RLP-ALG2A · RLP Algebra 2A — Sequences, Polynomials, Rational Functions and Complex Numbers

Unit 3: Rational Functions and Equations

Practice Workbook. The same problems, in the same order, as the Practice sections of the online lessons.

Name _____ Period _____

Lesson 3.1 — Average Cost and Rational Functions

FLUENCY

1. Find the asymptotes and intercepts of $f(x) = (3x - 2)/(x + 5)$.

2. Find the asymptotes and y-intercept of $g(x) = 4/(x^2 - 9)$.

3. Does $h(x) = (x^2 - 1)/(x - 1)$ have a vertical asymptote at $x = 1$?

4. Find the vertical asymptote and end behavior of $k(x) = (x^2 + 1)/(x - 2)$.

5. State the domain of $r(x) = (x + 7)/(x^2 + 3x - 10)$.

APPLICATION

6. A robotics club's printer cost $900 and each part uses $1.80 of material. Write the average cost per part, find it for 100 parts, and find how many parts bring it to $3.

7. An electric car (illustrative) costs $42,000 and its energy costs $0.05 per mile. Write the average cost per mile after m miles, evaluate at 100,000 miles, and name the horizontal asymptote.

8. 20 L of a 15% juice drink gets x L of pure juice added. Write the concentration function, find it at $x = 10$, and interpret its horizontal asymptote.

CHALLENGE

9. Write a rational function with vertical asymptote $x = 2$, horizontal asymptote $y = -3$ and x-intercept 4. Check each feature.

REVIEW

10. Divide $2x^3 + x^2 + 3x + 6$ by $x + 2$. State the quotient and remainder, and use the remainder to evaluate $p(-2)$.

11. Multiply: $(-2x - 6)(-3x^2 - 5x - 2)$

12. A geometric sequence has first term 3 and common ratio 1/2. Write an explicit formula, then find term 8 and the sum of the first 8 terms.

Lesson 3.2 — Rewriting and Operating on Rational Expressions

FLUENCY

1. Rewrite $(2x^2 - x + 4)/(x - 1)$ as $q(x) + r/(x - 1)$.

2. Rewrite $(x^2 + 5x + 1)/(x + 2)$ as $q(x) + r/(x + 2)$.

3. Simplify $(x^2 - 9)/(x^2 + 5x + 6)$ and state restrictions.

4. Add: $2/x + 3/(x - 1)$.

5. Subtract: $1/(x - 2) - 1/(x + 2)$.

6. Multiply and simplify: $(x^2 - 4)/(3x) \cdot 6x^2/(x + 2)$.

7. Divide and simplify: $((x + 3)/(x - 1)) \div ((x^2 - 9)/(x^2 - 1))$.

APPLICATION

8. A cyclist rides d km to Davis at 30 km/h and back at 20 km/h. Show the average speed for the round trip is $2(30)(20)/(30 + 20)$ and evaluate it.

9. Two printers finish a job alone in a and b hours. Write their combined rate as a single fraction and the time together, then evaluate for $a = 4$, $b = 6$.

10. Show that $1/n - 1/(n + 1) = 1/(n(n + 1))$, and use it to find $1/(1\cdot2) + 1/(2\cdot3) + \ldots + 1/(9\cdot10)$.

CHALLENGE

11. Rewrite $(2x^3 + 3x^2 - x + 5)/(x^2 + 1)$ as $q(x) + r(x)/(x^2 + 1)$, and describe the graph's end behavior.

REVIEW

12. Divide $-3x^3 + 6x^2 - 6x + 8$ by $x - 3$. State the quotient and remainder, and use the remainder to evaluate $p(3)$.

13. Divide $-x^3 - 2x^2 + 6x + 6$ by $x + 2$. State the quotient and remainder, and use the remainder to evaluate $p(-2)$.

Lesson 3.3 — Rational Equations and Extraneous Solutions

FLUENCY

1. Solve: $7 / (x + 1) = 4 / (x - 6)$

2. Solve: $6 / (x + 5) = 3 / (x - 2)$

3. Solve: $9 / (x + 1) = 1 / (x - 3)$

4. Solve: $1 / (x + 5) = 4 / (x + 3)$

5. Solve: $4 / (x + 5) = 9 / (x - 2)$

6. Solve: $x^2 / (x - 4) = 16 / (x - 4)$

7. Solve: $x^2 / (x + 5) = 25 / (x + 5)$

8. Solve: $(x + 6) / (x - 6) = 12 / (x - 6)$

APPLICATION

9. Pipe A fills a Central Valley storage tank 5 hours faster than pipe B. Together they fill it in 6 hours. How long does each take alone?

10. A shop's average cost per T-shirt is $(1{,}200 + 4n)/n$ dollars. Solve for the number of shirts that brings the average to \$10, and confirm with a graph.

11. Solve $3/x + 1/(x + 2) = 1$ and give decimal approximations. Are any solutions extraneous?

CHALLENGE

12. Solve $1/(x - 2) + 1/(x + 2) = 4/(x^2 - 4)$ and explain the result.

REVIEW

13. Divide $x^3 + x^2 - 7x - 4$ by $x - 5$. State the quotient and remainder, and use the remainder to evaluate $p(5)$.

14. Solve: $x^2 - 6x - 16 = 0$

Lesson 3.4 — Rearranging Formulas and Rate Problems

FLUENCY

1. Solve: $7 / (x - 3) = 4 / (x - 2)$

2. Solve: $5 / (x + 1) = 7 / (x + 2)$

3. Solve: $1 / (x + 2) = 8 / (x - 1)$

4. Solve $1/f = 1/d_o + 1/d_i$ for f.

5. Solve $1/R = 1/R_1 + 1/R_2$ for R_2.

6. Solve $c = (2 + x)/(10 + x)$ for x.

APPLICATION

7. A lens has focal length 12 cm. Where must the sensor be for an object 60 cm away?

8. Resistors of 12 and 4 ohms are wired in parallel. Find the combined resistance, and which resistor must be added in parallel to 12 ohms to make 3 ohms.

9. A 12 L tank holds a 10% salt solution. How much fresh water must be added to dilute it to 4%? Which constraints apply?

CHALLENGE

10. Crew A takes 3 hours longer than crew B to clear a trail; together they take 2 hours. Find each crew's time, and explain which root you reject and why.

REVIEW

11. Multiply: $(-x + 4)(3x^2 + 4x + 1)$

12. An arithmetic sequence has first term −7 and common difference −5. Write an explicit formula, then find term 25 and the sum of the first 25 terms.

Unit 3 checkpoint

1. Asymptotes of f(x) = (2x + 1)/(x − 4)?
   A. x = 4, y = 2
   B. x = −4, y = 2
   C. x = 4, y = −1/4
   D. x = 2, y = 4

2. True or false: (x² − 25)/(x − 5) has a vertical asymptote at x = 5.

3. (x² + 3x + 5)/(x + 1) = x + 2 + _____/(x + 1).

4. 1/x + 1/(x + 2) = ?
   A. 2/(2x + 2)
   B. (2x + 2)/(x(x + 2))
   C. 2/(x(x + 2))
   D. (x + 2)/x

5. True or false: (x² + 4)/(x² + 8) simplifies to 1/2.

6. Solution set of x/(x − 3) = 3/(x − 3)?
   A. {3}
   B. {0}
   C. No solution
   D. All reals

7. x/(x − 1) − 2/(x + 1) = 2/(x² − 1) has the single solution x = _____.

8. Why can clearing denominators create an extraneous solution?
   A. Arithmetic errors
   B. At some x you multiplied both sides by zero
   C. Rational equations have no solutions
   D. The graph is wrong

9. True or false: The x-coordinates where y = 3/x + 1/(x + 2) and y = 1 intersect are the solutions of 3/x + 1/(x + 2) = 1.

10. Solving 1/R = 1/R₁ + 1/R₂ with R₁ = 6 and R₂ = 3 gives R = _____ ohms.

11. In a blend C(x) = (60,000 + 300x)/(50 + x), the horizontal asymptote y = 300 means…

    A. the groundwater's TDS
    B. the blend can approach but not go below 300 mg/L
    C. 300 units are needed
    D. the y-intercept

12. True or false: A negative time that satisfies a work-rate equation is an extraneous solution.

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