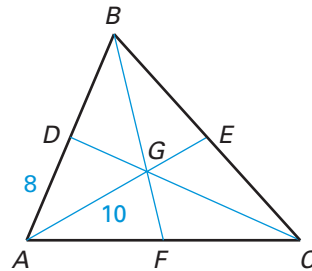




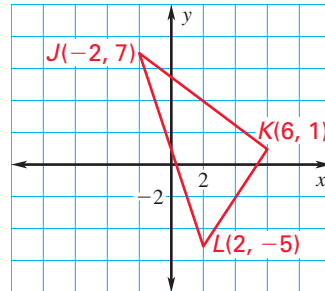
- MM1G1c** Determine the midpoint of a segment.
- MM1G1e** Use the coordinate plane to investigate properties of and verify conjectures related to triangles and quadrilaterals.
- MM1G3e** Find and use points of concurrency in triangles: incenter, orthocenter, circumcenter, and centroid.

**G is the centroid of  $\triangle ABC$ ,  $AD = 8$ ,  $AG = 10$ , and  $CD = 18$ . Find the length of the segment.**

- |                    |                    |
|--------------------|--------------------|
| 1. $\overline{BD}$ | 2. $\overline{AB}$ |
| 3. $\overline{EG}$ | 4. $\overline{AE}$ |
| 5. $\overline{CG}$ | 6. $\overline{DG}$ |



7. Use the graph shown.
- Find the coordinates of  $M$ , the midpoint of  $\overline{JK}$ . Use the median  $\overline{LM}$  to find the coordinates of the centroid  $P$ .
  - Find the coordinates of  $N$ , the midpoint of  $\overline{JL}$ . Verify that  $KP = \frac{2}{3}KN$ .

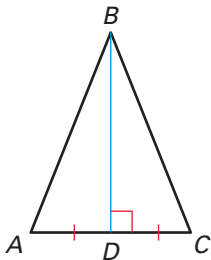


**Find the coordinates of the centroid  $P$  of  $\triangle ABC$ .**

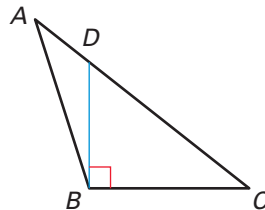
- |                                    |                                  |
|------------------------------------|----------------------------------|
| 8. $A(-7, -4), B(-3, 5), C(1, -4)$ | 9. $A(0, -2), B(6, 1), C(9, -5)$ |
|------------------------------------|----------------------------------|

**Is  $\overline{BD}$  a perpendicular bisector of  $\triangle ABC$ ? Is  $\overline{BD}$  a median? an altitude?**

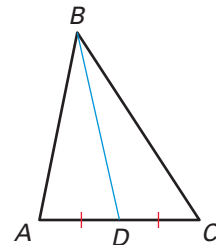
10.



11.



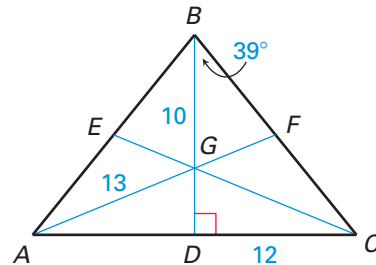
12.



## Exercise Set A (continued)

Find the measurements.

13. Given that  $AB = BC$ , find  $AD$  and  $m\angle ABC$ .  
 14. Given that  $G$  is the centroid of  $\triangle ABC$ , find  $FG$  and  $BD$ .

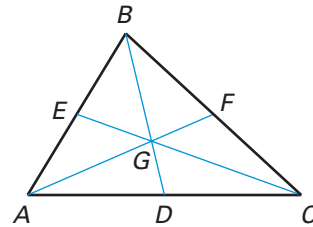


Copy and complete the statement for  $\triangle HJK$  with medians  $\overline{HN}$ ,  $\overline{JL}$ , and  $\overline{KM}$ , and centroid  $P$ .

15.  $PN = \underline{\quad?} \underline{\quad?} HN$       16.  $PL = \underline{\quad?} \underline{\quad?} JP$       17.  $KP = \underline{\quad?} \underline{\quad?} KM$

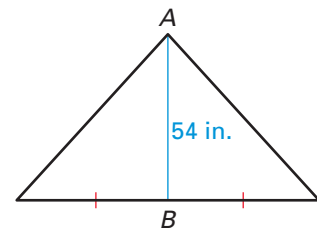
Point  $G$  is the centroid of  $\triangle ABC$ . Use the given information to find the value of  $x$ .

18.  $CG = 3x + 7$  and  $CE = 6x$   
 19.  $FG = x + 8$  and  $AF = 9x - 6$   
 20.  $BG = 5x - 1$  and  $DG = 4x - 5$

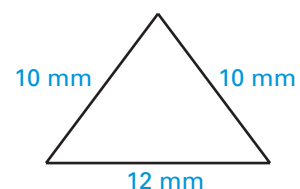


Complete the sentence with *always*, *sometimes*, or *never*.

21. The median of a triangle is   ?   the perpendicular bisector.  
 22. The altitude of a triangle is   ?   the perpendicular bisector.  
 23. The medians of a triangle   ?   intersect inside the triangle.  
 24. The altitudes of a triangle   ?   intersect inside the triangle.  
 25. **House Decoration** You are going to put a decoration on your house in the triangular area above the front door. You want to place the decoration on the centroid of the triangle. You measure the distance from point  $A$  to point  $B$  (see figure). How far down from point  $A$  should you place the decoration? *Explain.*



26. **Art Project** You are making an art piece which consists of different items of all shapes and sizes. You want to insert an isosceles triangle with the dimensions shown. In order for the triangle to fit, the height (altitude) must be less than 8.5 millimeters. Find the altitude. Will the triangle fit in your art piece?



LESSON  
5.4

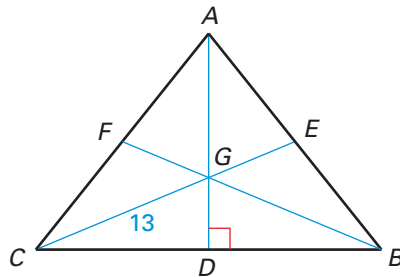
Exercise  
Set B



- MM1G1c** Determine the midpoint of a segment.
- MM1G1e** Use the coordinate plane to investigate properties of and verify conjectures related to triangles and quadrilaterals.
- MM1G3e** Find and use points of concurrency in triangles: incenter, orthocenter, circumcenter, and centroid.

**G** is the centroid of  $\triangle ABC$ ,  $AD = 15$ ,  $CG = 13$ , and  $\overline{AD} \perp \overline{CB}$ .  
Find the length of the segment.

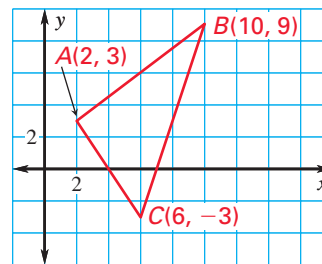
1.  $\overline{AG}$
2.  $\overline{GD}$
3.  $\overline{CD}$
4.  $\overline{GE}$
5.  $\overline{GB}$



Copy and complete the statement for  $\triangle LMN$  with medians  $\overline{LQ}$ ,  $\overline{NP}$ , and  $\overline{MO}$ , and centroid  $R$ .

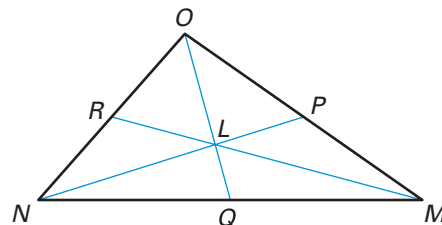
6.  $MR = \underline{\quad ? \quad} MO$
7.  $RQ = \underline{\quad ? \quad} LQ$
8. Use the graph shown.
  - a. Find the coordinates of  $D$ , the midpoint of  $\overline{AB}$ .
  - b. Use the median  $\overline{CD}$  to find the coordinates of the centroid  $G$ .
  - c. Find the coordinates of  $E$ , the midpoint of  $\overline{AC}$ .

Verify that  $BG = \frac{2}{3}BE$ .



Point  $L$  is the centroid of  $\triangle NOM$ . Use the given information to find the value of  $x$ .

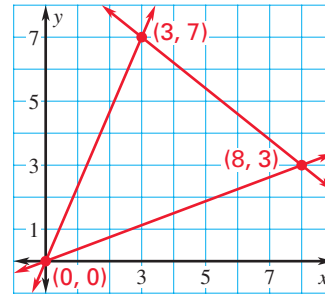
9.  $OL = 8x$  and  $OQ = 9x + 6$
10.  $NL = x + 4$  and  $NP = 3x + 3$
11.  $ML = 10x - 4$  and  $MR = 12x + 18$



## Exercise Set B *(continued)*

12. **Multiple Representations** Find the orthocenter of the triangle shown.

- a. **Estimating the Orthocenter** Copy the triangle and draw the altitudes. Estimate the coordinates of the orthocenter.
- b. **Solving a System of Equations** Find the equation of each altitude of the triangle. Solve the system of equations to find the orthocenter.

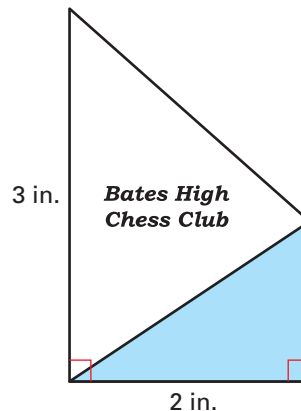


Find the coordinates of the centroid  $D$  of  $\triangle ABC$ .

13.  $A(0, 0), B(10, 0), C(5, 6)$                       14.  $A(-5, 2), B(-3, 6), C(-7, 10)$

Copy and complete the sentence with *always*, *sometimes*, or *never*.

15. The altitude from the vertex angle of an isosceles triangle is   ? the median.
16. The median to any side of an equilateral triangle is   ? the angle bisector.
17. **Chess** A badge is awarded to each new member of the chess club. Find the area of the unshaded triangular portion of the badge. Which special segment of the triangle did you use?



18. **Proof** Write a two-column or paragraph proof.

**GIVEN:**  $\triangle ABC$  is isosceles.  
 $\overline{BD}$  is the median to base  $\overline{AC}$ .

**PROVE:**  $\overline{BD}$  is also an altitude.

