Algebra Lab Module 1

Chapter 1: Exponents and Radicals

All letters represent real numbers, and they are nonzero if they make the denominators zero.

1. Use the properties of exponents to simplify the following expressions:

In groups:

(a) $x^7 \cdot x^6 \cdot x^{-3}$

(b) $(-2a^3b^6)(-5b^{-1}a^{-7})$

(c) $\left(\dfrac{8p^2}{q^3}\right)^2$

(d) $\left(\dfrac{1}{4} - \dfrac{3}{8} + \dfrac{2}{3}\right)^2$

(e) $\left(\dfrac{-16x^2y^8}{4x^6y^{-3}}\right)^{-2}$

(f) $\left(\dfrac{6x^2y^{-4}z^3}{12y^3x^5z^{-4}}\right)^2 \cdot \left(-x^4y^5z^{-4}\right)^{-4}$

(g) $(3a+2)^{-7}(3a+2)^3$

Individually:

(a) $(5x^{-4}y^{-3})(-3x^{-1}y^8)$

(b) $\dfrac{x^{-3}x^6}{x^2}$

(c) $\dfrac{27y^2y^9}{18x^5y^2}$

(d) $\dfrac{-7p^3q^{11}}{49p^7q^3}$

(e) $\dfrac{x^{-13}x^6}{x^{20}}$

(f) $(x^{-2})^7$

(g) $(-3y^{-4})^4$

(h) $(-2a^5)^3$

(i) $\left(\dfrac{4x^{-2}y^{-3}}{8y^4}\right)^3$

(j) $\left(\dfrac{1}{4}\right)^{-2} - \left(\dfrac{3}{8}\right)^{-1} + \left(\dfrac{2}{3}\right)^0$

(k) $\left(\frac{1}{4}\right)^{-3} - \left(\frac{3}{8}\right)^{-1} + \left(\frac{2}{3}\right)^{0}$

(l) $\left(\frac{1}{2} - \frac{1}{3} + \frac{1}{4}\right)^{-2}$

(m) $\left(\frac{6x^4y^{-4}}{18x^{-2}y^{-3}}\right)^{-3}$

(n) $\left(\frac{2}{6p^3q^{-3}}\right)^{-2}\left(\frac{3}{2p^{-6}q^{-7}}\right)^{-1}$

(o) $\left(\frac{1}{4a^6b^{-1}}\right)^{2}\left(\frac{2}{5a^3b^{-4}}\right)^{-1}$

(p) $\left(\frac{14a^{-2}b^2c^5}{21c^2b^{-2}a^4}\right)^{2} \cdot \left(-3a^{-2}c^4b^{-2}\right)^{-3}$

(q) $\left(\frac{\left(y^{-4}\right)^{-2}y^{-3}}{y^{-5}}\right)^{-1}$

(r) $\left(\frac{\left(a^{-1}\right)^{3}a^{-2}}{a^{-2}}\right)^{-4}$

(s) $(5x-2)^{-3}(5x-2)^{4}$

(t) $(7x-1)^{4}(7x-1)^{-3}$

(u) $(1-7x)^{4}(7x-1)^{-3}$

(v) $\left((4x+3)^{4}\right)^{-3}$

(w) $\left((-5x+2)^{-5}\right)^{2}$

2. Use the properties of exponents, including rational exponents and radicals to simplify the following expressions:

In groups:

(a) $36^{1/2}$

(b) $\left(\frac{121}{144}\right)^{1/2}$

(c) $-16^{3/4}$

(d) $25^{3/2}$

Individually:

(a) $\left(\frac{49}{81}\right)^{1/2}$

(b) $16^{3/4}$

(c) $(-16)^{3/4}$

(d) $16^{-3/4}$

(e) $-16^{-3/4}$

(f) $(-16)^{-3/4}$

(g) $8^{2/3}$

(h) $-8^{2/3}$

(i) $(-8)^{2/3}$

(j) $8^{-2/3}$

(k) $-8^{-2/3}$

(l) $(-8)^{-2/3}$

3. Rewrite the following expressions using rational exponents:

   In groups:

   (a) $\sqrt[4]{x^3}$

   (b) $\sqrt[6]{a^6 + b^6}$

   (c) $\sqrt{9x^5}$

   Individually:

   (a) $\sqrt[8]{y^5}$

   (b) $9\sqrt{x^5}$

   (c) $\sqrt[5]{3x^2 - y^3}$

   (d) $\sqrt[4]{16p^{16} - q^{16}}$

   (e) $\sqrt{9a^8 - b^8}$

4. Simplify and rewrite the result using only positive rational exponents:

   In groups:

   (a) $\dfrac{x^{4/3}x^{2/3}}{x^{1/3}}$

   (b) $\dfrac{4z^{-4/7}z^{2/7}}{12z^{-1/7}}$

   (c) $\left(\dfrac{a^{2/3}}{b^{3/4}}\right)^{12}\left(\dfrac{b^{2/5}}{b^{3/2}}\right)^{10}$

   (d) $\left(\dfrac{x^2}{x+y}\right)^{-1}\left(\dfrac{x^2}{x+y}\right)^{1/2}$

Individually:

(a) $\dfrac{y^{2/5}y^{1/5}}{x^{3/5}}$

(b) $\dfrac{21x^{4/3}x^{2/3}}{14x^{1/3}}$

(c) $\dfrac{45a^{-4/5}a^{2/5}}{9b^{-1/3}}$

(d) $\dfrac{p^{-5/7}q^{-2/7}}{(-3)^{-2}r^{-2/5}}$

(e) $\left(16a^{-8}b^{1/5}\right)^{3/4}$

(f) $\left(125x^{6}b^{-7/5}\right)^{1/3}$

(g) $\left(\dfrac{x^2}{x-y}\right)^{-2}\left(\dfrac{x^2}{x-y}\right)^{3/2}$

(h) $\left(\dfrac{a^{2/3}}{b^{3/4}}\right)^{-2}\left(\dfrac{b^{2/5}}{b^{3/2}}\right)^{10}$

v

Algebra Lab Module 2

From the previous chapter on exponents:

All letters represent real numbers, and they are nonzero if they make the denominators zero.

5. Simplify each expression, and write the result in terms of positive exponents and radicals:

In groups:

(a) $\sqrt{x^7}$

(b) $\sqrt[3]{x^7}$

(c) $\sqrt[3]{250a^2b^6c^{13}}$

(d) $\sqrt{\dfrac{x^9}{36}}$

(e) $4\sqrt[3]{\dfrac{p^3z^8}{8}}$

(f) $\sqrt{10}\cdot\sqrt{14}$

(g) $\sqrt[3]{x^2y}\cdot\sqrt[3]{xy^2}$

(h) $\left(3\sqrt[4]{x^3}\right)\left(-5\sqrt[4]{x^3}\right)$

(i) $\left(-\dfrac{1}{2}\sqrt[3]{6x^2y^2z}\right)\left(\dfrac{4}{3}\sqrt[3]{4x^2z^2}\right)$

(j) $\sqrt[5]{x\sqrt[3]{x^2}}$

Individually:

(a) $\sqrt[4]{x^7}$

(b) $\sqrt[8]{x^7}$

(c) $\sqrt{24}$

(d) $\sqrt[3]{24}$

(e) $\sqrt{54}$

(f) $\sqrt[3]{54}$

(g) $\sqrt[4]{40x^3y^9z^{14}}$

(h) $\sqrt[4]{243p^{19}q^{10}}$

(i) $\sqrt{84(a-2)^3}$

(j) $\sqrt{12(x+42)^5}$

(k) $\sqrt{\dfrac{a^{13}}{64}}$

(l) $8\sqrt[3]{\dfrac{x^6y^7}{64}}$

(m) $\sqrt{6}\cdot\sqrt{21}$

(n) $\sqrt[4]{p^3q}\cdot\sqrt[4]{pq^3}$

(o) $\left(7\sqrt[6]{a^5}\right)\left(-2\sqrt[6]{a^5}\right)$

(p) $\left(\dfrac{1}{6}\sqrt[3]{9p^2q^5r}\right)\left(-\dfrac{3}{4}\sqrt[3]{6p^2qz^4}\right)$

(q) $\sqrt[5]{x^6y^5}\cdot\sqrt[4]{x}$

(r) $\sqrt[4]{p^3q}\cdot\sqrt[3]{pq^2}$

(s) $\sqrt[6]{a\sqrt[4]{a^3}}$

(t) $\sqrt{x\sqrt{x\sqrt{x}}}$

(u) $\sqrt[3]{x\sqrt[3]{x\sqrt[3]{x}}}$

6. Add or subtract as indicated. Leave your answers as simplified as possible:
In groups:

(a) $3\sqrt[3]{2x^2}-9\sqrt[3]{2x^2}+\sqrt[3]{2x^2}$

(b) $-3x\sqrt[3]{16xy^4}+xy\sqrt[3]{54xy}-5\sqrt[3]{250x^4y^4}$

Individually:

(a) $\dfrac{1}{5}\sqrt{50}-\dfrac{7}{3}\sqrt{18}+\dfrac{5}{6}\sqrt{72}$

(b) $\dfrac{2}{5}\sqrt{75}-\dfrac{2}{3}\sqrt{27}-\dfrac{1}{2}\sqrt{12}$

(c) $8\sqrt[4]{32p^5q^6}-5q\sqrt[4]{2p^5q^2}-pq\sqrt[4]{162pq^2}$

(d) $-\dfrac{1}{2}\sqrt{8x}+\dfrac{3}{7}\sqrt{98x}$

Chapter 2: Factoring

1. Factor the Greatest Common Factor (GCF).
   Groups:

   (a) $10x^7 - 40x^6 + 15x^5$
   (b) $5a(b - 6c) + 7(b - 6c)$

   Individually:

   (c) $21x^3y^6 - 14x^4y^5 + 35x^5y^2$
   (d) $8p^3(4k + 9) + 4p^2(4k + 9)$
   (e) $36a^5b^8 + 18a^4b^6 - 27a^3b^7$
   (f) $-7q^3p^2 + 49p^4q^3$
   (g) $-8y^4 + 24y^3 - 16y^2$

2. Factor out the indicated common factor.
   Groups:

   (a) Factor out a -1 from $a - b$
   (b) Factor out a -1 from $-5k^4 - 15c^3 + 20$
   (c) Factor out a -5 from $-15a^2 - 10y + 25$
   (d) Factor out a 3 from $-6y^2 + 12y + 9$
   (e) Factor out $-7x^3y$ from $-14x^4y^3 + 21x^3y^2 - 7x^3y$

   Individually:

   (f) Factor out a -1 from $-3y - 2x$
   (g) Factor out a -1 from $3y^2 - 5x^3 + 17$
   (h) Factor out a 5 from $-15a^2 - 10y + 25$
   (i) Factor out a -3 from $-6y^2 + 12y + 9$
   (j) Factor out $-4a^2b$ from $-12a^3b^2 - 8a^4b^3 + 4a^2b$

3. Factor by grouping
   Groups:

   (a) $6xy + 9y + 14x + 21$
   (b) $12a^3 - 9a^2 - 40a + 30$

   Individually:

   (c) $8xy + 18x + 20y + 45$
   (d) $30p^3 - 35p^2 - 24p + 28$
   (e) $ab - 8b + 4a - 2b^2$
   (f) $7x - 6y^2 + xy - 42y$

Algebra Lab Module 3

From the previous chapter on factoring:

4. Factor the following trinomials. You start by trying to factor any GCF, and then you may use any other method you know such as the AC method or Vietta, etc:
   Groups:
   (a) $x^2 + 2x - 63$
   (b) $2a^3 - 28a^2 + 80a$
   (c) $50y^3 + 160x^2y + 128xy^2$
   Individually:
   (d) $x^2 + 5x - 66$
   (e) $a^2 - 18a + 81$
   (f) $k^2 + 8k + 16$
   (g) $5p^4 - 40p^3 + 35p^2$
   (h) $25k + 6k^2 + 14$
   (i) $8 + 15n^2 + 26n$
   (j) $7a^3b - 40a^2b^2 - 12ab^3$
   (k) $48x^3 - 72x^2y + 27xy^2$
   (l) $9z^4 + 49w^8 + 42z^2w^4$
5. Factor by using the quadratic formula.
   Groups:
   (a) $x^2 - 3x - 7$
   (b) $121y^2 + 4$
   (c) $(5x + 7)(2x - 3) + 2x(x + 15) + 35$
   (d) $5x - 2 - 6x^2$
   (e) $\frac{1}{2}x^2 - \frac{2}{7} - \frac{5}{14}x$
   Individually:
   (f) $k(k + 10) + 34$
   (g) $4z + z^2 + 6$
   (h) $-3 - 5x^2 + 7x$
   (i) $-5x - 9 + x^2$
   (j) $y^2 + 8y + 19$
   (k) $9a^2 + 49$
   (l) $(6x + 5)(x - 3) + 2x(7x + 5) - x + 12$

(m) $x(x-6)+10$

(n) $\frac{1}{3}x^2 - \frac{7}{6} - \frac{3}{2}x$

6. Factor the following binomials.

Groups:

(a) $9x^2 - 64$

(b) $27a^3 + 8b^3$

(c) $81k^6 - 24m^9$

Individually:

(f) $49 - 16p^2$

(g) $200w^4 - 18z^6$

(h) $81a^4 - 1$

(i) $8a^6 - 125b^9$

(j) $1000x^{12} + 64y^6$

7. Apply all possible strategies learned and factor them completely.

Groups:

(a) $30y^4 + 70y^3 - 120y^2 - 280y$

(b) $p^2 - q^2 + 10q - 25$

(c) $(x^2-2) - 3(x^2-2) - 28$

(d) $h^6 - 7h^3 - 8$

Individually:

(f) $k^6 + 26k^3 - 27$

(g) $p^7 + 27p^4 - p^3 - 27$

(h) $24m^7 + 21m^4 - 3m$

(i) $4x^4 - 10x^3 - 36x^2 + 90x$

(j) $a^2 - b^2 + 8b - 16$

(k) $60p^4q + 78p^3q - 180p^2q$

(l) $(x^2+2)^2 + 5(x^2+2) - 24$

(m) $(x^3+12)^2 - 16$

(n) $(a^3+34)^2 - 49$

(o) $(p+q)^3 + k^3$

(p) $4m^2 + 36m(7n-1) + 81(7n-1)^2$

(q) $x^2 - y^2 - x - y$

(r) $x^2 + xy - 2y^2 - y + x$

x

Algebra Lab Module 4

Chapter 3: Polynomial Equations

1. Solve the following quadratic equations by factoring.
   Groups:

   (a) $x^2 + 5x = 24$

   (b) $8y(y + 3) = 2y - 5$

   (c) $40a^2 - 90 = 0$

   (d) $3x^2 = 12x$

   Individually:

   (e) $z^2 - 18 = -7z$

   (f) $6x(x + 4) = x - 15$

   (g) $32y^2 - 162 = 0$

   (h) $x^2 = 25x$

2. Solve by using the square root property: $x^2 - u = 0 \iff x^2 = u \iff x = \pm\sqrt{u}$
   Groups:

   (a) $x^2 = 81$

   (b) $5k^2 = 35$

   (c) $4y^2 + 64 = 0$

   (d) $(x + \sqrt{3})^2 = 32$

   (e) $\left(x - \frac{1}{4}\right)^2 = -49/27$

   Individually:

   (f) $x^2 = 169$

   (g) $6v^2 - 30 = 0$

   (h) $8y^2 + 32 = 0$

   (i) $(k + 9)^2 = 24$

   (j) $(x - 9)^2 = 121$

   (k) $(z + \sqrt{2})^2 = 28$

   (l) $\left(x - \frac{1}{5}\right)^2 = -\frac{19}{8}$

3. Solve the quadratic equation by completing the square and then applying the square root property.

   Groups:

   (a) $x^2 - 4 + 22x = 0$
   (b) $z^2 - 8z = -24$
   (c) $4y^2 + 24y = -160$
   (d) $2k(k-3) = 4 + k^2$

   Individually:

   (e) $y^2 + 14y - 3 = 0$
   (f) $x^2 - 24x + 156 = 0$
   (g) $2x^2 + 20x = -70$
   (h) $5y(y-2) = 6 + 3y$
   (i) $-4k^2 - 12k + 5 = 0$
   (j) $-2y^2 - 14x + 5 = 0$

4. Solve by using the quadratic formula.

   Groups:

   (a) $x^2 - 3x - 7 = 0$
   (b) $121y^2 + 4 = 0$
   (c) $(5x+7)(2x-3) = -2x(x+15) - 35$
   (d) $5x - 2 = 6x^2$
   (e) $\frac{1}{2}x^2 - \frac{2}{7} = \frac{5}{14}x$

   Individually:

   (f) $k(k+10) + 34 = 0$
   (g) $4z + z^2 = -6$
   (h) $-3 - 5x^2 = -7x$
   (i) $-5x = 9 - x^2$
   (j) $y^2 + 8y + 19 = 0$
   (k) $9a^2 + 49 = 0$
   (l) $(6x+5)(x-3) = -2x(7x+5) + x - 12$
   (m) $x(x-6) = -10$
   (n) $\frac{1}{3}x^2 - \frac{7}{6} - \frac{3}{2}x = 0$

5. Solve the quadratic equations by using any method.

   Groups:

   (a) $(3y-5)^2=0$
   (b) $x^2+4x=-2$
   (c) $\dfrac{x^2-4x}{6}-\dfrac{5x}{3}=0$
   (d) $2(x+4)+x^2=x(x+2)+8$
   (e) $x^2-\sqrt{121}=0$

   Individually:

   (f) $(2x+1)^2=0$
   (g) $a^2+8a=-3$
   (h) $\dfrac{x^2+2x}{7}-\dfrac{x}{14}=\dfrac{3}{2}$
   (i) $3(z-5)+z^2=z(z+3)-15$
   (j) $\dfrac{3}{5}x^2-\dfrac{1}{10}x=\dfrac{1}{2}$
   (k) $\dfrac{1}{12}x^2-\dfrac{11}{24}x=-\dfrac{1}{2}$
   (l) $y^2-5y=5y(y-1)-4y^2+1$
   (m) $k^2-4k=4k(k-1)-3k^2+2$
   (n) $(3x-8)(x+2)=3x^2+10$
   (o) $(2a+7)(a+1)=2a^2-11$
   (p) $x^2-\sqrt{5}=0$

Algebra Lab Module 5

From the previous chapter on polynomial equations:

6. Solve the following polynomial equations:

   Groups:

   (a) $4x^3 + 12x^2 - 9x - 27 = 0$
   (b) $2y^5 = 16y^2$
   (c) $k^3 = -27$

   Individually:

   (d) $x^3 = -64$
   (e) $75x^3 + 100x^2 - 3x - 4 = 0$
   (f) $3x^2(x^2 + 3) = 20 - 2x^2$
   (g) $98y^3 - 49y^2 - 8y + 4 = 0$
   (h) $10a^5 = -1250a^2$
   (i) $2x^4 - 32 = 0$
   (j) $2x^2(x^2 - 2) = 18 + x^2$
   (k) $5k^4 = 5$
   (l) $25x^3 + 100x^2 - x = 4$
   (m) $z^4 = 27z$
   (n) $2y^4 = -128y$

7. Solve the following equations in quadratic form by using a change of variable.

   Groups:

   (a) $(x^2 - 3)^2 - 9(x^2 - 3) - 52 = 0$
   (b) $y^2(y^2 - 2) = y^2 + 13$

   Individually:

   (c) $(x^2 + 2)^2 + (x^2 + 2) - 42 = 0$
   (d) $x^2(x^2 + 5) = 7$
   (e) $(2x^2 - 3)^2 + 36(2x^2 - 3) + 35 = 0$
   (f) $(x^2 - 6)^2 + 33(x^2 - 6) = -62$

Chapter 4: Rational Expressions

1. Determine the real restrictions of the variables, if any:
   Groups:

   (a) $\dfrac{x-3}{x+2}$

   (b) $\dfrac{x}{x^2-49}$

   (c) $\dfrac{5}{x-y}$

   (d) $\dfrac{x+2}{x^2-x-6}$

   Individually:

   (e) $\dfrac{x+5}{x-\sqrt{11}}$

   (f) $\dfrac{-3}{121-y^2}$

   (g) $\dfrac{x}{x(x-y)}$

   (h) $\dfrac{-7}{x^2+4}$

2. Simplify the following rational functions by factoring and dividing, and state any real restrictions needed for any simplification performed:
   Groups:

   (a) $\dfrac{x^2-16}{x^2-x-12}$

   (b) $\dfrac{8+2\sqrt{7}}{4}$

   (c) $\dfrac{y^2-64}{y^2-7y-8}$

   (d) $\dfrac{4b-4a}{ax-xb-2a+2b}$

   Individually:

   (e) $\dfrac{x^2-9}{x^2-4x-21}$

   (f) $-\dfrac{12a^2bc}{3ab^5}$

   (g) $\dfrac{10-5\sqrt{5}}{15}$

(h) $\dfrac{2y^2 - 16y}{64 - y^2}$

3. Multiply or divide as indicated. Assumed the variables can only take values that yield nonzero denominators.

Groups:

(a) $\dfrac{8x - 3y}{x^3y^4} \times \dfrac{6xy^8}{24x - 9y}$

(b) $\dfrac{a^{11}b^2}{a^2 - b^2} \div \dfrac{18a^9b^5}{9a^2 + 6ab - 15b^2}$

(c) $\dfrac{3x^5y^7}{x - 5y} \times \dfrac{2x - 10y}{12x^4y^{10}}$

(d) $\dfrac{a^2 - b^2}{ab^{11}} \div \dfrac{8a^2 + 4ab - 4b^2}{8a^4b^{10}}$

Individually:

(e) $\dfrac{2x^2y - xy^2}{8y^2 + xy} \times \dfrac{x^2 + 16xy + 64y^2}{2x^2 + 15xy - 8y^2}$

(f) $\dfrac{a^3 - 64}{16a - a^3} \div \dfrac{2a^2 + 8a + 32}{a^2 + 2a - 8}$

(g) $\dfrac{2m^2 - 2mn}{3m^2n + 2m^3} \times \dfrac{4m^2 + 12mn + 9n^2}{2m^2 + mn - 3n^2}$

(h) $\dfrac{3x^2 + 21x + 147}{25x - x^3} \div \dfrac{x^3 - 343}{x^2 - 12x + 35}$

Algebra Lab Module 6

From the previous chapter on rational expressions:

4. Identify the Least Common Denominator (LCD) for each pair of rational expressions.

   Groups:

   (a) $\dfrac{7}{6a^5bc^4}$ and $\dfrac{3}{20ab^2c^3}$

   (b) $\dfrac{2x+1}{(3x+4)^3(x-2)}$ and $\dfrac{4}{x(3x+4)^2(x-2)^2}$

   Individually:

   (c) $\dfrac{12}{35x^4yz^3}$ and $\dfrac{8}{25x^2y^3z}$

   (d) $\dfrac{5a-7}{a(2a-5)^3(a+6)^4}$ and $\dfrac{6}{(2a-5)^3(a+6)^2}$

   (e) $\dfrac{b+3}{b^2+20b+100}$ and $\dfrac{3}{2b^2+20b}$

   (f) $\dfrac{w-4}{4w^2-20w+25}$ and $\dfrac{5}{12w^2-30w}$

5. Add or subtract as indicated. Assumed the variables can only take values that yield nonzero denominators.

   Groups:

   (a) $\dfrac{x^2}{x+3}+\dfrac{6x+9}{(x+3)^2}$

   (b) $\dfrac{9}{2a^2y^4}-\dfrac{11}{xy^5}$

   (c) $\dfrac{1}{w^2+wz}-\dfrac{2}{x^2-y^2}$

   (d) $\dfrac{3b}{b-5}+\dfrac{2b+4}{5-b}$

   (e) $\dfrac{5}{y}+\dfrac{2}{y+1}-\dfrac{6}{y^2}$

   Individually:

   (f) $\dfrac{a^2}{a+5}+\dfrac{7a+10}{a+5}$

   (g) $\dfrac{6}{25n}-\dfrac{7}{10n^4}$

(h) $\dfrac{-2}{3x^3y} - \dfrac{5}{x^2y^4}$

(i) $\dfrac{4}{4a^2 - b^2} - \dfrac{1}{2a^2 - ab}$

(j) $\dfrac{2w - 1}{w - 8} - \dfrac{w + 6}{8 - w}$

(k) $\dfrac{5}{x^2} + \dfrac{4}{x + 2} - \dfrac{3}{x}$

6. Simplify the following fractions:

Groups:

(a) $\dfrac{\dfrac{1}{27a} + \dfrac{1}{9}}{\dfrac{1}{3} + \dfrac{1}{9a}}$

(b) $\dfrac{\dfrac{b}{6} - \dfrac{5b + 14}{6b}}{\dfrac{1}{6} - \dfrac{7}{6b}}$

(c) $\dfrac{2y^{-1} - y^{-1}}{4y^{-2} - y^{-2}}$

(d) $\dfrac{\dfrac{4}{1 + x} - 4}{x}$

Individually:

(e) $\dfrac{\dfrac{1}{8z} + \dfrac{1}{4}}{\dfrac{1}{2} + \dfrac{1}{4z}}$

(f) $\dfrac{\dfrac{y}{3} - \dfrac{2y + 3}{3y}}{\dfrac{1}{3} + \dfrac{1}{3y}}$

(g) $\dfrac{3x^{-1} - x^{-1}}{9x^{-2} - x^{-2}}$

(h) $\dfrac{\dfrac{3}{1 + a} - 3}{a}$

(i) $\dfrac{\dfrac{7}{x + y} - \dfrac{7}{x}}{y}$

(j) $\dfrac{\dfrac{8}{a+b} - \dfrac{8}{a}}{b}$

7. Find the solution(s), if any, to the following rational equations:

   Groups:

   (a) $\dfrac{5}{x^2+2x+1} = 0$

   (b) $\dfrac{3x^2+8x-5}{x^2+3} = 3$

   (c) $\dfrac{4x^2+2}{x^2+4x-5} = 0$

   (d) $\dfrac{x^3-4x^2-2x+8}{x^3+3x^2-4} = 1$

   Individually:

   (e) $\dfrac{8}{x^2+4x+4} = 0$

   (f) $\dfrac{-4x^2+5x-1}{x^2+2} = -4$

   (g) $\dfrac{2x+4}{x^2+7x-4} = 0$

   (h) $\dfrac{2x^2-3x-5}{x^2+1} = 2$

   (i) $\dfrac{x+3}{2x^2-3x-5} = 0$

   (j) $\dfrac{4x^2+7x-2}{x^2+4} = 4$

   (k) $\dfrac{x^3+3x^2-6x-8}{x^3-2x^2-5x+6} = 1$