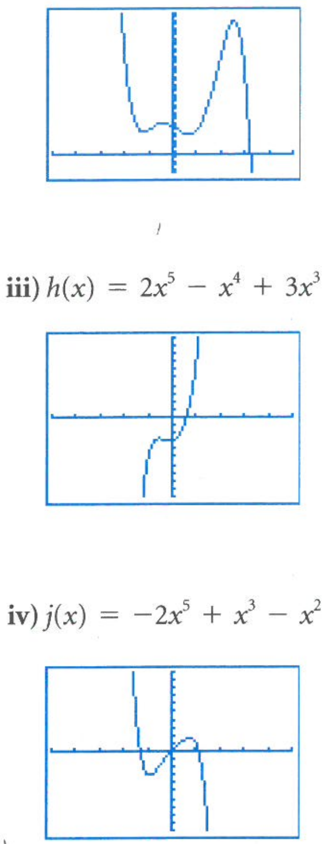
ii) $g(x) = -x^5 + 2x^4 + 5x^3 - 3x^2 - 4x + 8$



iii) $h(x) = 2x^5 - x^4 + 3x^3 + 5x^2 + x - 3$

iv) $j(x) = -2x^5 + x^3 - x^2 + 3x$

b) How does the sign of the x^5-term affect the shape of the graph?

When the x^5-term is positive, the graph falls to the left and rises to the right. When the x^5-term is negative, the graph rises to the left and falls to the right.

c) How does the value of the constant term affect the graph of the function?

The value of the constant term is the y-intercept of the graph of the function.

d) How are the graphs of quintic functions like the graphs of cubic functions? How are they different?

When the term with the greatest degree in the equation is positive, the graph falls to the left and rises to the right. When the term with the greatest degree is negative, the graph rises to the left and falls to the right. The value of the constant term in the equation of a cubic or quintic function is the y-intercept of its graph. The graph of a cubic or quintic function has equal numbers of hills and valleys. The graph of a cubic function can have at most 1 hill and 1 valley, but the graph of a quintic function can have up to 2 hills and 2 valleys.

TECHNOLOGY NOTE

Graphing Calculator

Use these window settings to generate the graphs in question 2a, parts ii to iv:
For part ii: Xmin = −5; Xmax = 5; Xscl = 1; Ymin = −5; Ymax = 40; Yscl = 1
For parts iii and iv: Xmin = −5; Xmax = 5; Xscl = 1; Ymin = −10; Ymax = 10; Yscl = 1

THINK FURTHER

How does the range of a function of degree 1, 3, or 5 differ from the range of a function of degree 2 or 4?

A function of degree 1, 3, or 5 has range $y \in \mathbb{R}$. A function of degree 2 or 4 has either a maximum or a minimum point, so its range is restricted.

TEACHER NOTE

Achievement Indicator

Question 2b, c, and d addresses AI 12.2: Explain the role of the constant term and leading coefficient in the equation of a polynomial function with respect to the graph of the function.

TEACHER NOTE

DI: Extending Thinking

Have students predict the shapes of the graphs of polynomial functions with degree 6 or 7, such as:
$y = x^6 - 8x^4 + 16x^2$ or
$y = -x^7 + 2x^6 + 2x^5 - 2x^4 - x^3 - 4x^2 - 4x$
Students can use graphing technology to check their predictions.

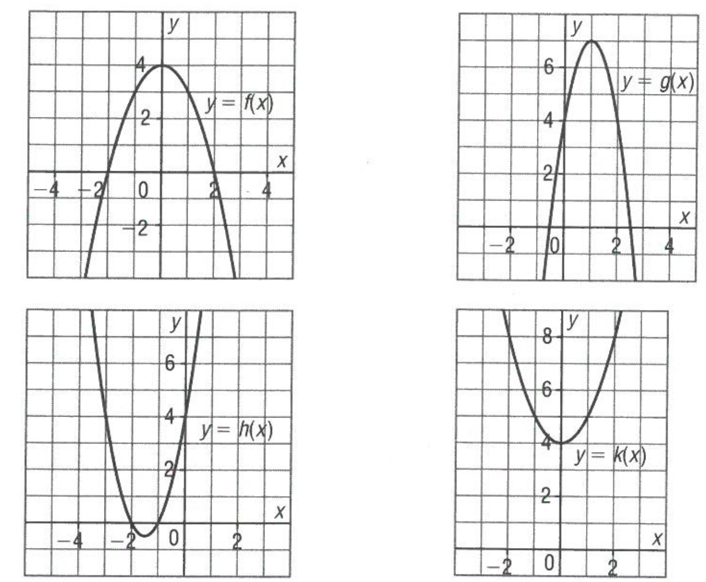
1.4 Relating Polynomial Functions and Equations

FOCUS Identify characteristics of polynomial functions and their graphs.

Get Started

Match each quadratic equation to a graph below.
What characteristics did you use?

$y = x^2 + 4$ $\qquad$ $y = -x^2 + 4$
$y = -3(x - 1)^2 + 7$ $\qquad$ $y = 2(x + 1)(x + 2)$



$y = x^2 + 4$ matches the graph of $y = k(x)$: from the equation, the graph opens up, and it is the image of the graph of $y = x^2$ after a translation of 4 units up.

$y = -x^2 + 4$ matches the graph of $y = f(x)$: from the equation, the graph opens down, and it is the image of the graph of $y = -x^2$ after a translation of 4 units up.

$y = -3(x - 1)^2 + 7$ matches the graph of $y = g(x)$: from the equation, the graph opens down and has vertex (1, 7).

$y = 2(x + 1)(x + 2)$ matches the graph of $y = h(x)$: from the equation, the graph opens up and has x-intercepts −1 and −2.

Lesson Organizer
60 – 75 min

Key Math Concepts
A polynomial function can be described by its degree, which indicates the end behaviour of its graph. The multiplicity of a zero indicates whether the graph intersects the x-axis or just touches it at that zero. The zeros of a polynomial function, the x-intercepts of its graph, and the roots of the corresponding equation are related.

Curriculum Focus

SO	AI
RF11	11.3
RF12	12.1, 12.2, 12.3, 12.4, 12.5, 12.6

Processes: C, CN, ME, T, V

Teacher Materials
- overhead transparency of grid paper (*optional*)

Student Materials
- scientific calculator
- graphing calculator (*optional*)

Vocabulary
leading coefficient, even-degree polynomial function, odd-degree polynomial function, local maximum point, local minimum point, polynomial equation, multiplicity