Use a grid and draw arrows to represent the following vectors. You can choose any starting point you like for each vector.

10. (3, 5) and 2(3, 5)
11. (4, −1) and 3(4, −1)
12. (−8, 4) and $\frac{1}{2}$(−8, 4)
13. (−6, −9) and $\frac{1}{3}$(−6, −9)
14. (4, 1) and −3(4, 1)
15. (6, −4) and $-\frac{1}{2}$(6, −4)

16. Name two vectors parallel to (3, −8).

17. The vectors (8, 6) and (12, k) are parallel. Find the value of k.

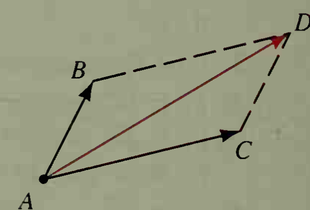
18. Show that (4, −5) and (15, 12) are perpendicular.

19. The vectors (8, k) and (9, 6) are perpendicular. Find the value of k.

Find each vector sum. Then illustrate each sum with a diagram like that on page 541.

20. (2, 1) + (3, 6)
21. (3, −5) + (4, 5)
22. (−8, 2) + (4, 6)
23. (−3, −3) + (7, 7)
24. (1, 4) + 2(3, 1)
25. (7, 2) + 3(−1, 0)

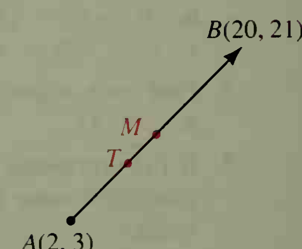
B **26.** Two forces $\overrightarrow{AB}$ and $\overrightarrow{AC}$ are pulling an object at point A. The single force $\overrightarrow{AD}$ that has the same effect as these two forces is their sum $\overrightarrow{AB} + \overrightarrow{AC}$. This sum can be found by completing parallelogram $ABDC$ as shown. Explain why the diagonal $\overrightarrow{AD}$ is the sum of $\overrightarrow{AB}$ and $\overrightarrow{AC}$.



27. Make a drawing showing an object being pulled by the two forces $\overrightarrow{KX} = (-1, 5)$ and $\overrightarrow{KY} = (7, 3)$. What single force has the same effect as the two forces acting together? What is the magnitude of this force?

28. Repeat Exercise 27 for the forces $\overrightarrow{KX} = (2, -3)$ and $\overrightarrow{KY} = (-2, 3)$.

29. In the diagram, M is the midpoint of $\overline{AB}$ and T is a trisector point of $\overline{AB}$.
a. Complete: $\overrightarrow{AB} = (\underline{\ ?\ }, \underline{\ ?\ })$, $\overrightarrow{AM} = (\underline{\ ?\ }, \underline{\ ?\ })$ and $\overrightarrow{AT} = (\underline{\ ?\ }, \underline{\ ?\ })$.
b. Find the coordinates of M and T.



30. Repeat Exercise 29 given the points $A(-10, 9)$ and $B(20, -15)$.

31. Use algebra to prove $|(ka, kb)| = |k| \cdot |(a, b)|$.

C **32. a.** Use definitions I and II below to prove that
$$k[(a, b) + (c, d)] = k(a, b) + k(c, d).$$
I. Definition of scalar multiple $\quad k(a, b) = (ka, kb)$
II. Definition of vector addition $\quad (a, b) + (c, d) = (a + c, b + d)$

b. Make a diagram illustrating what you proved in part (a).