103. $-12a^3 + 22a^2b - 6ab^2$

104. $-36a^2b + 21ab^2 - 3b^3$

Applications

Solve each problem.

105. ***Height of a ball.*** If a ball is thrown straight upward at 40 feet per second from a rooftop 24 feet above the ground, then its height in feet above the ground t seconds after it is thrown is given by

$$h(t) = -16t^2 + 40t + 24.$$

a) Find $h(0)$, $h(1)$, $h(2)$, and $h(3)$.
b) Rewrite the formula with the polynomial factored completely.
c) Find $h(3)$ using the result of part (b).

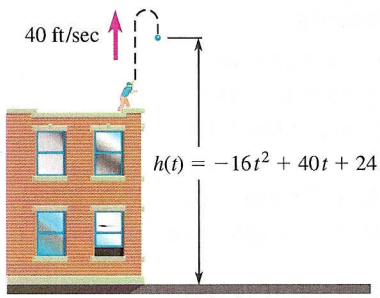

Figure for Exercise 105

106. ***Worker efficiency.*** In a study of worker efficiency at Wong Laboratories it was found that the number of components assembled per hour by the average worker t hours after starting work could be modeled by the formula

$$N(t) = -3t^3 + 23t^2 + 8t.$$

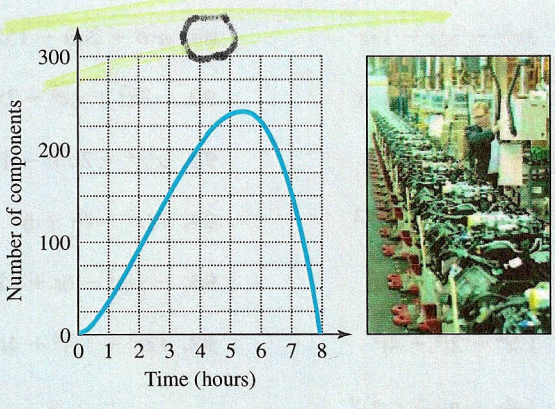

Figure for Exercise 106

a) Rewrite the formula by factoring the right-hand side completely.
b) Use the factored version of the formula to find $N(3)$.
c) Use the accompanying graph to estimate the time at which the workers are most efficient.
d) Use the accompanying graph to estimate the maximum number of components assembled per hour during an 8-hour shift.

Getting More Involved

107. ***Exploration***

Find all positive and negative integers b for which each polynomial can be factored.

a) $x^2 + bx + 3$ **b)** $3x^2 + bx + 5$
c) $2x^2 + bx - 15$

108. ***Exploration***

Find two integers c (positive or negative) for which each polynomial can be factored. Many answers are possible.

a) $x^2 + x + c$
b) $x^2 - 2x + c$
c) $2x^2 - 3x + c$

109. ***Cooperative learning***

Working in groups, cut two large squares, three rectangles, and one small square out of paper that are exactly the same size as shown in the accompanying figure. Then try to place the six figures next to one another so that they form a large rectangle. Do not overlap the pieces or leave any gaps. Explain how factoring $2x^2 + 3x + 1$ can help you solve this puzzle.

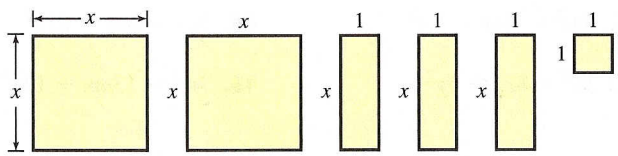

Figure for Exercise 109

110. ***Cooperative learning***

Working in groups, cut four squares and eight rectangles out of paper as in the previous exercise to illustrate the trinomial $4x^2 + 7x + 3$. Select one group to demonstrate how to arrange the 12 pieces to form a large rectangle. Have another group explain how factoring the trinomial can help you solve this puzzle.