

1. Reduce to lowest terms. Assume that all the denominators are nonzero:

a.  $\frac{(x+5)}{(x+3)(x+5)}$

b.  $\frac{y^2 - 2y - 24}{y^2 - 3y - 28}$

c.  $\frac{x^2 - 7x + 10}{x^2 - 4x + 4}$

d.  $\frac{5x^2 - 9x - 2}{x^2 - 4}$

e.  $\frac{x^2 - 81}{3x^2 + 25x - 18}$

f.  $\frac{x-7}{(4+x)(7-x)}$

2. Multiply or divide as indicated:

a.  $\frac{x^2 - 9}{x^2 - 4} \cdot \frac{x-2}{x-3}$

b.  $\frac{6x^2 + 2x}{x^2 + 4x + 4} \cdot \frac{x^2 - 4}{3x^2 - 5x - 2}$

c.  $\frac{(x+3)(x+4)}{x(x-5)} \cdot \frac{(x-2)(x-5)}{(x+3)(x+6)}$

d.  $\frac{x^2 + 2x - 24}{x^2 - x - 12} \div \frac{x^2 + 11x + 30}{x^2 + 9x + 20}$

e.  $\frac{8x^2 - 10x - 3}{2x^2 + 7x - 15} \div \frac{x^2 + x - 12}{x^2 + 2x - 15}$

f.  $\frac{6x^2 + 11x - 10}{12x^2 - 8x} \div \frac{2x^2 + 3x - 5}{4x^2 - 4x}$

3. Add or subtract as indicated. Reduce answers to lowest terms, if possible :

a.  $\frac{-2x}{x^2 - 6x + 5} + \frac{3x-5}{x^2 - 6x + 5}$

b.  $\frac{3x^2 - 4x - 25}{x^2 + 10x + 16} + \frac{-2x^2 + 7x - 15}{x^2 + 10x + 16}$

c.  $\frac{9x-2}{7x} - \frac{2x-3}{7x}$

d.  $\frac{4a+5}{a^2 + 6a + 5} - \frac{3a+4}{a^2 + 6a + 5}$

e.  $\frac{x-2}{x^2 - x - 2} + \frac{2x-3}{x^2 + 4x - 12}$

f.  $\frac{3x+5}{x^2 + 4x + 3} - \frac{2x+3}{x^2 + 2x + 1}$

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4. Solve these equations. Remember to check your solutions.

a.  $x + \frac{1}{x} = \frac{5}{2}$

b.  $\frac{1}{2x} - \frac{2}{3} = \frac{3}{5x}$

c.  $\frac{y}{y-2} - 2 = \frac{1}{y-2}$

d.  $\frac{3}{x+2} = \frac{4}{x-2}$

e.  $4 + \frac{3x^2 + 4}{x-8} = \frac{2x^2 + x}{x-8}$

f.  $\frac{2}{a} + \frac{3}{b} = c$  **Solve for a.**

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5. Write an algebraic equation and solve:

a. The sum of the reciprocal of a number and  $\frac{2}{5}$  is  $\frac{1}{2}$ . Find the number.b. The sum of the reciprocal of a number and  $\frac{5}{6}$  is  $\frac{14}{15}$ . Find the number.c. If  $y$  varies directly as  $x$ , and  $y = 15$  when  $x = 3$ , find  $y$  when  $x = 4$ .d. If  $y$  varies directly as  $x$ , and  $y = 35$  when  $x = 5$ , find  $y$  when  $x = 9$ .

e. Your paycheck (before deductions) varies directly as the number of hours you work. If your paycheck is 293.80 for 26 hours, find your pay for 10 hours.

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6. Divide. (Assume all variables are nonzero.)

a.  $\frac{3x^4 - 6x^3 + 9x^2}{3x^2}$

b.  $\frac{8x^3y^4 + 12x^2y^3 - 4xy^2}{4xy^2}$

c.  $\frac{-12x^3 + 6x^2 - 2x}{-2x}$

d.  $\frac{45x^8 - 60x^5 + 30x^2 - 15x}{15x}$ 

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7. Simplify each radical expression.

|                           |                   |                       |                                 |
|---------------------------|-------------------|-----------------------|---------------------------------|
| a. $\sqrt{\frac{36}{81}}$ | b. $\sqrt{180}$   | c. $\sqrt{64a^2b^7}$  | d. $\sqrt{8} \cdot \sqrt{18}$   |
| e. $\sqrt[3]{-27}$        | f. $\sqrt[3]{64}$ | g. $\sqrt{140x^6y^9}$ | h. $12\sqrt{7} \cdot 2\sqrt{7}$ |

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8. Evaluate each numerical expression, and simplify each variable expression. Use positive exponents only in your answer.

|  |                                      |                                    |
|--|--------------------------------------|------------------------------------|
| a. $8^{-2}$                            | b. $\frac{1}{2^{-3}}$                | c. $(3x)^0$                        |
| d. $(a^5b^{-3})^6 \cdot (a^{-2}b^4)^3$ | e. $4^{-9} \cdot 4^3 \cdot 4^2$      | f. $\frac{-54x^4y^{-5}}{9x^{-4}y}$ |
| g. $\left(\frac{a^{-2}}{a^5}\right)^3$ | h. $(-6x^2y^4)^2$                    | i. $\frac{x^9y^3}{x^7y^5}$         |
| j. $x^{-5} \cdot x^2$                  | k. $\frac{a^{-1}}{a^5 \cdot a^{-4}}$ | l. $\frac{a^4}{a^{10}}$            |

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9. Rewrite as a radical. Simplify, if possible to simplest radical form. Assume all variables represent nonnegative numbers.

|                      |                         |                      |
|----------------------|-------------------------|----------------------|
| a. $x^{\frac{1}{2}}$ | b. $81^{\frac{1}{2}}$   | c. $8^{\frac{2}{3}}$ |
| d. $x^{\frac{6}{3}}$ | e. $(5x)^{\frac{1}{2}}$ | f. $9^{\frac{3}{2}}$ |

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10. Write with positive rational exponents. Simplify if possible.

|                             |                          |                          |
|-----------------------------|--------------------------|--------------------------|
| a. $(\sqrt[5]{3y})^2$       | b. $(\sqrt[3]{2b})^2$    | c. $(\sqrt[3]{64y^3})^2$ |
| d. $(x^{15})^{\frac{1}{5}}$ | e. $(x^9)^{\frac{2}{3}}$ | f. $(\sqrt{4x^6})^3$     |

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11. Add or subtract as indicated to simplify these radical expressions.

a.  $7\sqrt{6} + 9\sqrt{6} - 2\sqrt{6}$       b.  $4\sqrt{18} + \sqrt{2}$       c.  $3\sqrt{12} + 4\sqrt{3}$

d.  $4\sqrt{8} - 2\sqrt{50} - 5\sqrt{72}$       e.  $(-2\sqrt{6} + 4\sqrt{3}) - (-5\sqrt{6} - \sqrt{3})$

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12. Multiply and simplify.

a.  $(3\sqrt{2}) \cdot (-5\sqrt{6})$       b.  $\sqrt{3} \cdot (\sqrt{2} - \sqrt{3})$

c.  $(\sqrt{11} - 7) \cdot (\sqrt{11} + 7)$       d.  $(\sqrt{2} + 3)^2$

e.  $(\sqrt{6} - 2) \cdot (\sqrt{6} + 5)$       f.  $(\sqrt{3} + \sqrt{8}) \cdot (\sqrt{12} - \sqrt{2})$

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13. Simplify. Rationalize denominators, if it applies.

a.  $\frac{\sqrt{9}}{\sqrt{81}}$       b.  $\frac{\sqrt{27}}{\sqrt{3}}$       c.  $\sqrt{\frac{5}{25}}$

d.  $\frac{2}{\sqrt{3}}$       e.  $\frac{\sqrt{3}}{\sqrt{7}}$       f.  $\frac{\sqrt{5}}{\sqrt{11}}$

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14. Solve the equations, and check your solutions.

a.  $x = \sqrt{5x - 4}$       b.  $\sqrt{y - 3} - 4 = 2$

c.  $x + 2 = \sqrt{6x + 7}$       d.  $\sqrt{x + 1} = -3$

e.  $\sqrt{8x - 4} = -2x$       f.  $\sqrt{2x - 3} = 1$

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|   |   |
|---|---|
| 1.a) $\frac{1}{x+3}$                      | 1.b) $\frac{y-6}{y-7}$                        |
| 1.c) $\frac{x-5}{x-2}$                    | 1.d) $\frac{5x+1}{x+2}$                       |
| 1.e) $\frac{x-9}{3x-2}$                   | 1.f) $-\frac{1}{4+x}$                         |
| 2.a) $\frac{x+3}{x+2}$                    | 2.b) $\frac{2x}{x+2}$                         |
| 2.c) $\frac{(x+4)(x-2)}{x(x+6)}$          | 2.d) $\frac{x+4}{x+3}$                        |
| 2.e) $\frac{4x+1}{x+4}$                   | 2.f) 1  |
| 3.a) $\frac{1}{x-1}$                      | 3.b) $\frac{x-5}{x+2}$                        |
| 3.c) $\frac{7x+1}{7x}$                    | 3.d) $\frac{1}{a+5}$                          |
| 3.e) $\frac{3x^2+3x-15}{(x-2)(x+1)(x+6)}$ | 3.f) $\frac{x^2-x-4}{(x+3)(x+1)(x+1)}$        |
| 4.a) $x = \frac{1}{2}, x = 2$             | 4.b) $x = -\frac{3}{20}$                      |
| 4.c) $y = 3$ 4d) $x = -14$                | 4.e) $x = 4, x = -7$<br>4f) $\frac{2b}{bc-3}$ |
| 5.a) $x = 10$                             | 5.b) $x = 10$                                 |
| 5.c) $y = 20$                             | 5.d) $y = 63$                                 |
| 5.e) Your pay is \$113.00                 |   |
| 6.a) $x^2 - 2x + 3$                       | 6.b) $2x^2y^2 + 3xy - 1$                      |
| 6.c) $6x^2 - 3x + 1$                      | 6.d) $3x^7 - 4x^4 + 2x - 1$                   |
| 7.a) $\frac{2}{3}$                        | 7.b) $6\sqrt{5}$                              |
| 7.c) $8ab^3\sqrt{b}$                      | 7.d) 12                                       |
| 7.e) -3                                   | 7.f) 4  |
| 7.g) $2x^3y^4\sqrt{35y}$                  | 7.h) 168                                      |
| 8.a) $\frac{1}{8^2} = \frac{1}{64}$       | 8.b) $2^3 = 8$                                |
| 8.c) 1                                    | 8.d) $a^{24}b^{-6} = \frac{a^{24}}{b^6}$      |
| 8.e) $\frac{1}{4^4} = \frac{1}{256}$      | 8.f) $-6x^8y^{-6} = -\frac{6x^8}{y^6}$        |

|  |  |
|--|--|
| 8.g) $a^{-21} = \frac{1}{a^{21}}$                                    | 8.h) $36x^4y^8$                                |
| 8.i) $x^2y^{-2} = \frac{x^2}{y^2}$                                   | 8.j) $x^{-3} = \frac{1}{x^3}$                  |
| 8.k) $a^{-2} = \frac{1}{a^2}$  | 8.l) $a^{-6} = \frac{1}{a^6}$                  |
| 9.a) $\sqrt{x}$  | 9.b) $\sqrt{81} = 9$                           |
| 9.c) $(\sqrt[3]{8})^2 = 2^2 = 4$                                     | 9.d) $\sqrt[3]{x^6} = x^2$                     |
| 9.e) $\sqrt{5x}$   | 9.f) $(\sqrt{9})^3 = (3)^3 = 27$               |
| 10.a) $(3y)^{\frac{2}{5}}$   | 10.b) $(2b)^{\frac{2}{3}}$                     |
| 10.c) $(64y^3)^{\frac{2}{3}} = (\sqrt[3]{64y^3})^2 = (4y)^2 = 16y^2$ | 10.d) $x^{\frac{15}{5}} = x^3$                 |
| 10.e) $x^{\frac{18}{3}} = x^6$                                       | 10.f) $(4x^6)^{\frac{3}{2}} = (2x^3)^3 = 8x^9$ |
| 11.a) $14\sqrt{6}$   | 11.b) $13\sqrt{2}$                             |
| 11.c) $10\sqrt{3}$   | 11.d) $-32\sqrt{2}$                            |
| 11.e) $3\sqrt{6} + 5\sqrt{3}$  | 12.a) $-30\sqrt{3}$                            |
| 12.b) $\sqrt{6} - 3$   | 12.c) $-38$                                    |
| 12.d) $11 + 6\sqrt{2}$   | 12.e) $-4 + 3\sqrt{6}$                         |
| 12.f) $2 + 3\sqrt{6}$  | 13.a) $\frac{3}{9} = \frac{1}{3}$              |
| 13.b) $\sqrt{9} = 3$   | 13.c) $\frac{\sqrt{5}}{5}$                     |
| 13.d) $\frac{2\sqrt{3}}{3}$  | 13.e) $\frac{\sqrt{21}}{7}$                    |
| 13.f) $\frac{\sqrt{55}}{11}$   | 14.a) $x = 1$ and $x = 4$                      |
| 14.b) $y = 39$   | 14.c) $x = -1$ and $x = 3$                     |
| 14.d) No solution; $x = 8$ does not check                            | 14.e) No solution; $x = 1$ does not check      |
| 14.f) $x = 2$  |  |