equal to the sum of the lengths of the given line segments.

5)

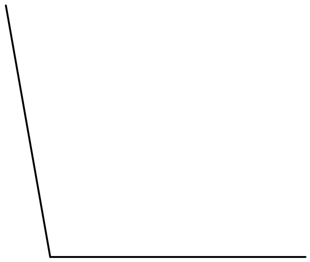


6)



Construct a copy of each angle given.

7)



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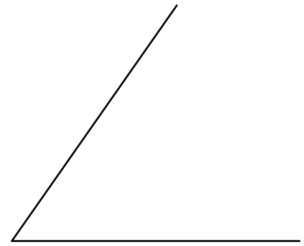
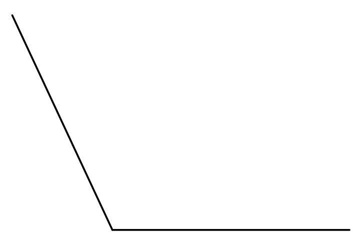


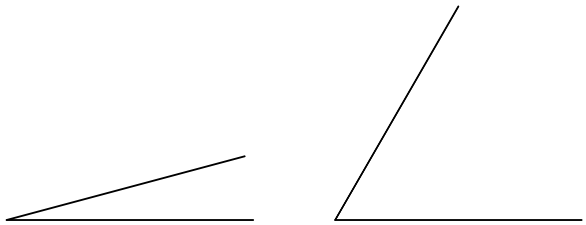
9)

10)



Construct an angle whose measure is equal to the sum of the measures of the angles given.

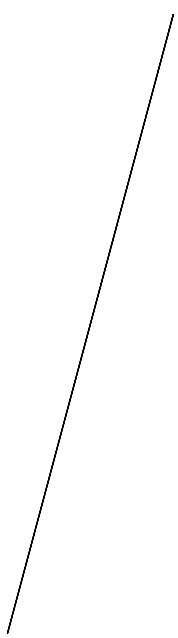
11)



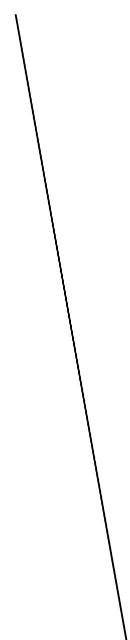
12)

Construct the perpendicular bisector of each.

13)

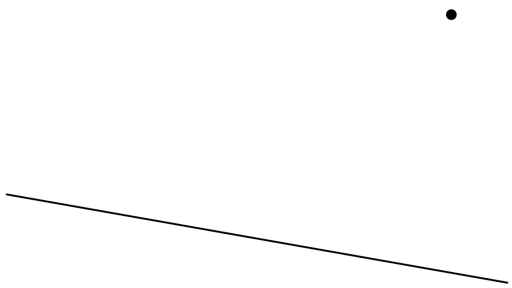


14)

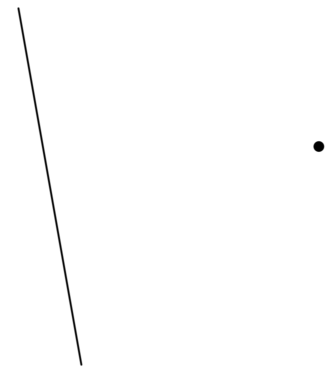


Construct a line segment perpendicular to the segment given through the point given.

15)

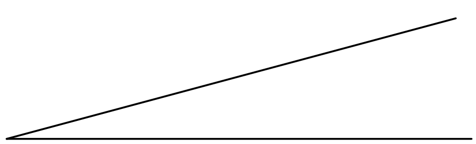


16)



Construct the bisector of each angle.

17)



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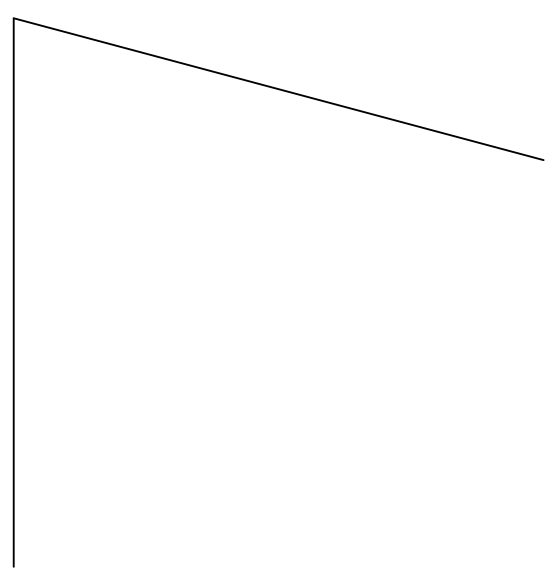


Lesson 3.5 • Constructing Parallel Lines

Name ______________________________ **Period** __________ **Date** ____________

For Exercises 1–6, construct a figure with the given specifications using a straightedge and compass or patty paper. Use additional sheets of paper to show your work.

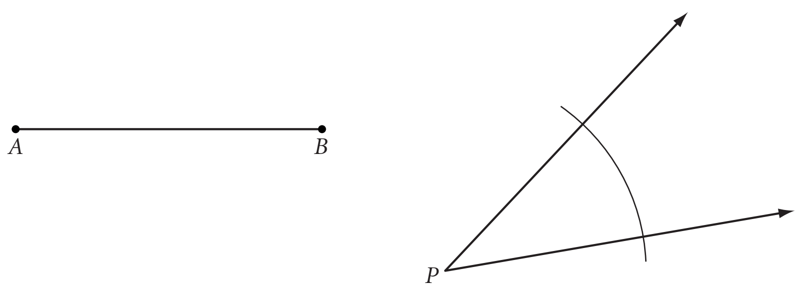
1. Draw a line and a point not on the line. Use a compass and straightedge to construct a line through the given point parallel to the given line.

2. Repeat Exercise 1, but draw the line and point on patty paper and fold to construct the parallel line.

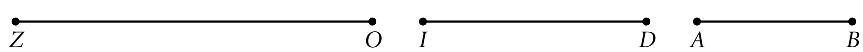
3. Use a compass and straightedge to construct a parallelogram.

4. Use patty paper and a straightedge to construct an isosceles trapezoid.

5. Construct a rhombus with sides equal in length to $\overline{AB}$ and having an angle congruent to $\angle P$.



6. Construct trapezoid *ZOID* with $\overline{ZO}$ and $\overline{ID}$ as nonparallel sides and *AB* as the distance between the parallel sides.



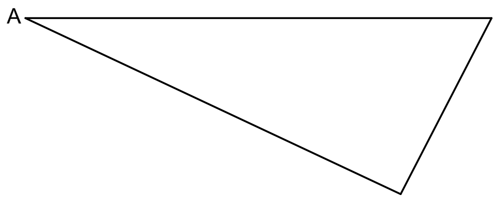
Geometry 1-2 Name: ____________________

Construct Medians and Altitudes

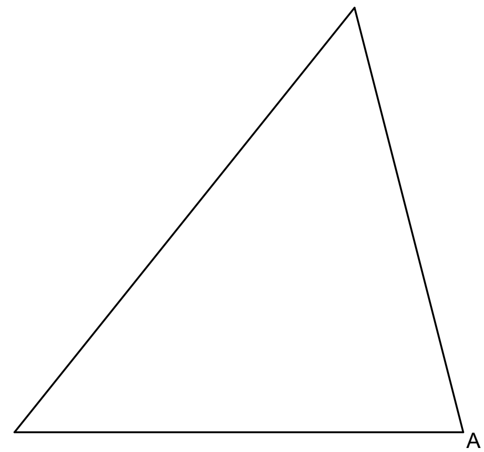
Date: ________________ Period: ______

For each triangle, construct the median from vertex A.

1)

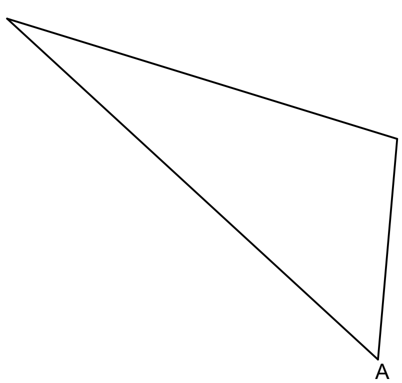


2)

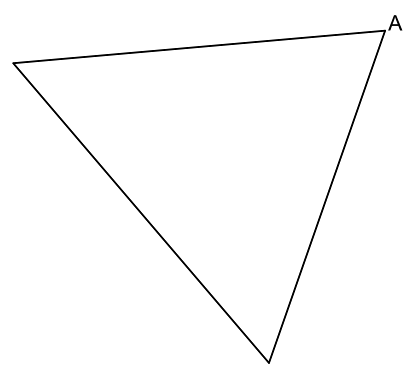


For each triangle, construct the altitude from vertex A.

3)



4)

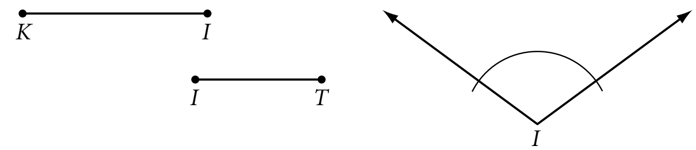


Lesson 3.6 • Construction Problems

Name ______________________ Period __________ Date ______________

For Exercises 1–5, construct a figure with the given specifications using either a compass and straightedge or patty paper. Use additional sheets of paper to show your work.

1. Construct kite *KITE* using these parts.

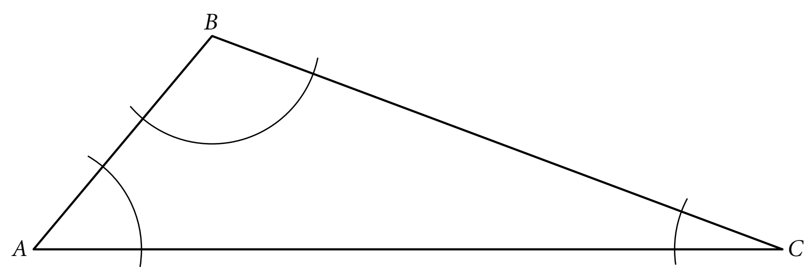


2. Construct a rectangle with perimeter the length of this segment.

3. Construct a rectangle with this segment as its diagonal.

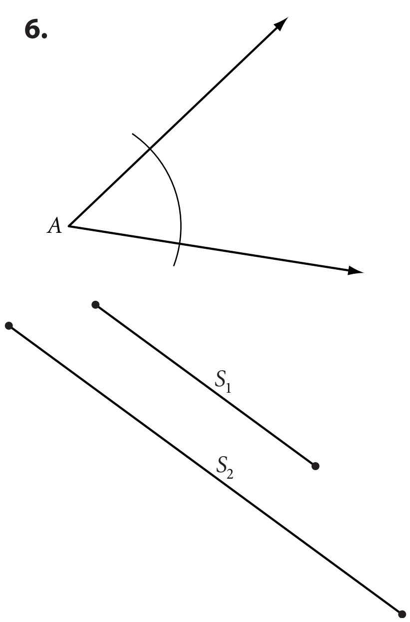
4. Draw obtuse $\triangle OBT$. Construct and label the three altitudes $\overline{OU}$, $\overline{BS}$, and $\overline{TE}$.

5. Construct a triangle congruent to $\triangle ABC$. Describe your steps.

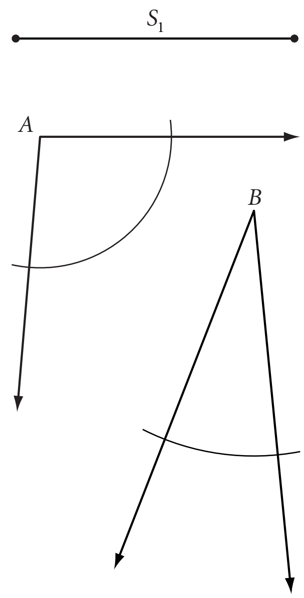


In Exercises 6–8, construct a triangle using the given parts. Then, if possible, construct a different (noncongruent) triangle using the same parts.

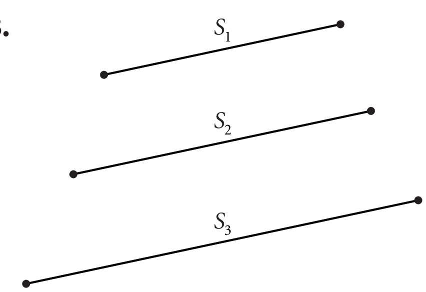
6.



7.



8.



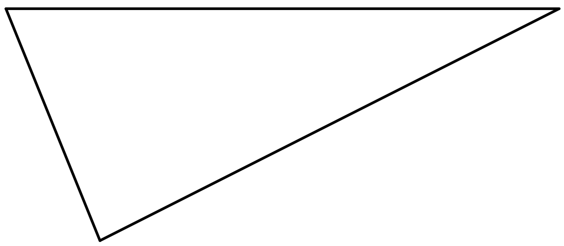
Geometry 1-2 Name: ______________________________

Practice: Construction Problems

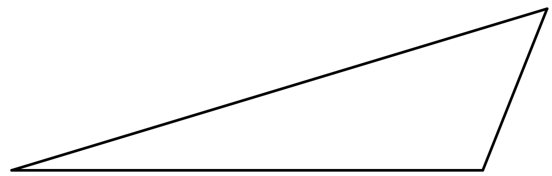
Date: ________________________ Period: ______

Construct a copy of the triangle given.

1)



2)



Construct an equilateral triangle.

3)

Construct an isosceles triangle given the length of the base and the length of the sides.

4)

Base:

Side:

5)

Base:

Side:

Construct a 30-60-90 triangle using the segment given as the hypotenuse.

6)

7)

Construct a triangle using the given information.

8)

Side 1:

Side 2:

Side 3:

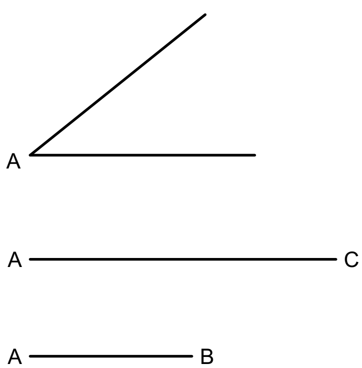
9)

Side 1:

Side 2:

Side 3:

10)



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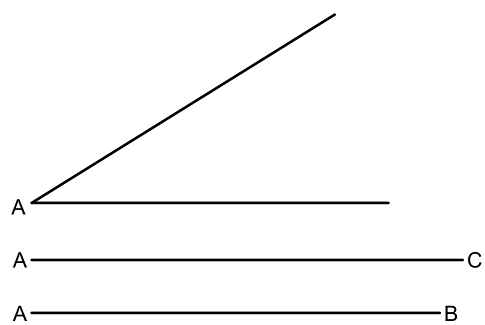

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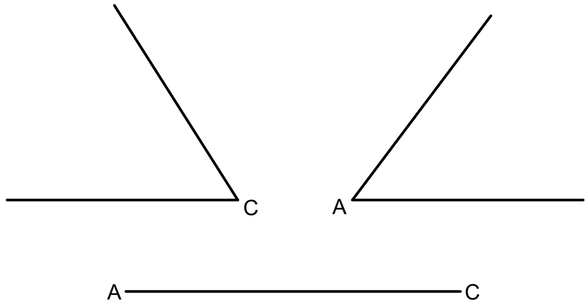

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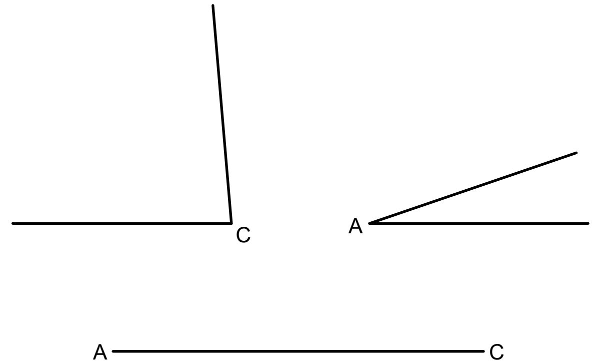

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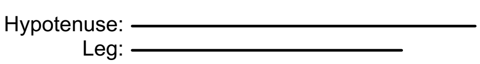

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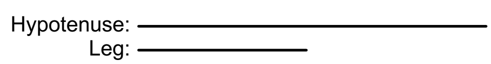


Lesson 3.7 • Constructing Points of Concurrency

Name ________________________ **Period** __________ **Date** ____________

For Exercises 1 and 2, make a sketch and explain how to find the answer.

1. A circular revolving sprinkler needs to be set up to water every part of a triangular garden. Where should the sprinkler be located so that it reaches all of the garden, but doesn't spray farther than necessary?

2. You need to supply electric power to three transformers, one on each of three roads enclosing a large triangular tract of land. Each transformer should be the same distance from the power-generation plant and as close to the plant as possible. Where should you build the power plant, and where should you locate each transformer?

For Exercises 3–5, construct a figure with the given specifications using a compass and straightedge. Use additional sheets of paper to show your work.

3. Draw an obtuse triangle. Construct the inscribed and the circumscribed circles.

4. Construct an equilateral triangle. Construct the inscribed and the circumscribed circles. How does this construction differ from Exercise 3?

5. Construct two obtuse, two acute, and two right triangles. Locate the circumcenter of each triangle. Make a conjecture about the relationship between the location of the circumcenter and the measure of the angles.

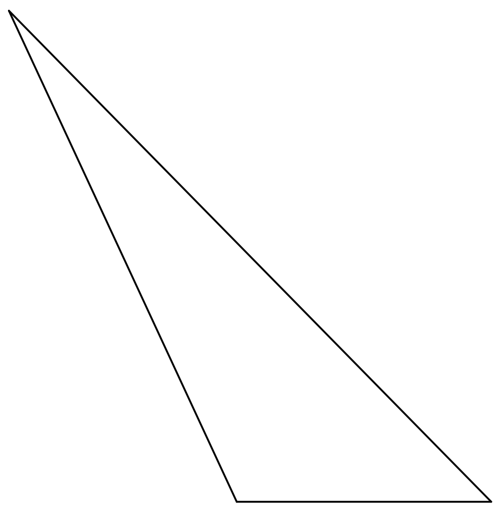
Geometry 1-2 Name: ___________________________________

Construct: Triangle Centers

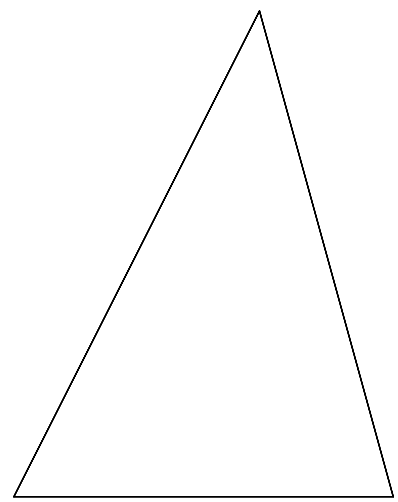
Date: ________________________ Period: ______

Locate the circumcenter of each triangle.

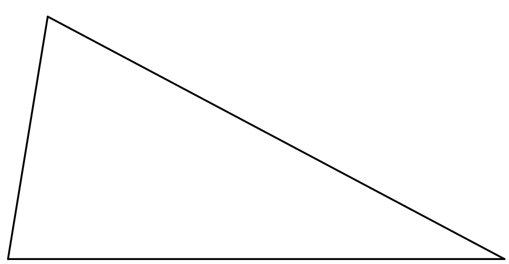
1)



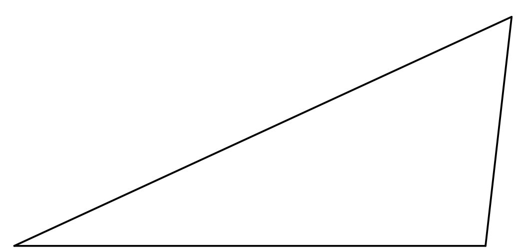
2)



3)

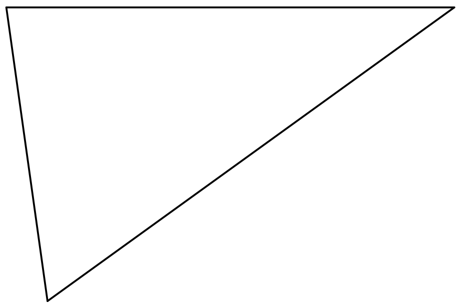


4)

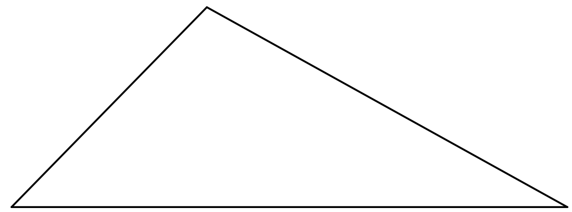


Circumscribe a circle about each triangle.

5)

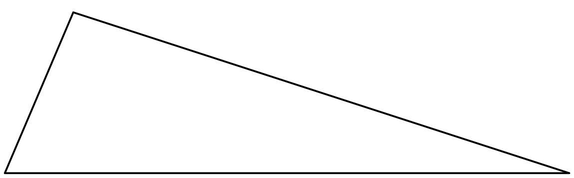


6)

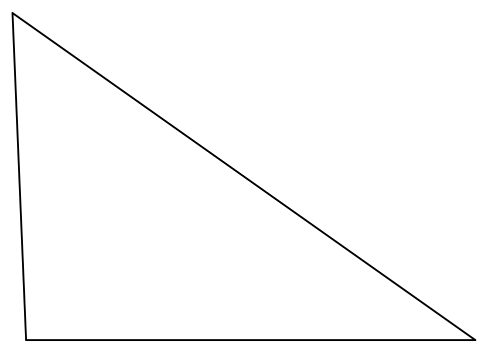


Locate the incenter of each triangle.

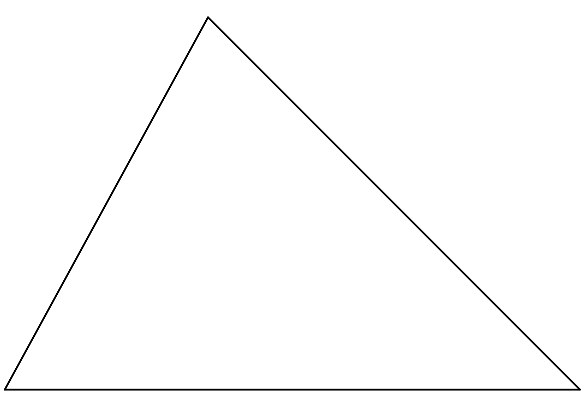
7)



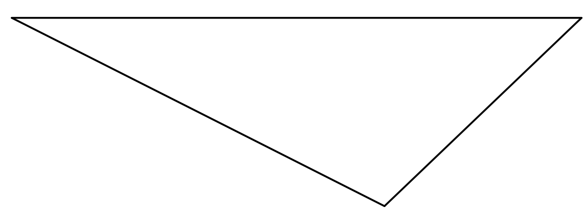
8)



9)

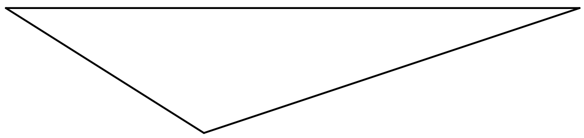


10)

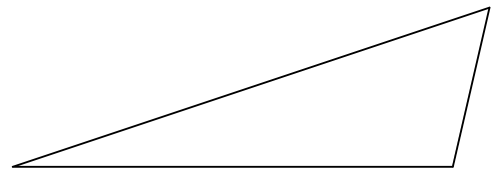


Inscribe a circle in each triangle.

11)

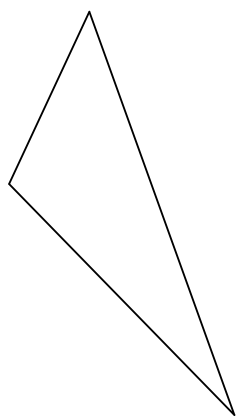


12)



Locate the orthocenter of each triangle.

13)



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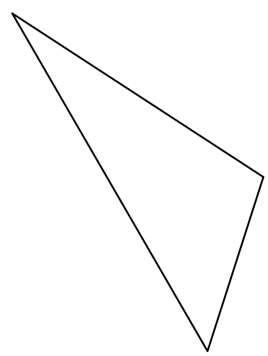
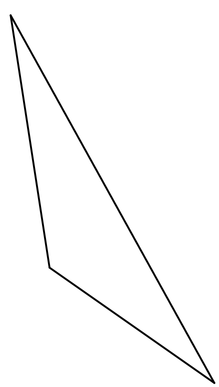
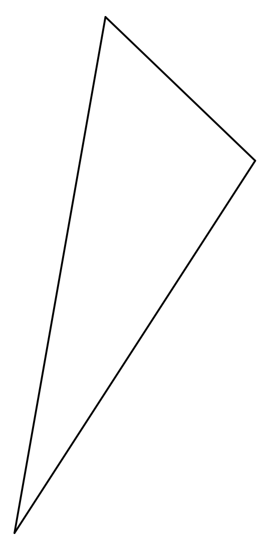


15)

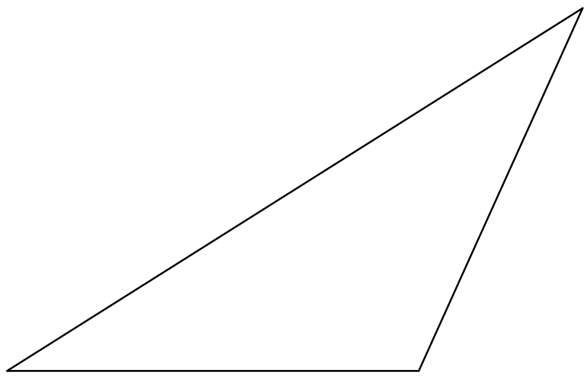


16)

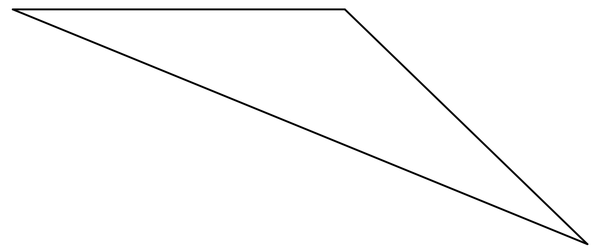


Locate the centroid of each triangle.

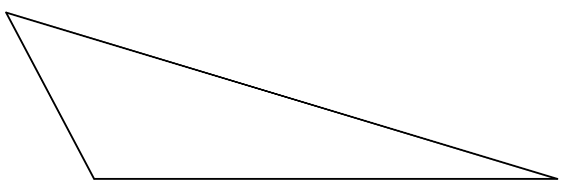
17)



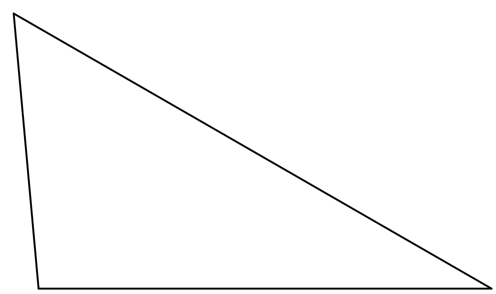
18)



19)



20)



Lesson 3.8 • The Centroid

Name ______________________ **Period** ________ **Date** ____________

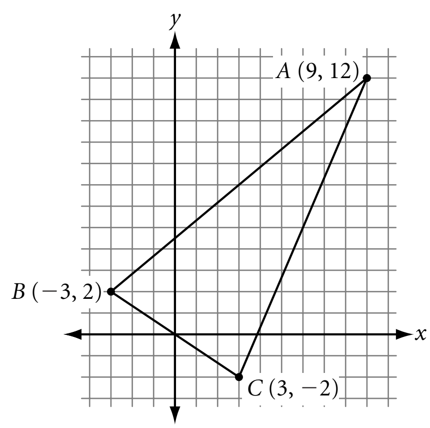
For Exercises 1–3, use additional sheets of paper to show your work.

1. Draw a large acute triangle. Construct the centroid.

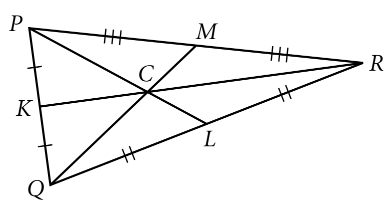
2. Construct a regular hexagon and locate its center of gravity.

3. Use a ruler and compass to find the center of gravity of a sheet-metal triangle with sides measuring 6 cm, 8 cm, and 10 cm. How far is the center from each vertex, to the nearest tenth of a centimeter?

4. $\triangle ABC$ has vertices $A(9, 12)$, $B(-3, 2)$, and $C(3, -2)$. Find the coordinates of the centroid.



5. $PL = 24$, $QC = 10$, and $KC = 7$. Find PC, CL, QM, and CR.



6. Identify each statement as describing the incenter, circumcenter, orthocenter, or centroid.

a. ______________ The point equally distant from the three sides of a triangle.

b. ______________ The center of gravity of a thin metal triangle.

c. ______________ The point equidistant from the three vertices.

d. ______________ The intersection of the perpendicular bisectors of the sides of a triangle.

e. ______________ The intersection of the altitudes of a triangle.

f. ______________ The intersection of the angle bisectors of a triangle.

g. ______________ The intersection of the medians of a triangle.

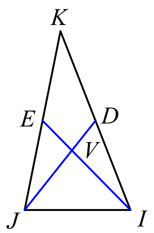
Geometry 1-2 Name: ____________________

Practice - The Centroid

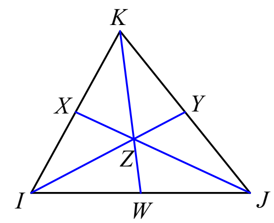
Date: ____________________ Period: ______

Each figure shows a triangle with one or more of its medians.

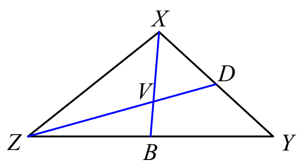
1) Find IE if $IV = 2$



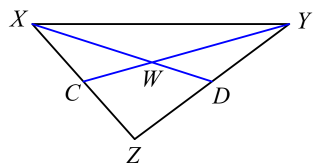
2) Find IY if $ZY = 2.5$



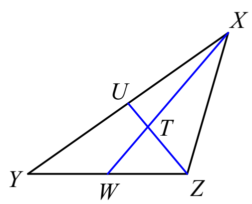
3) Find ZD if $VD = 2.9$



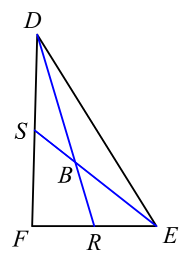
4) Find YW if $WC = 2.3$



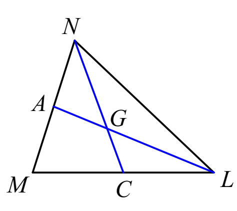
5) Find ZT if $TU = 9.8$



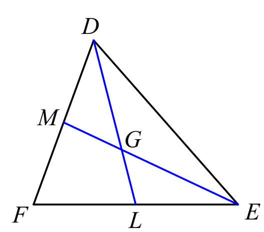
6) Find EB if $ES = 27$



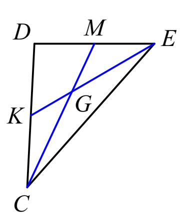
7) Find x if $NG = x - 2$ and $NC = 2x - 8$



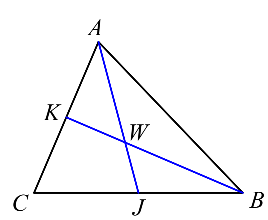
8) Find x if $DG = x - 4$ and $DL = 2x - 11$



9) Find x if $EG = 2x - 4$ and $GK = 2x - 5$



10) Find x if $BW = 2x$ and $BK = 2 + 2x$



Unit 3 • Challenge Problems

1. (*Target 3a*)
   Construct **<u>regular</u>** octagon *ALTOSIGN*

2. (*Target 3d*)
   Construct a large scalene acute triangle and label it ΔPAR. Place point E anywhere on side PR, and construct a line $\overleftrightarrow{EL}$ parallel to side $\overline{PA}$. Use your ruler to measure the lengths of the four segments $\overline{AL}$, $\overline{LR}$, $\overline{RE}$, and $\overline{EP}$, and compare ratios $\frac{RL}{LA}$ and $\frac{RE}{EP}$. Notice anything special?

Unit 3 • Challenge Problems

Using Geogebra software on a chrome book or your mobile device answer the following questions.

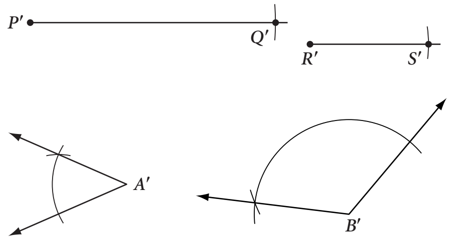
3. (*Target 3e*)
   Draw a large scalene obtuse triangle ABC with $\angle B$ the obtuse angle. Construct the angle bisector $\overrightarrow{BR}$, the median $\overline{BM}$, and the altitude $\overline{BS}$. What is the order of the points on $\overline{AC}$? Drag B. Is the order of points always the same? Write a conjecture.

4. (*Target 3f*)
   Is it possible for the midpoints of the three altitudes of a triangle to be collin ear? Write a paragraph describing your findings.

5. (*Target 1f*)
   Complete the activity on pages 189-190 in the text book about The Euler Line. Once finished, complete the two bonus conjectures.

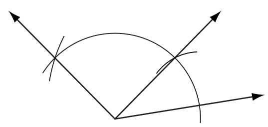
LESSON 3.1 • Duplicating Segments and Angles

1.

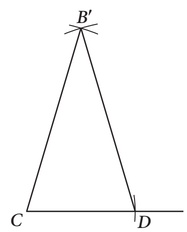


2. $XY = 3PQ - 2RS$

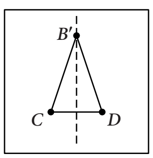
3. Possible answer:
$128° - 35° = 93°$



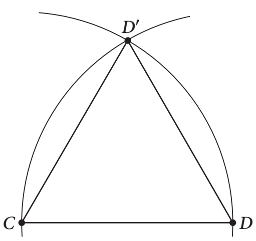
4.



5.

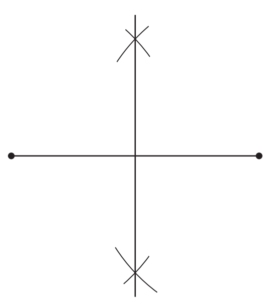


6.

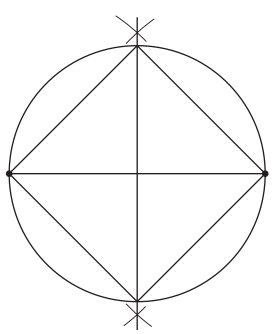


LESSON 3.2 • Constructing Perpendicular Bisectors

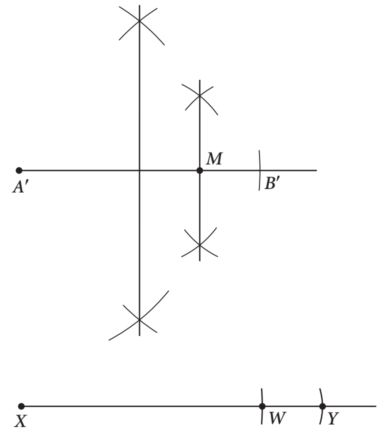
1.



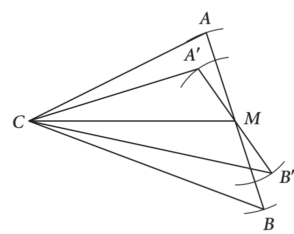
2. Square



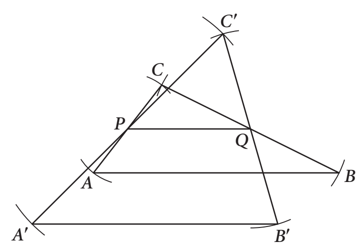
3. $XY = \frac{5}{4}AB$



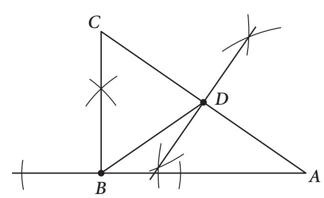
4. $\triangle ABC$ is not unique.



5. $\triangle ABC$ is not unique.



6. $BD = AD = CD$



7. **a.** *A* and *B*

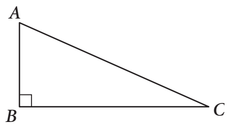
b. *A*, *B*, and *C*

c. *A* and *B* and from *C* and *D* (but not from *B* and *C*)

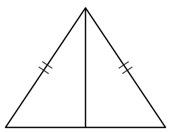
d. *A* and *B* and from *D* and *E*

LESSON 3.3 • Constructing Perpendiculars to a Line

1. False. The altitude from A coincides with the side so it is not shorter.



2. False. In an isosceles triangle, an altitude and median coincide so they are of equal length.

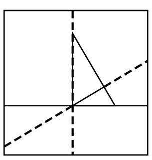


3. True

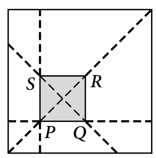
4. False. In an acute triangle, all altitudes are inside. In a right triangle, one altitude is inside and two are sides. In an obtuse triangle, one altitude is inside and two are outside. There is no other possibility so exactly one altitude is never outside.

5. False. In an obtuse triangle, the intersection of the perpendicular bisectors is outside the triangle.

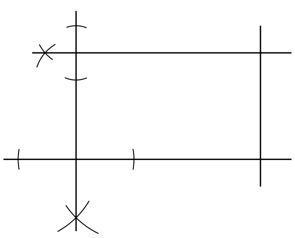
6.



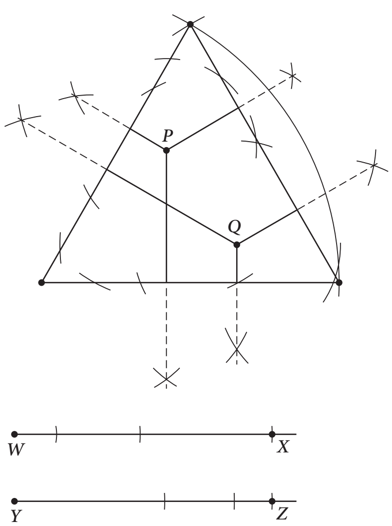
7.



8.



9. $WX = YZ$



LESSON 3.4 • Constructing Angle Bisectors

1. a. ℓ_1 and ℓ_2

b. ℓ_1, ℓ_2, and ℓ_3

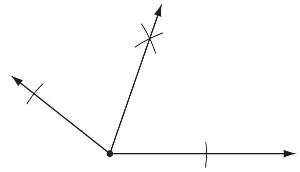
c. ℓ_2, ℓ_3, and ℓ_4

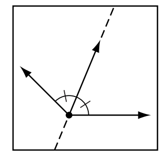
d. ℓ_1 and ℓ_2 and from ℓ_3 and ℓ_4

2. $\overrightarrow{AP}$ is the bisector of $\angle CAB$

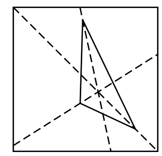
3. $x = 20°$, $m\angle ABE = 50°$

4.

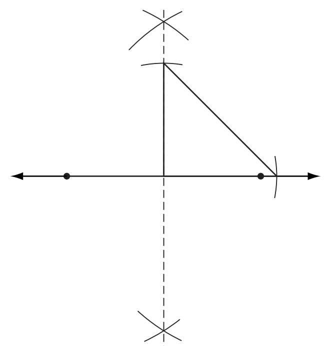




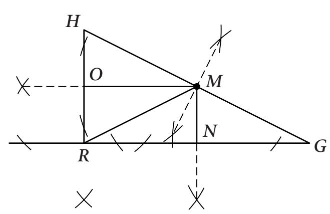
5. They are concurrent.



6.

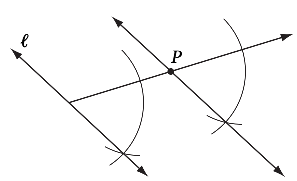


7. $RN = GN$ and $RO = HO$

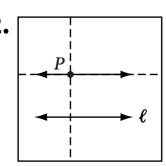


LESSON 3.5 • Constructing Parallel Lines

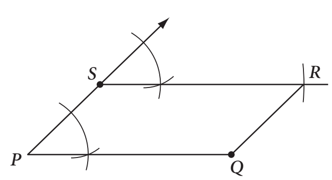
1.



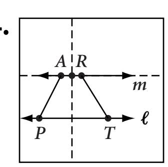
2.



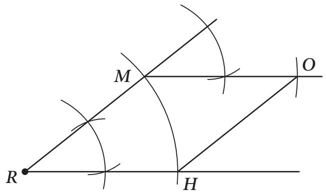
3.



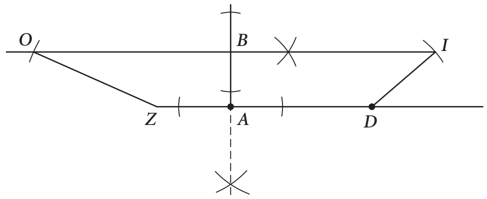
4.



5.

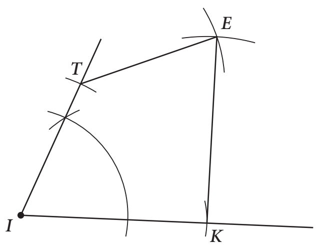


6. Possible answer:

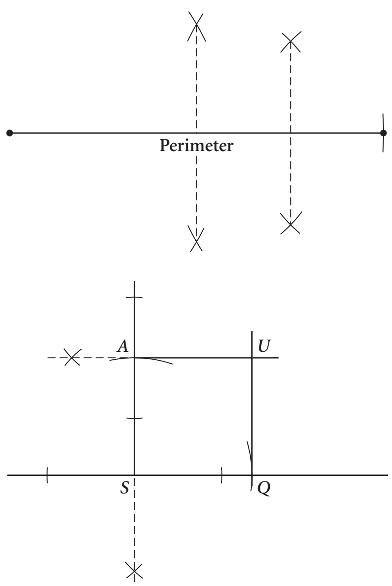


LESSON 3.6 • Construction Problems

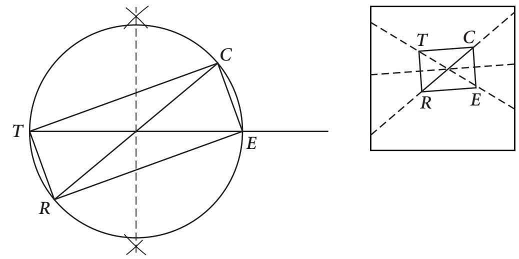
1. Possible answer:



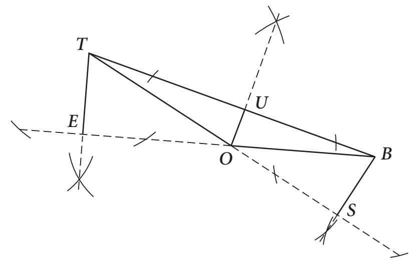
2. Possible answer:



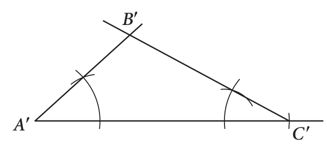
3. Possible answers:



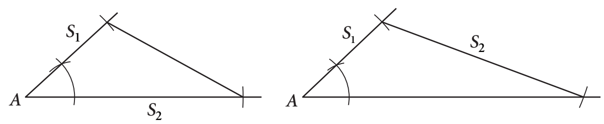
4. Possible answer:



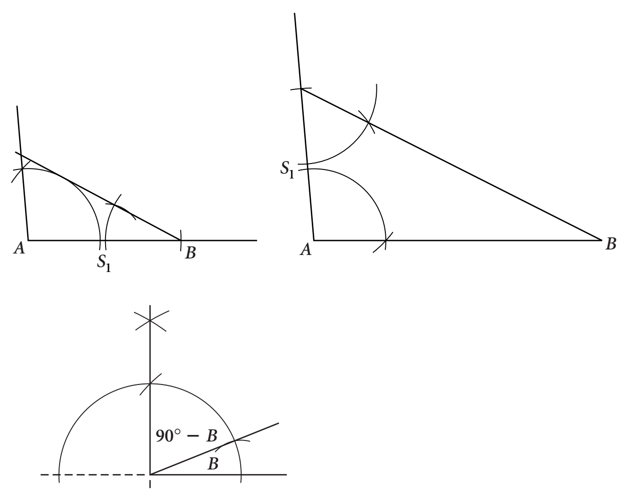
5. Possible answer:



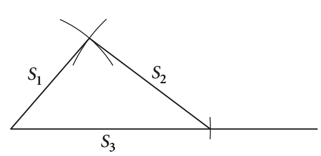
6. Possible answer:



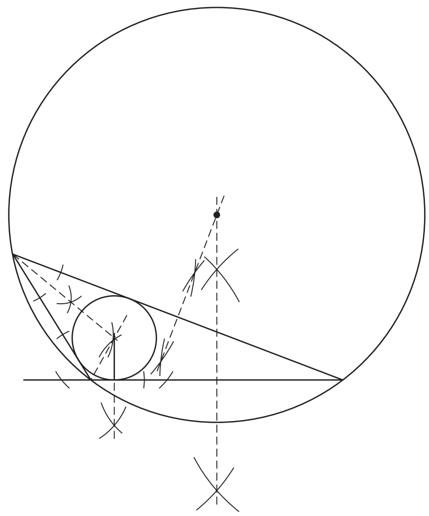
7. Possible answer:

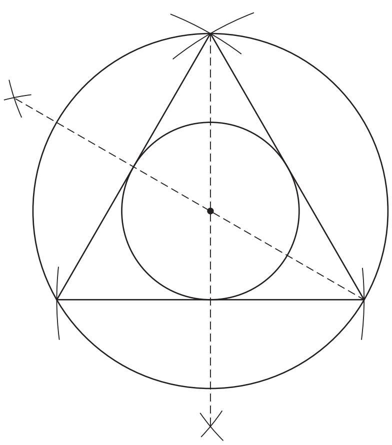


8.



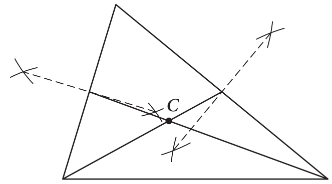
LESSON 3.7 • Constructing Points of Concurrency

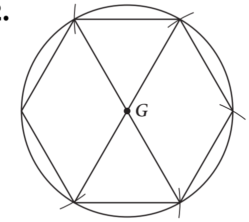
1. Circumcenter
2. Locate the power-generation plant at the incenter. Locate each transformer at the foot of the perpendicular from the incenter to each side.
3. 
4. Possible answer: In the equilateral triangle, the centers of the inscribed and circumscribed circles are the same. In the obtuse triangle, one center is outside the triangle.



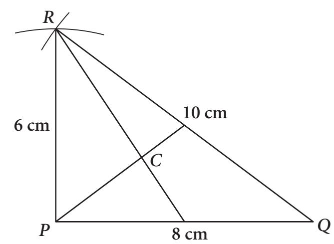
5. Possible answer: In an acute triangle, the circumcenter is inside the triangle. In a right triangle, it is on the hypotenuse. In an obtuse triangle, the circumcenter is outside the triangle. (Constructions not shown.)

LESSON 3.8 • The Centroid

1. 

2. 

3. $CP = 3.3$ cm, $CQ = 5.7$ cm, $CR = 4.8$ cm



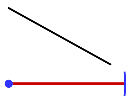
4. (3, 4)
5. $PC = 16$, $CL = 8$, $QM = 15$, $CR = 14$
6. **a.** Incenter **b.** Centroid
   c. Circumcenter **d.** Circumcenter
   e. Orthocenter **f.** Incenter
   g. Centroid

LESSON 4.1 • Triangle Sum Conjecture

1. $p = 67°$, $q = 15°$
2. $x = 82°$, $y = 81°$
3. $a = 78°$, $b = 29°$
4. $r = 40°$, $s = 40°$, $t = 100°$
5. $x = 31°$, $y = 64°$
6. $y = 145°$
7. $s = 28°$
8. $m = 72\frac{1}{2}°$
9. $m\angle P = a$
10. $m\angle QPT = 135°$
11. 720°
12. The sum of the measures of $\angle A$ and $\angle B$ is 90° because $m\angle C$ is 90° and all three angles must be 180°. So, $\angle A$ and $\angle B$ are complementary.
13. $m\angle BEA = m\angle CED$ because they are vertical angles. Because the measures of all three angles in each triangle add to 180°, if equal measures are subtracted from each, what remains will be equal.

Answers to Constructions

1)



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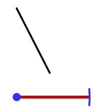

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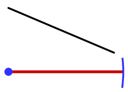

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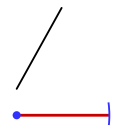

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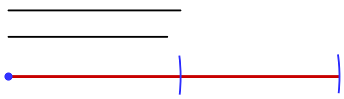

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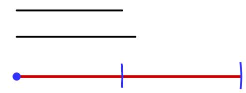

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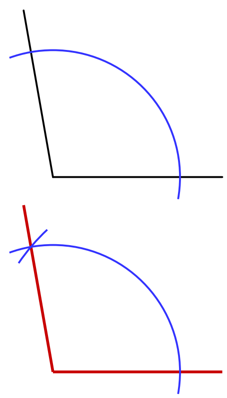

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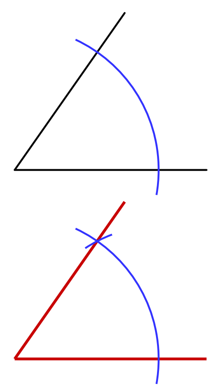

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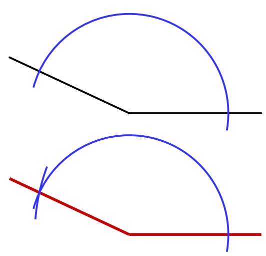

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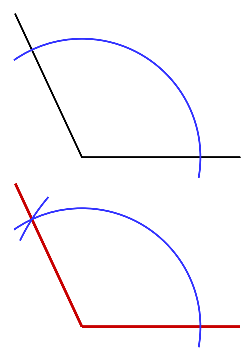

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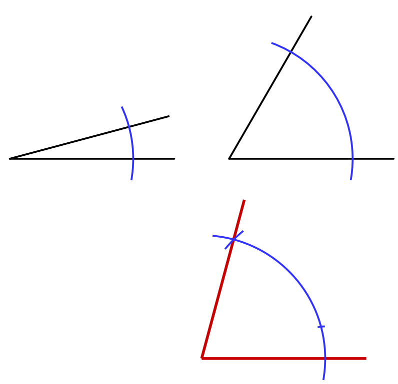

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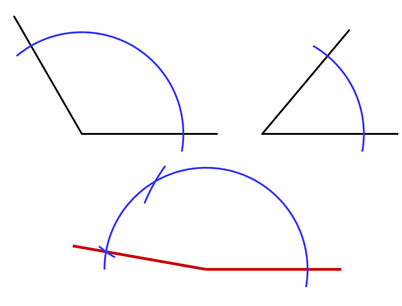

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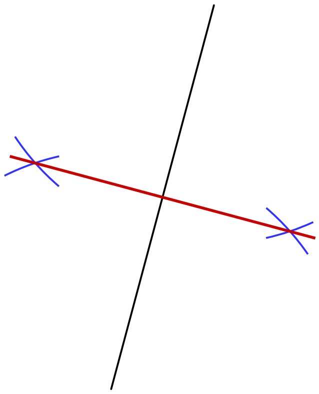

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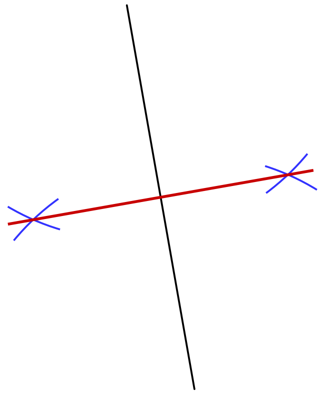

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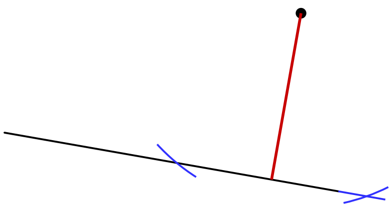

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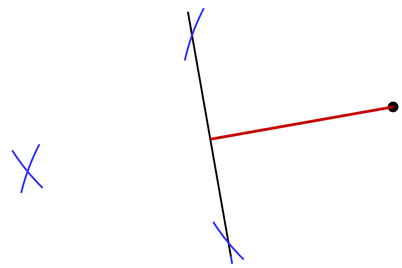

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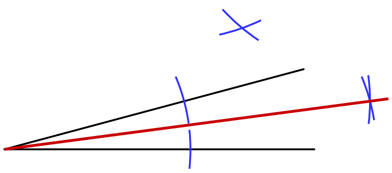

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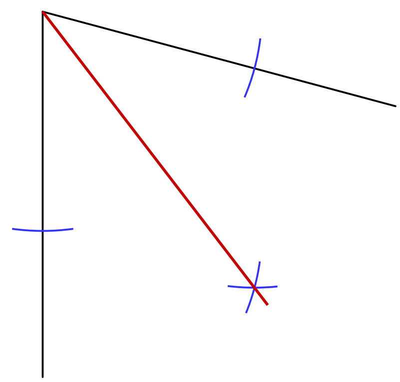

Answers to Construct Medians and Altitudes

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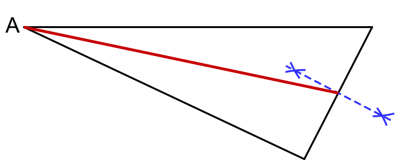

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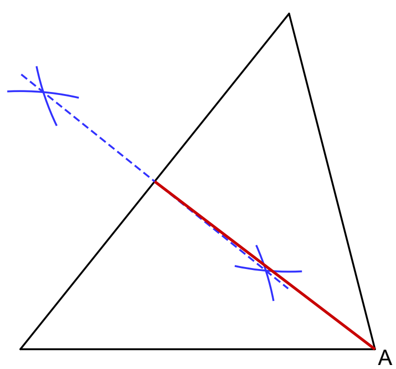

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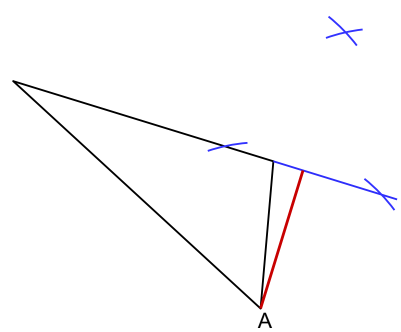

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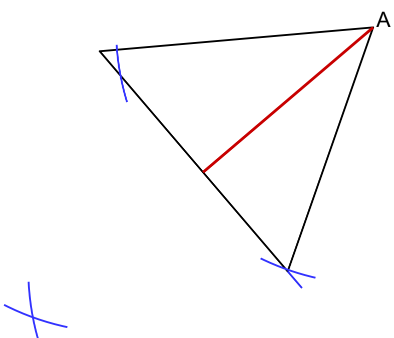
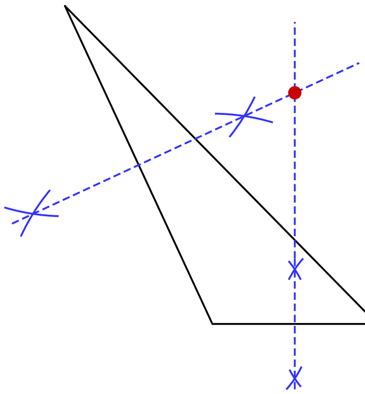


Answers to Construct: Triangle Centers

1)



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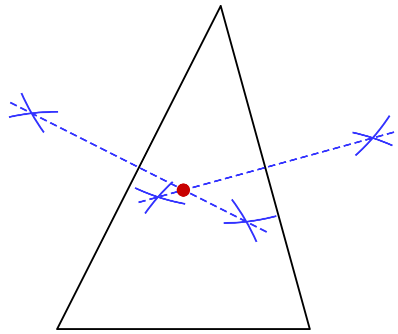

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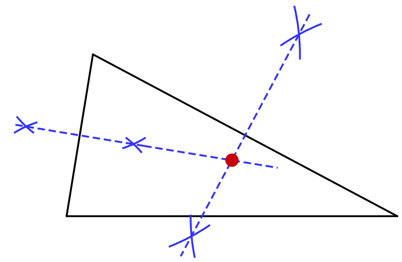

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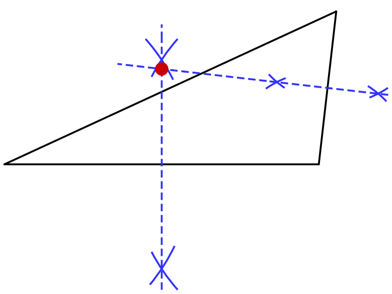

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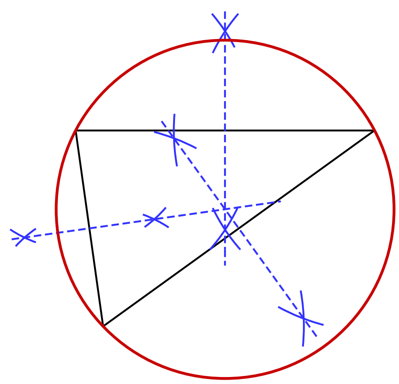

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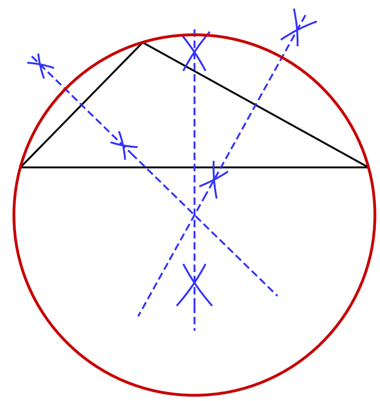

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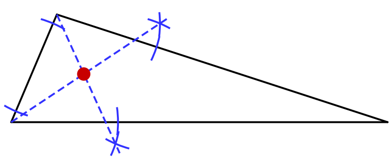

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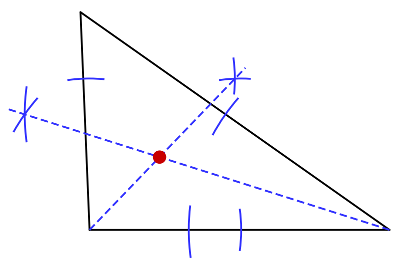

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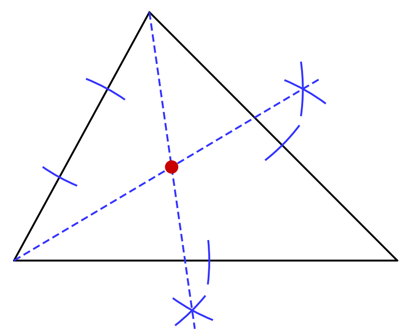

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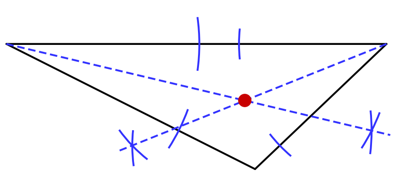

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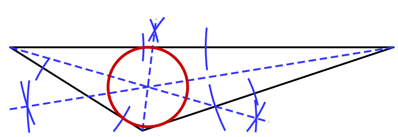

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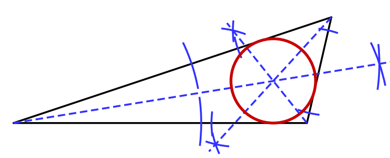

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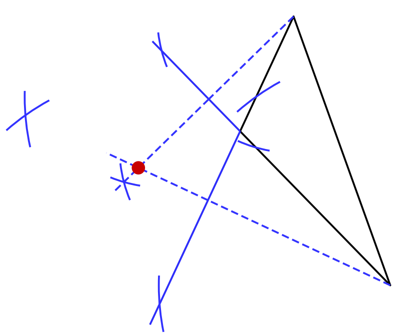

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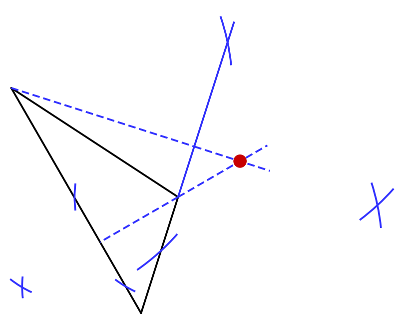

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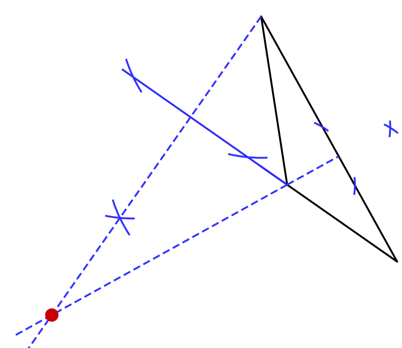

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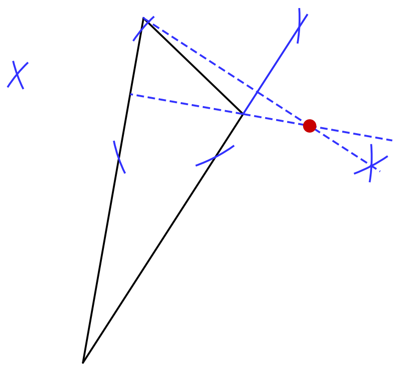

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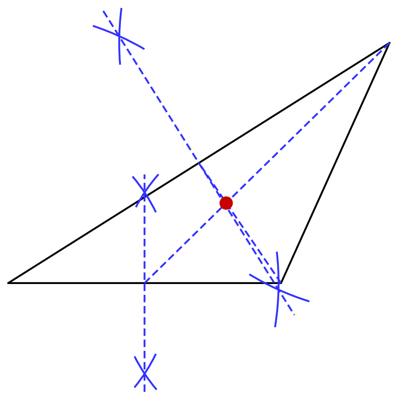

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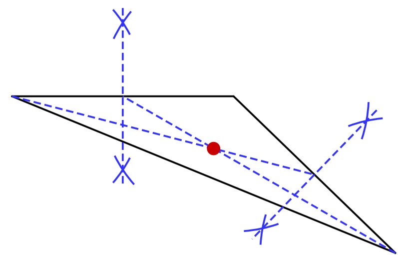

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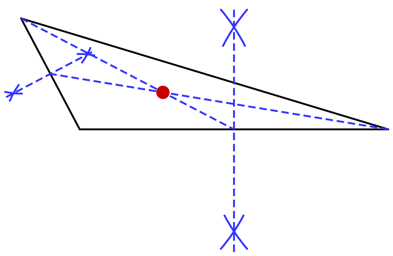

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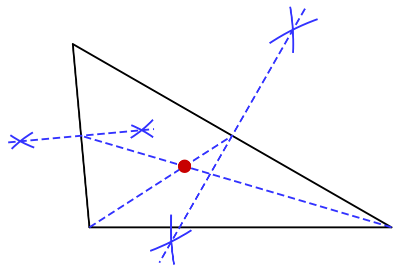

Answers to Practice - The Centroid

1) 3	2) 7.5	3) 8.7	4) 4.6
5) 19.6	6) 18	7) 10	8) 10
9) 3	10) 2		