Review

Student Text Pages
140 to 141

Suggested Timing
45–50 min

Tools
- graphing calculator
- computer algebra system

Related Resources
- G–5 Number Lines
- T–4 The Computer Algebra System (CAS) on the TI-89 Calculator
- BLM 2–98 Chapter 2 Review

Differentiated Instruction
Build a **decision tree** with students to identify the appropriate techniques for solving inequalities.

Study Guide

Use the following study guide to direct students who have difficulty with specific questions to appropriate examples to review.

Question	Section(s)	Refer to
1	2.1	Example 1 (page 85), Example 2 (page 86), Example 4 (page 89)
2	2.1	Example 5 (page 90)
3	2.1	Example 5 (page 90)
4	2.2	Example 2 (pages 97–98)
5	2.2	Example 3 (page 99)
6	2.2	Example 4 (pages 100–101)
7	2.2	Example 1 (pages 95–96)
8	2.3	Example 4 (pages 108–109)
9	2.3	Example 3 (pages 107–108)
10	2.3	Example 2 (pages 105–106), Example 4 (pages 108–109)
11	2.3	Example 3 (pages 107–108)
12	2.4	Investigate (page 114)
13	2.4	Example 3 (page 117)
14	2.4	Example 4 (pages 117–118)
15	2.5	Example 1 (page 126), Example 2 (pages 126–127)
16	2.5	Example 3 (page 128)
17	2.6	Example 1 (page 132)
18	2.6	Example 2 (pages 133–137)

Problem Wrap-Up

Student Text Page
141

Suggested Timing
30–50 min

Tools
- grid paper
- graphing calculator

Related Resources
- G–1 Grid Paper
- BLM 2–10 Chapter 2 Problem Wrap-Up Rubric

Summative Assessment
- Use **BLM 2–10 Chapter 2 Problem Wrap-Up Rubric** to assess student achievement.

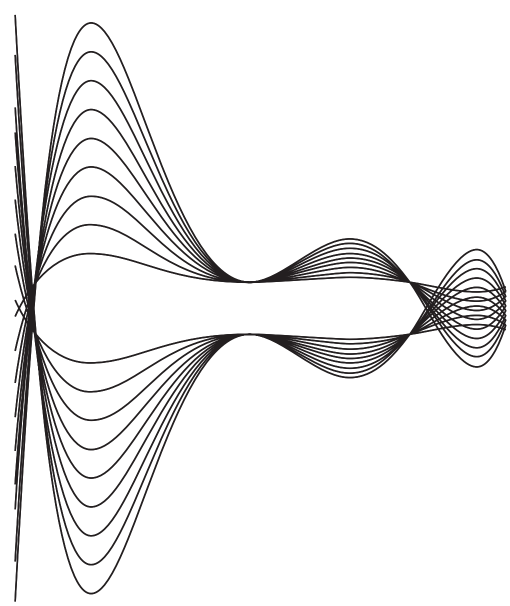
Using the Chapter Problem

- Students may work on the Chapter Problem individually or in pairs.
- Remind students to keep track of their solutions to the Chapter Problem questions. Discuss how the Chapter Problem questions relate to the Chapter Problem Wrap-Up.
- The use of technology is recommended when creating the bottle designs for the Chapter Problem Wrap-Up. Students who have computers at home may work on the design using free graphing software, such as Winplot. If an in-class computer is available, you may wish to have them display their design electronically (the use of animation and colour can result in some very attractive design).
- The following tips may benefit all students or just those having difficulty getting started with their designs.
  - Choose a degree of your polynomial function.
  - Select the x-intercepts.
  - Graph the function.
  - Reflect it in the x-axis.
  - Change the leading coefficient to create a family of functions.
  - Apply your knowledge of transformations to create interesting designs.

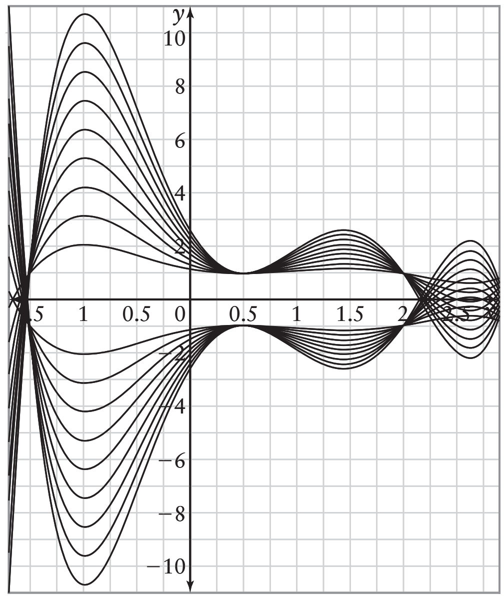
Level 3 Sample Response

Bottle Design for Ladies' Perfume

Design without a grid.



Design on a grid.



The family of functions that was used to create this design is $y = a(x - 3)(x - 2)(2x + 3)(2x - 1)^2$.

To obtain the design, I used corresponding positive and negative values of the leading coefficient a. I also applied vertical translations to get the top and bottom part of the design.

Equations used for the top part of the design:
$y = a(x - 3)(x - 2)(2x + 3)(2x - 1)^2 + 1$, with $a = 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09$.

Equations used for the bottom part of the design:
$y = a(x - 3)(x - 2)(2x + 3)\ (2x - 1)^2 - 1$, with $a = -0.01, -0.02, -0.03, -0.04, -0.05, -0.06, -0.07, -0.08, -0.09$.

To get the shape of the bottle, I used the domain restrictions $[-1.7, 2.9]$.

The x-intercepts of the family of functions $y = a(x - 3)(x - 2)(2x + 3)(2x - 1)^2$ are $x = -1.5$, $x = 0.5$ (order 2), $x = 2$, and $x = 3$. The x-intercepts of the graph correspond to the real roots of this family of functions. When the graphs are translated 1 unit up or down, they no longer intersect the x-axis at these values.

i) For $y = 0.09(x - 3)(x - 2)(2x + 3)(2x - 1)^2 + 1$, solve
$0 = 0.09(x - 3)(x - 2)(2x + 3)(2x - 1)^2 + 1$.
Using a graphing calculator, the x-intercepts are $x = -1.52$, $x = 2.16$, and $x = 3.15$. The x-intercept 3.15 is not in the restricted domain $[-1.7, 2.9]$.

ii) For $y = 0.07(x - 3)(x - 2)(2x + 3)(2x - 1)^2 + 1$, solve
$0 = 0.07(x - 3)(x - 2)(2x + 3)(2x - 1)^2 + 1$.
Using a graphing calculator, the x-intercepts are $x = -1.52$, $x = 2.108$, and $x = 2.926$.
The x-intercept 2.926 is not in the restricted domain $[-1.7, 2.9]$.

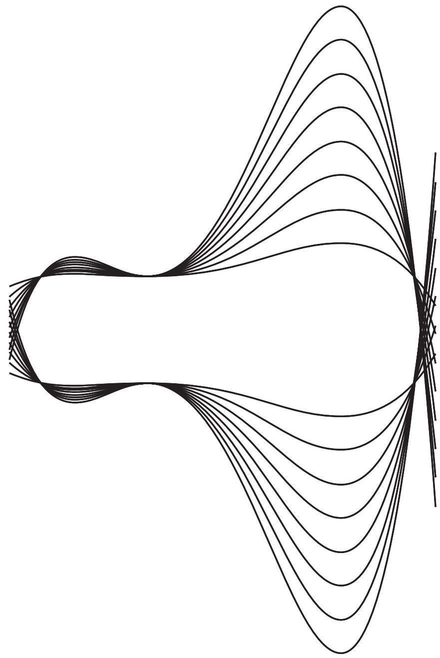
Use the above equations to write two inequalities.

i) $0.09(x - 3)(x - 2)(2x + 3)(2x - 1)^2 + 1 \geq 0$
Use the x-intercepts: $-1.52, 2.16, 3.15$.
From the graph we can see that $y \geq 0$ for $x \in [-1.52, 2.16]$ and $x \in (3.15, \infty)$.

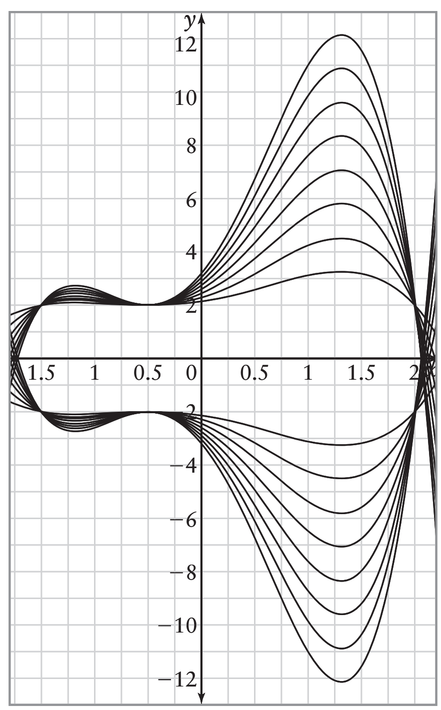
ii) $-0.07(x - 3)(x - 2)(2x + 3)(2x - 1)^2 - 1 \leq 0$
Use the x-intercepts: $-1.52, 2.108, 2.926$.
From the graph we can see that $y \leq 0$ for $x \in [-1.52, 2.108]$ and $x \in (2.926, \infty)$.

Bottle Design for Men's Cologne

Design without a grid.



Design with a grid.



The family of functions that was used to create this design is $y = a(2x + 3)(x - 2)(2x + 1)^2$.

To obtain the design, I used corresponding positive and negative values of the leading coefficient a. I also applied vertical translations to get the top and bottom part of the design.

Equations used for the top part of the design: $y = a(2x + 3)(x - 2)(2x + 1)^2 + 2$, with $a = -0.200, -0.175, -0.150, -0.125, -0.100, -0.075, -0.050, -0.0250$.

Equations used for the bottom part of the design:
$y = a(2x + 3)(x - 2)(2x + 1)^2 - 2$, with $a = 0.200, 0.175, 0.150, 0.125, 0.100, 0.075, 0.050, 0.0250$.

To get the shape of the bottle, with a base and lid, I used the domain restrictions $[-1.8, 2.2]$.

The x-intercepts of the family of functions $y = a(2x + 3)(x - 2)(2x + 1)^2$ are $x = -1.5$, $x = -0.5$ (order 2), and $x = 2$. The x-intercepts of the graph correspond to the real roots of this family of functions. When the graphs are translated up by 2, or down by 2, they no longer intersect the x-axis at these values.

The x-intercepts and real roots of the two outer functions that define the shape of the bottle are:

i) For $y = -0.2(2x + 3)(x - 2)(2x + 1)^2 + 2$, solve
$0 = -0.2(2x + 3)(x - 2)(2x + 1)^2 + 2$.
Using a graphing calculator, the x-intercepts are: $x = -1.72$ and $x = 2.05$.

ii) For $y = 0.1(2x + 3)(x - 2)(2x + 1)^2 - 2$, solve
$0 = 0.1(2x + 3)(x - 2)(2x + 1)^2 - 2$.
Using a graphing calculator, the x-intercepts are $x = -1.85$ and $x = 2.1$.

Use the above equations to write two inequalities.

i) $-0.2(2x + 3)(x - 2)(2x + 1)^2 + 2 \geq 0$
Use the x-intercepts: -1.72, 2.05.
From the graph we can see that $y \geq 0$ for $x \in [-1.22, 2.05]$.

ii) $0.1(2x + 3)(x - 2)(2x + 1)^2 - 2 \leq 0$
Use the x-intercepts: -1.85, 2.1.
From the graph we can see that $y \leq 0$ for $x \in [-1.85, 2.1]$.

Level 3 Notes

- Equations include a family of polynomial functions of some complexity
- Interesting and somewhat complex design created with numerous curves
- Solutions to most parts of the question are provided
- Solutions may contain very minor errors
- Fairly good understanding of how to determine the real roots of the equations and their connection to the x-intercepts of the corresponding graphs
- Good understanding of techniques to solve equations and inequalities
- Fairly organized and logical solution
- Clear justification or reasoning for choices made

What Distinguishes Level 2

- Equations include a family of polynomial functions of some complexity
- Simple and not very complex design created with a few curves
- Solutions to some parts of the question are provided
- Solutions may contain some errors
- Some understanding of how to determine the real roots of the equations and their connection to the x-intercepts of the corresponding graphs
- Some understanding of techniques to solve equations and inequalities
- Somewhat organized and logical solution
- Somewhat appropriate solutions with some significant errors
- Little justification or reasoning for choices made

What Distinguishes Level 4

- Equations include a family of polynomial functions of fair complexity
- Very interesting, creative, and complex design created with a variety of curves
- Solutions to all parts of the question are provided
- Solutions are all accurate
- High degree of understanding of how to determine the real roots of the equations and their connection to the x-intercepts of the corresponding graphs
- Excellent understanding of techniques to solve equations and inequalities
- Thoroughly organized and logical solution
- Clear justification or reasoning for choices made