

I.

1.

a)  $f(x) = \frac{n(x)}{d(x)}$ , here  $n(x)$  and  $d(x)$  are polynomials.

b)  $d(x)$  cannot equal zero. (When the denominator is zero, a fraction is undefined.)

c) The zeros of the function  $f(x)$ . (A fraction is zero if and only if its numerator is zero. So  $f(x)=0$  if and only if  $n(x)=0$ .)

2.

a) Example:  $\frac{2x+100}{x^2+7x+10}$  (infinite examples)

b) Example:  $\frac{-x^2+4}{6x^3+x}$  (infinite examples)

c) Example:  $\frac{\frac{1}{2}x^3+2x^2}{\frac{3}{2}x+17}$  (infinite examples)

3.

a) A quadratic function. (degree 2)

b) A linear function. (degree 1)

c)  $x$  represented the length.

$f(x)$  represented the perimeter.

d) 20.85 (Evaluate  $f(7)$ , either by symbol manipulation or using the graph.)

e)  $x=1.82$  or  $x=13.18$ . (TRACE the graph and locate the points for which  $y=30$ ; or use TABLE and locate the  $x$ -values for which  $y=30$ .)

4.

a) The reciprocal function. Because, if you input a value for  $x$ , it outputs its reciprocal value.

b) It is very small.

c) It is very large.

d) It is very small.

e) It does not exist. (A fraction with a zero denominator is undefined.) There is a break in the graph at  $x=0$ .

(The vertical line  $x=0$  is called the vertical asymptote for this function.)

II.

1.

a)  $x=0$

b)  $x=-5$

c)  $x=7$

d)  $x-1/2$

2.

a)  $\frac{1}{x}$

b)  $\frac{1}{x}+4$

c)  $x=0$ . 1 or 1/10 (Solve  $\frac{1}{x} + 4 = 14$ , either by graphical exploration or by symbol manipulation.)

III.

a) \$80.00 ( $30+.25(200)=80$ )

b)  $30+.25x$  or  $.25x+30$

c)  $\frac{.25x+30}{x}$ . A rational function.

d) 500 miles. (Graph  $f(x) = \frac{.25x+30}{x}$ . Don't forget the parentheses around the numerator when you key in the fraction. Use TRACE or TABLE. In either case, look for  $y=.31$ ; you find the corresponding  $x=500$ .)

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# ALGEBRA 1

## The Complete Course

### Lesson Nineteen

### Section IV: Exploring Rational Functions

# Introductory Explorations

KA8449

## Worksheet

### HOW TO USE THE VIDEO AND WORKSHEET

1. The "STOP TO THINK" signal means pause to think.
2. The "STOP TO WORK" signal means work the problem(s).
3. Rewind the tape and watch the lesson again if the concept is not clear.
4. Students should complete the exercises on the worksheet to confirm their understanding of this lesson.

Instructors may duplicate the worksheets as needed

## I. VIDEOTAPE FOLLOW-UP QUESTIONS

- What is the general form of a rational function?
  - What restrictions must be placed on the denominator? Why?
  - What do the zeros of the numerator represent?
- Give examples of a rational function that is the quotient of:
  - a linear function and a quadratic function.
  - a quadratic function and a cubic function.
  - a cubic function and a linear function.
- In Exploration 1, we found the rational function  $f(x) = \frac{2x^2+48}{x}$ .
  - What type of polynomial function is the numerator?
  - What type of polynomial function is the denominator?
  - In this functional relationship, what did  $x$  represent? What did  $f(x)$  represent?
  - What is the perimeter when the length is 7 linear units?
  - What is the length when the perimeter is 30 linear units?
- In Exploration 1, we took a close look at the function  $f(x)=1/x$ .
  - What name do we call this function? Why?
  - If we choose a very large  $x$ , what can you say about its reciprocal?
  - If we choose a very small, positive  $x$ , what can you say about its reciprocal?
  - If we choose a very large, negative  $x$ , what can you say about its reciprocal?
  - What about the reciprocal of 0? How is this fact translated graphically?

## II. SUPPLEMENTARY EXERCISES

- In each of the following cases, state the value(s) of  $x$  for which the function is undefined:
  - $f(x) = \frac{5}{x}$
  - $f(x) = \frac{x}{x+5}$
  - $f(x) = \frac{x^2+1}{x-7}$
  - $f(x) = \frac{x^3}{1/2-x}$
- The reciprocal of a number plus 4 equals 14.
  - Write an algebraic expression for “the reciprocal of a number.”
  - Write an algebraic expression for “the reciprocal of a number plus 4.”
  - Suppose the above sum equals 14. What is the number? Explain how you found your answer.

## III. INVESTIGATIVE PROBLEM

- The XYZ car rental company charges a flat fee of \$30.00 plus .25 per mile.
  - Suppose you drove 200 miles in one day, what will be your cost?
  - Suppose you drove  $x$  miles, write an algebraic expression for your cost.
  - Write an algebraic expression for the average cost per mile for driving an XYZ car  $x$  miles. What type of a function is this?
  - If your average cost per mile was .31(cents), how many miles did you drive?

