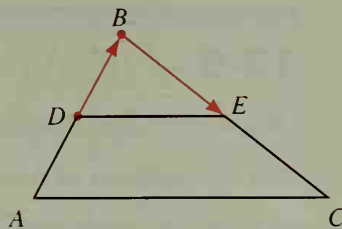


33. a. Given:  $\overrightarrow{AB} = 2\overrightarrow{DB}$  and  $\overrightarrow{BC} = 2\overrightarrow{BE}$

Supply the reasons for each step.

1.  $\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$
2.  $= 2\overrightarrow{DB} + 2\overrightarrow{BE}$
3.  $= 2(\overrightarrow{DB} + \overrightarrow{BE})$  (Hint: See Exercise 32.)
4.  $= 2\overrightarrow{DE}$

- b. What theorem about midpoints does part (a) prove?



34. Suppose two nonvertical vectors  $(a, b)$  and  $(c, d)$  are perpendicular.

- a. Use slopes to show that  $\frac{bd}{ac} = -1$ .
- b. Show that  $ac + bd = 0$ .
- c. The number  $ac + bd$  is called the **dot product** of vectors  $(a, b)$  and  $(c, d)$ . Complete: If  $(a, b)$  and  $(c, d)$  are perpendicular vectors, then their dot product     ?.
- d. Verify the statement in part (c) for the vectors in Example 2(b) on page 540 and in Exercise 18 on page 542.

## Mixed Review Exercises

1. On a number line, point  $A$  has coordinate  $-11$  and  $B$  has coordinate  $7$ . Find the coordinate of the midpoint of  $\overline{AB}$ .
2. If  $M$  is the midpoint of the hypotenuse  $\overline{AB}$  of right triangle  $ABC$ , and  $AM = 6$ , find  $MB$  and  $MC$ .
3. The lengths of the bases of a trapezoid are  $12$  and  $20$ . Find the length of the median.
4. If the length of one side of an equilateral triangle is  $2a$ , find the length of an altitude.
5. Find the measure of each interior angle of a regular hexagon.
6. Each side of a regular hexagon  $ABCDEF$  has length  $x$ . Find  $AD$  and  $AC$ .
7. Find the measure of each exterior angle of a regular octagon.
8. Find the coordinates of the fourth vertex of a rectangle that has three vertices at  $(-3, -2)$ ,  $(2, -2)$ , and  $(2, 5)$ .
9. The vertices of quad.  $ABCD$  are  $A(2, 0)$ ,  $B(7, 0)$ ,  $C(7, 5)$ , and  $D(2, 5)$ . Find the area of quad.  $ABCD$ .
10. The vertices of  $\triangle PQR$  are  $P(0, 0)$ ,  $Q(-6, 0)$ , and  $R(-6, 6)$ . Find the area of  $\triangle PQR$ .
11.  $\triangle DEF$  has vertices  $D(-5, 1)$ ,  $E(-2, -3)$ , and  $F(6, 3)$ .
  - a. Use the distance formula to show that  $\triangle DEF$  is a right triangle.
  - b. Use slopes to show that  $\triangle DEF$  is a right triangle.
12.  $\triangle ABC$  has vertices  $A(6, 0)$ ,  $B(4, 8)$ , and  $C(2, 6)$ .
  - a. Find the slope of the altitude from  $B$  to  $\overline{AC}$ .
  - b. Find the slope of the perpendicular bisector of  $\overline{AB}$ .