NAME _____ DATE _____ SCORE _____

Vectors; The Midpoint Formula

For use after Section 13–5

In Exercises 1–6 points A and B are given. Make a sketch. Then find $\overrightarrow{AB}$ and $|\overrightarrow{AB}|$.

1. $A(2, -1)$, $B(4, 3)$ $\langle 2, 4\rangle$; $2\sqrt{5}$
2. $A(-1, -1)$, $B(3, 2)$ $\langle 4, 3\rangle$; 5
3. $A(0, 0)$, $B(4, -2)$ $\langle 4, -2\rangle$; $2\sqrt{5}$
4. $A(6, 2)$, $B(1, 3)$ $\langle -5, 1\rangle$; $\sqrt{26}$
5. $A(-2, 4)$, $B(1, 5)$ $\langle 3, 1\rangle$; $\sqrt{10}$
6. $A(-2, -2)$, $B(-3, -4)$ $\langle -1, -2\rangle$; $\sqrt{5}$

7. The vectors (6, 4) and (8, k) are parallel. Find the value of k.

   $k =$ $16/3$

8. The vectors (6, k) and (−20, 15) are perpendicular. Find the value of k. $k =$ 8

Find the vector sum.

9. $(4, 2) + (-1, 4)$ $\langle 3, 6\rangle$
10. $(1, 5) + (-3, 2)$ $\langle -2, 7\rangle$
11. $(2, -4) + 3(1, -2)$ $\langle 5, -10\rangle$
12. $(5, 1) + 2(4, 3)$ $\langle 13, 7\rangle$

Find the coordinates of the midpoint of the segment that joins the given points.

13. (−2, 3) and (4, 7) $(1, 5)$
14. (3, 8) and (−1, −4) $(1, 2)$
15. (6, −5) and (−9, 3) $(-3/2, -1)$
16. (2.7, 3.8) and (5.9, 4.2) $(4.3, 4)$
17. $(a + 3, \frac{8}{3})$ and $(a + 5, \frac{7}{3})$ $(a+4, 5/2)$
18. (e, f) and (j, k) $\left(\frac{e+j}{2}, \frac{f+k}{2}\right)$

In Exercises 19–21 find the length, slope, and midpoint of $\overline{PQ}$.

19. $P(2, -6)$, $Q(-4, -2)$ $2\sqrt{13}$; $-2/3$; $(-1, -4)$
20. $P(-2, -3)$, $Q(4, 5)$ 10; $4/3$; $(1, 1)$
21. $P(0, 0)$, $Q(-3, -4)$ 5; $4/3$; $(-3/2, -2)$

S is the midpoint of $\overline{AB}$. The coordinates of A and S are given. Find the coordinates of B.

22. $A(1, 6)$; $S(4, 8)$ $(7, 10)$
23. $A(-2, 0)$; $S(-4, 3)$ $(-6, 6)$
24. $A(3, -9)$; $S(-1, -4)$ $(-5, 1)$
25. $A(-4, 2)$; $S(2, -3)$ $(8, -8)$
26. $A(0, 0)$; $S(-2, -6)$ $(-4, -12)$
27. $A(r, s)$; $S(0, 4)$ $(-r, 8-s)$