

Unit 4 Section 1 Simplifying Rational Expressions

Simplify each and state the excluded values.

1) $-\frac{9k^5}{90k^4}$

2) $\frac{50a^2}{100a}$

3) $\frac{x+5}{x^2+9x+20}$

4) $\frac{9p^2-6p}{30p}$

5) $\frac{n-9}{n^2-6n-27}$

6) $\frac{x^2-11x+28}{x^2+2x-24}$

7) $\frac{p^2-7p+10}{3p-6}$

8) $\frac{m^2+3m-54}{9m+81}$

9) $\frac{n^2-n-42}{n^2+4n-12}$

10) $\frac{n^2-7n+6}{10n^3-10n^2}$

11) $\frac{49p^2+56p-84}{14p^2-77p+98}$

12) $\frac{x^2+11x+10}{2x^3+34x^2+140x}$

13) $\frac{x^3+x^2-x-1}{x^3-x^2-x+1}$

14) $\frac{x^4-1}{x^3+x^2+x+1}$

15) $\frac{x^3-x^2y+xy^2-y^3}{x^4-y^4}$

16) $\frac{x^4-y^4}{x^4+2x^2y^2+y^4}$

Unit 4 Section 2 Multiplying and Dividing Rational Expressions

Simplify each and state the excluded values.

1) $\frac{9k}{10k^2} \cdot \frac{2}{9}$

2) $\frac{3x}{3} \div \frac{2}{6x^2}$

3) $\frac{n+3}{(n+5)(n-6)} \cdot \frac{(n-6)(-n+3)}{n-3}$

4) $\frac{5(x+8)}{(x+6)(x+8)} \div \frac{1}{x+6}$

5) $\frac{1}{6b^2+54b} \cdot \frac{7b-28}{4-b}$

6) $(6a+48) \cdot \frac{a+7}{a+8}$

7) $\frac{n^2+10n+16}{n-4} \div \frac{n^2-5n-14}{n-7}$

8) $\frac{r^2-4r+3}{9r^3+36r^2} \cdot \frac{9r^3+45r^2}{r^2+2r-15}$

9) $\frac{50x+70}{6x-9} \cdot \frac{8x^2-12x}{50x+70}$

10) $\frac{10x^2+19x+6}{6-11x-10x^2} \div \frac{45x+18}{35x-14}$

11) $\frac{63p^3-54p^2}{70p-60} \cdot \frac{21p-21}{3p-3}$

12) $\frac{5k^2-11k-36}{9k^2} \div \frac{15k^2-8k-63}{27k^3-63k^2}$

13) $\frac{20}{56n+16} \cdot \frac{56n+16}{6}$

14) $\frac{4a^2+4a}{10a^2-6a-16} \div \frac{a-2}{35a^2-56a}$

15) $\frac{x^2+3ax}{3a-x} \cdot \frac{x^2-4ax+3a^2}{a^2-x^2} \div \frac{x+3a}{x+a}$

16) $\frac{3x^2+xy-2y^2}{3x^2-xy-2y^2} \div \frac{3x^2+7xy-6y^2}{3x^2-2xy-y^2} \div \frac{3x+y}{3x+2y}$

Unit 4 Section 3 Adding and Subtracting Rational Expressions

Find the least common multiple for each pair.

1) $3x^2y^2$ and $4x^4y^5z^3$

2) $x^2 - 1$ and $x^2 + 7x + 6$

3) $x^2 - x - 6$ and $x^2 - 8x + 15$

Simplify each expression.

4) $\frac{x - y}{18y^2} + \frac{x + 5y}{18y^2}$

5) $\frac{3}{2} + \frac{5y}{4y}$

6) $\frac{3x}{2x^3} - \frac{2y}{2x}$

7) $\frac{5}{6} - \frac{6y}{6xy^2}$

8) $\frac{5n}{5} - \frac{5}{n - 2}$

9) $\frac{5}{a + 4} - \frac{3a}{a + 2}$

10) $\frac{5}{5v + 1} + \frac{3}{v - 3}$

11) $\frac{6}{3b + 1} - \frac{b - 4}{b - 1}$

12) $\frac{3v}{v - 2} + \frac{5}{3v^2 + 9v}$

13) $\frac{3}{x^2 + x - 6} - \frac{2}{x^2 - 3x + 2}$

14) $\frac{3x^2 - 1}{x^2 - 3x - 18} - \frac{x + 2}{x - 6}$

15) $\frac{x + 2}{x^2 - 2x - 15} + \frac{x}{x + 3}$

16) $\frac{x + 6}{x^2 - 7x - 18} - \frac{2x}{x - 9}$

17) $\frac{a + b}{a - b} + \frac{a - b}{a + b} + \frac{b - a}{a - b} + \frac{b - a}{a + b}$

18) $\frac{x}{x - a} - \frac{x^2 + a^2}{x^2 - a^2} + \frac{a}{x + a}$

Unit 4 Section 4 Solving Rational Expressions

Solve each equation. Remember to check for extraneous solutions.

1) $\frac{1}{2p} = \frac{1}{p} + \frac{1}{p^2}$

2) $\frac{5a - 25}{a} = \frac{1}{2a} + \frac{1}{2}$

3) $1 = \frac{r - 4}{r^2} + \frac{r - 4}{r}$

4) $\frac{1}{n} = \frac{n - 6}{6n^2} + \frac{1}{6}$

5) $1 - \frac{p - 5}{2} = \frac{6}{p}$

6) $\frac{r^2 + 3r + 2}{2r} - 2 = \frac{1}{r}$

7) $\frac{1}{x + 5} = \frac{x + 2}{x^2 + 5x} + \frac{x + 1}{x^2 + 5x}$

8) $\frac{5}{m - 5} = \frac{1}{m + 4} - \frac{6}{m^2 - m - 20}$

9) $\frac{2}{n + 2} = \frac{n - 3}{n^2 + 5n + 6} + \frac{4}{n + 3}$

10) $\frac{k^2 - 7k + 6}{6k} + \frac{k}{6} = 1$

11) $\frac{1}{2n^2 + 12n + 16} = \frac{1}{2} - \frac{n}{2n + 4}$

12) $\frac{1}{k^2 + 3k + 2} = 1 - \frac{1}{k + 2}$

13) $1 + \frac{1}{p^2 + p - 30} = \frac{p + 4}{p + 6}$

14) $\frac{1}{x} - \frac{1}{x^2 - x} = 6$

15) $\frac{x - 5}{x - 2} = \frac{1}{x^2 - 4x + 4} + 1$

16) $\frac{4}{n^2 - 6n} - \frac{n - 6}{n^2 - 5n} = \frac{1}{n^2 - 11n + 30}$

17) $\frac{2}{3m - 3} + \frac{1}{3} = \frac{2m + 2}{m^2 - 3m + 2}$

18) $\frac{4x^2 - 2x - 6}{x^2 - 8x + 12} = 1 + \frac{1}{x - 2}$

Unit 4 Section 5 Application Problems Involving Rational Equations

Solve each question. Round your answer to the nearest hundredth.

- 1) Working together, Adam and Ryan can weed a garden in 6 minutes. Had he done it alone it would have taken Ryan 15 minutes. How long would it take Adam to do it alone?
- 2) Brenda can build a home in 10 weeks. One day her friend Aliyah helped her and it only took 6 weeks. How long would it take Aliyah to do it alone?
- 3) It takes Jill eight hours to oil the lanes in a bowling alley. Darryl can oil the same lanes in nine hours. If they worked together how long would it take them?
- 4) Working alone, it takes Amanda 15 hours to pick forty bushels of apples. Jill can pick the same amount in 14 hours. How long would it take them if they worked together?
- 5) Sam walks up a hill at 3 miles per hour and back down at 5 miles per hour. How many miles did she travel in all if her total walking time was 2 hours and 20 minutes?
- 6) Pam jogged up a hill at 6 km/h and then jogged back down at 10 km/h. How many kilometers did she travel in all if her total jogging time was 1 h 20 min?
- 7) The river boat Delta Duchess paddled upstream at 12 km/h, stopped for 2 h of sightseeing, and paddled back at 18 km/h. How far upstream did the boat travel if the total time for the trip, including the stop, was 7 h?
- 8) The German Club collected the same amount from each member participating in a trip to a music festival. When 6 members could not attend, each of the remaining members were charged \$2 more to cover the total cost of \$360. How many members went on the excursion?
- 9) The members of a computer club were assessed equally to raise \$400 for the purchase of software. When four more people joined the club, the per-member assessment was reduced by \$5.00. What is the new size of the club membership?
- 10) The rent for a ski lodge is \$600. The members of the ski club were to share the rental fee equally. When 5 members canceled, the cost per member increased by \$4. Find out how many members went on the trip.
- 11) Tim drove halfway Indianapolis at 60 mi/h and the rest of the way at 80 mi/h. What was his average speed for the whole trip?
- 12) Beth drove the first half of her trip at 36 mi/h. At what speed should she cover the remaining half in order to average 45 mi/h for the whole trip?

Unit 4 Section 6 Graphing Rational Expressions

Describe the transformation.

1) $f(x) = \frac{1}{x+5}$

2) $f(x) = -\frac{1}{x+2}$

3) $f(x) = \frac{3}{x}$

4) $f(x) = -\frac{4}{x}$

5) $f(x) = \frac{1}{x-7} - 2$

6) $f(x) = -\frac{1}{x-1} + 2$

7) $f(x) = \frac{3}{x+3} - 5$

8) $f(x) = -\frac{2}{x+6} + 3$

Identify the vertical asymptotes, horizontal asymptote, domain, and range of each. Then sketch the graph.

9) $f(x) = \frac{1}{x+2} + 1$

10) $f(x) = -\frac{1}{x+3}$

11) $f(x) = \frac{1}{x-2} - 2$

12) $f(x) = -\frac{1}{x-4}$

13) $f(x) = -\frac{1}{x+2} - 3$

14) $f(x) = \frac{4}{x+2}$

15) $f(x) = \frac{2}{x-3} + 1$

16) $f(x) = -\frac{4}{x+1} - 2$