EVALUATING EXPRESSIONS Using the given matrices, evaluate the expression.

$$A = \begin{bmatrix} 5 & -3 \\ -2 & 4 \end{bmatrix}, B = \begin{bmatrix} 0 & 1 \\ 4 & -2 \end{bmatrix}, C = \begin{bmatrix} -6 & 3 \\ 4 & 1 \end{bmatrix}, D = \begin{bmatrix} 1 & 3 & 2 \\ -3 & 1 & 4 \\ 2 & 1 & -2 \end{bmatrix}, E = \begin{bmatrix} -3 & 1 & 4 \\ 7 & 0 & -2 \\ 3 & 4 & -1 \end{bmatrix}$$

22. $3AB$

23. $-\frac{1}{2}AC$

24. $AB + AC$

25. $AB - BA$

26. $E(D + E)$

27. $(D + E)D$

28. $-2(BC)$

29. $4AC + 3AB$

SOLVING MATRIX EQUATIONS Solve for x and y.

30. $\begin{bmatrix} -2 & 1 & 2 \\ 3 & 2 & 4 \\ 0 & -2 & 4 \end{bmatrix} \begin{bmatrix} 1 \\ x \\ 3 \end{bmatrix} = \begin{bmatrix} 6 \\ 19 \\ y \end{bmatrix}$

31. $\begin{bmatrix} 4 & 1 & 3 \\ -2 & x & 1 \end{bmatrix} \begin{bmatrix} 9 & -2 \\ 2 & 1 \\ -1 & 1 \end{bmatrix} = \begin{bmatrix} y & -4 \\ -13 & 8 \end{bmatrix}$

FINDING POWERS Using the given matrix, find $A^2 = AA$ and $A^3 = AAA$.

32. $A = \begin{bmatrix} 1 & -1 \\ 0 & 2 \end{bmatrix}$

33. $A = \begin{bmatrix} -4 & 1 \\ 2 & -1 \end{bmatrix}$

34. $A = \begin{bmatrix} 2 & 0 & -1 \\ 1 & 3 & 2 \\ -2 & -1 & 0 \end{bmatrix}$

35. ⬦ **TAKS REASONING** Find two matrices A and B such that $A \neq B$ and $AB = BA$.

36. **CHALLENGE** Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ and $B = \begin{bmatrix} e & f \\ g & h \end{bmatrix}$, and let k be a scalar. Prove the associative property of scalar multiplication for 2×2 matrices by showing that $k(AB) = (kA)B = A(kB)$.

PROBLEM SOLVING

In Exercises 37 and 38, write an inventory matrix and a cost per item matrix. Then use matrix multiplication to write a total cost matrix.

37. **SOFTBALL** A softball team needs to buy 12 bats, 45 balls, and 15 uniforms. Each bat costs $21, each ball costs $4, and each uniform costs $30.

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38. **ART SUPPLIES** A teacher is buying supplies for two art classes. For class 1, the teacher buys 24 tubes of paint, 12 brushes, and 17 canvases. For class 2, the teacher buys 20 tubes of paint, 14 brushes, and 15 canvases. Each tube of paint costs $3.35, each brush costs $1.75, and each canvas costs $4.50.

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39. **MULTI-STEP PROBLEM** Tickets to the senior class play cost $2 for students, $5 for adults, and $4 for senior citizens. At Friday night's performance, there were 120 students, 150 adults, and 40 senior citizens in attendance. At Saturday night's performance, there were 192 students, 215 adults, and 54 senior citizens in attendance. Organize the information using matrices. Then use matrix multiplication to find the income from ticket sales for Friday and Saturday nights' performances.

○ = **WORKED-OUT SOLUTIONS**
on p. WS1

⬦ = **TAKS PRACTICE AND REASONING**