

## 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)  $\sqrt{\frac{x^9}{36}}$
- (e)  $4\sqrt[3]{\frac{p^3z^8}{8}}$
- (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)  $\left(-\frac{1}{2}\sqrt[3]{6x^2y^2z}\right)\left(\frac{4}{3}\sqrt[3]{4x^2z^2}\right)$
- (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)  $\sqrt{\frac{a^{13}}{64}}$
- (l)  $8\sqrt[3]{\frac{x^6y^7}{64}}$
- (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)  $\left(\frac{1}{6}\sqrt[3]{9p^2q^5r}\right)\left(-\frac{3}{4}\sqrt[3]{6p^2qz^4}\right)$
- (q)  $\sqrt[5]{x^6y^5} \cdot \sqrt[4]{x}$
- (r)  $\sqrt[4]{p^3q} \cdot \sqrt[3]{pq^2}$
- (s)  $\sqrt[6]{a^4\sqrt[4]{a^3}}$
- (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)  $\frac{1}{5}\sqrt{50} - \frac{7}{3}\sqrt{18} + \frac{5}{6}\sqrt{72}$
- (b)  $\frac{2}{5}\sqrt{75} - \frac{2}{3}\sqrt{27} - \frac{1}{2}\sqrt{12}$
- (c)  $8\sqrt[4]{32p^5q^6} - 5q\sqrt[4]{2p^5q^2} - pq\sqrt[4]{162pq^2}$
- (d)  $-\frac{1}{2}\sqrt{8x} + \frac{3}{7}\sqrt{98x}$

## 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:

- (d)  $k(k + 10) + 34$
- (e)  $4z + z^2 + 6$
- (f)  $-3 - 5x^2 + 7x$
- (g)  $-5x - 9 + x^2$
- (h)  $y^2 + 8y + 19$
- (i)  $9a^2 + 49$
- (j)  $(6x + 5)(x - 3) + 2x(7x + 5) - x + 12$

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

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

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

## 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)  $\frac{x^2 - 4x}{6} - \frac{5x}{3} = 0$

(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)  $\frac{x^2 + 2x}{7} - \frac{x}{14} = \frac{3}{2}$

(i)  $3(z - 5) + z^2 = z(z + 3) - 15$

(j)  $\frac{3}{5}x^2 - \frac{1}{10}x = \frac{1}{2}$

(k)  $\frac{1}{12}x^2 - \frac{11}{24}x = -\frac{1}{2}$

(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)  $x^2 - \sqrt{5} = 0$

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)  $10a^5 = -1250x^2$
- (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)  $(x^2 - 6)^2 + 33(x^2 - 6) = -62$