4.4 The Quadratic Formula, pages 244–257

18. Use the discriminant to determine the nature of the roots for each quadratic equation. Do not solve the equation.

   a) $2x^2 + 11x + 5 = 0$

   b) $4x^2 - 4x + 1 = 0$

   c) $3p^2 + 6p + 24 = 0$

   d) $4x^2 + 4x - 7 = 0$

19. Use the quadratic formula to determine the roots for each quadratic equation. Express your answers as exact values.

   a) $-3x^2 - 2x + 5 = 0$

   b) $5x^2 + 7x + 1 = 0$

   c) $3x^2 - 4x - 1 = 0$

   d) $25x^2 + 90x + 81 = 0$

20. A large fountain in a park has 35 water jets. One of the streams of water shoots out of a metal rod and follows a parabolic path. The path of the stream of water can be modelled by the function $h(x) = -2x^2 + 6x + 1$, where h is the height, in metres, at any horizontal distance x metres from its jet.

   a) What quadratic equation would you solve to determine the maximum horizontal distance the water jet can reach?

   b) What is the maximum horizontal distance the water jet can reach? Express your answer to the nearest tenth of a metre.

21. A ferry carries people to an island airport. It carries 2480 people per day at a cost of $3.70 per person. Surveys have indicated that for every $0.05 decrease in the fare, 40 more people will use the ferry. Use x to represent the number of decreases in the fare.

   a) Write an expression to model the fare per person.

   b) Write an expression to model the number of people that would use the ferry per day.

   c) Determine the expression that models the revenue, R, for the ferry, which is the product of the number of people using the ferry per day and the fare per person.

   d) Determine the number of fare decreases that result in a revenue of $9246.

22. Given the quadratic equation in standard form, $ax^2 + bx + c = 0$, arrange the following algebraic steps and explanations in the order necessary to derive the quadratic formula.

	Algebraic Steps	Explanations
A	$x + \dfrac{b}{2a} = \pm\sqrt{\dfrac{b^2 - 4ac}{4a^2}}$	Complete the square.
B	$\left(x + \dfrac{b}{2a}\right)^2 = \dfrac{b^2 - 4ac}{4a^2}$	Solve for x.
C	$x^2 + \dfrac{b}{a}x = -\dfrac{c}{a}$	Subtract c from both sides.
D	$ax^2 + bx = -c$	Take the square root of both side.
E	$x^2 + \dfrac{b}{a}x + \dfrac{b^2}{4a^2} = \dfrac{b^2}{4a^2} - \dfrac{c}{a}$	Divide both sides by a.
F	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	Factor the perfect square trinomial.