Chapter

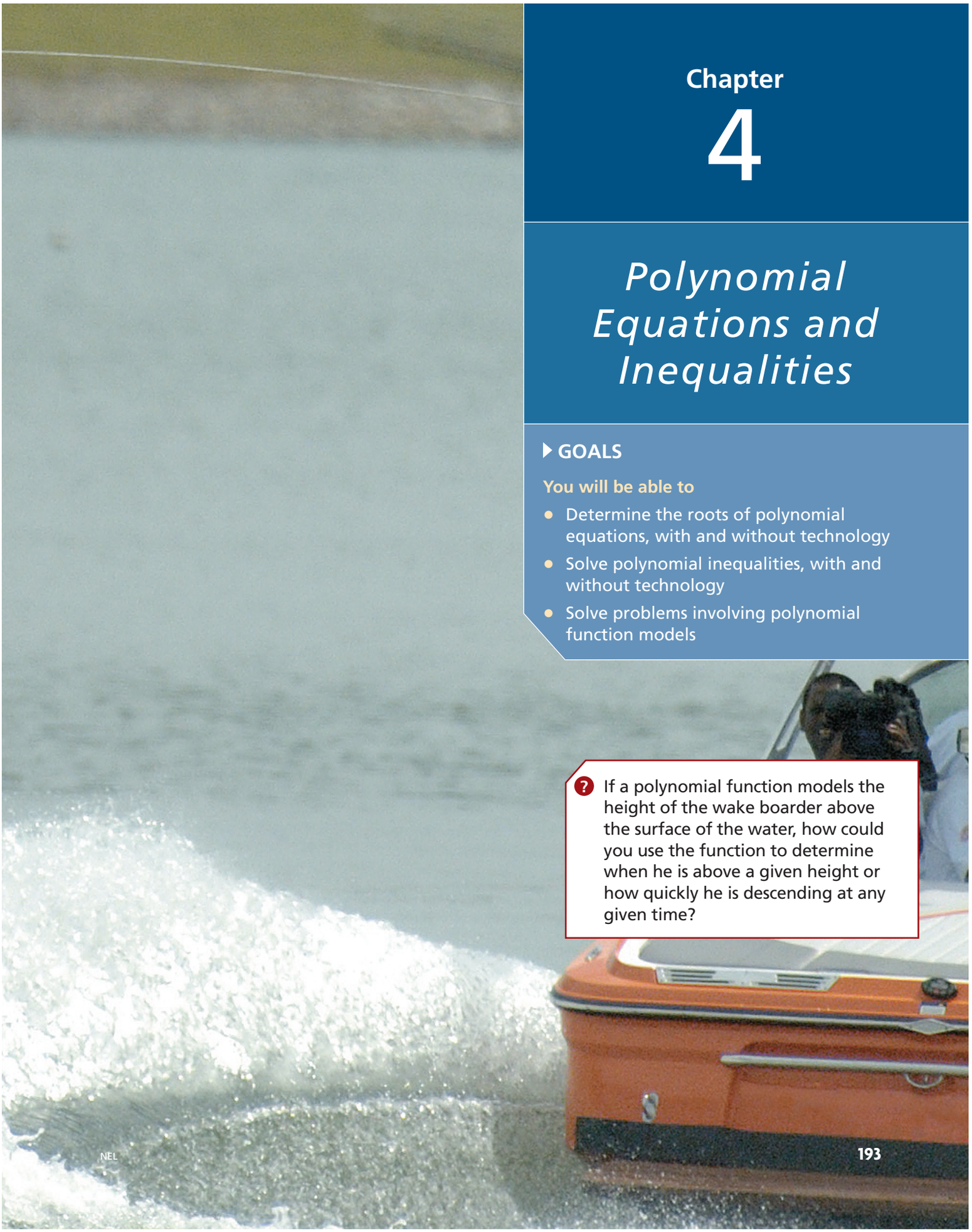
4

Polynomial Equations and Inequalities

GOALS

You will be able to

- Determine the roots of polynomial equations, with and without technology
- Solve polynomial inequalities, with and without technology
- Solve problems involving polynomial function models



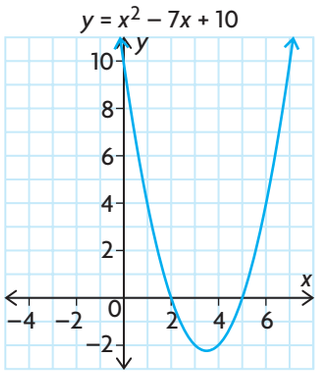
? If a polynomial function models the height of the wake boarder above the surface of the water, how could you use the function to determine when he is above a given height or how quickly he is descending at any given time?

4 Getting Started

Study *Aid*

- For help, see the Review of Essential Skills found at the Nelson Advanced Functions website.

Question	Appendix/Lesson
1, 4, 5	R-6
2	R-3, 3.6
3	3.3
6, 7	2.5



SKILLS AND CONCEPTS You Need

1. Solve the following linear equations.

a) $5x - 7 = -3x + 17$

b) $12x - 9 - 6x = 5 + 3x + 1$

c) $2(3x - 5) = -4(3x - 2)$

d) $\frac{2x + 5}{3} = 7 - \frac{x}{4}$

2. Factor the following expressions.

a) $x^3 + x^2 - 30x$

b) $x^3 - 64$

c) $24x^4 + 81x$

d) $2x^3 + 7x^2 - 18x - 63$

3. Sketch a graph of each of the following functions.

a) $y = (x - 2)(x + 3)(x - 4)$

b) $y = 2(x + 6)^3 - 10$

4. Given the graph of the function shown, determine the roots of the equation $x^2 - 7x + 10 = 0$.

5. Determine the roots of each of the following quadratic equations.

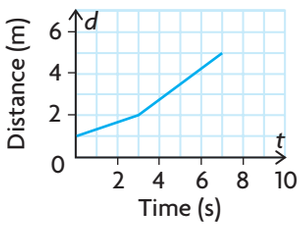
a) $2x^2 = 18$

b) $x^2 + 8x - 20 = 0$

c) $6x^2 = 11x + 10$

d) $x(x + 3) = 3 - 5x - x^2$

6. The graph below shows Erika's walk in front of a motion sensor.



a) In which time interval is she walking the fastest? Explain.

b) Calculate the speeds at which she walks on the intervals $t \in (0, 3)$ and $t \in (3, 7)$.

c) Is she moving away or toward the motion sensor? How do you know?

7. A T-ball player hits a baseball from a tee that is 0.5 m tall. The height of the ball is modelled by $h(t) = -5t^2 + 9.75t + 0.5$, where h is the height in metres at t seconds.

a) How long is the ball in the air?

b) Determine the average rate of change in the ball's height during the first second of flight.

c) Estimate the instantaneous rate of change in the ball's height when it hits the ground.

8. Copy and complete the anticipation guide in your notes.

Statement	Agree	Disagree	Justification
The quadratic formula can only be used when solving a quadratic equation.			
Cubic equations always have three real roots.			
The graph of a cubic function always passes through all four quadrants.			
The graphs of all polynomial functions must pass through at least two quadrants.			
The expression $x^2 > 4$ is only true if $x > 2$.			
If you know the instantaneous rates of change for a function at $x = 2$ and $x = 3$, you can predict fairly well what the function looks like in between.			

APPLYING What You Know

Modelling a Situation with a Polynomial Function

Shown is a picture of the Gateway Arch located in St. Louis, Missouri, U.S.A. The arch is about 192 m wide and 192 m tall.

The city of St. Louis would like to hang a banner from the arch for their New Year celebrations. They have determined that the banner should be suspended from a horizontal cable that spans the arch 175 m off the ground to ensure optimal viewing around the city.

? Assuming that the arch is parabolic in shape, how long should the cable be?

A. Draw a sketch showing the arch on a coordinate grid using an appropriate scale.

B. Determine a quadratic function that could model the inside of the arch using vertex or factored form.

C. How did you predict what the sign of the leading coefficient in the function would be? Explain.

D. Use your model to determine the length of the cable needed to support the banner.