Math 115—College Algebra
Measurable Outcomes

Mathematics Department, UMass Boston

Reference text: Numbers in brackets refer to sections of Miller, O'Neill, and Hyde, *Intermediate Algebra,* fourth edition.

Note: Outcomes marked **(Optional)** may appear on the final exam with the unanimous consent of all instructors.

1. Linear equations in one variable

- **1(a)** Distinguish linear from non-linear equations. [1.1]
- **1(b)** Solve linear equations in one variable. [1.1]
- **1(c)** **(Optional)** Model word problems with linear equations. [1.2]
- **1(d)** Solve for one variable in a linear equation involving several variables. [1.3]

2. Linear inequalities in one variable

- **2(a)** Solve linear inequalities in one variable. [1.4]
- **2(b)** Describe unions and intersections of sets of real numbers. [1.5]
- **2(c)** Solve systems of linear inequalities connected by "and" or "or." [1.5]

3. Equations and inequalities with absolute values

- **3(a)** Solve equations involving one or two absolute value expressions. [1.6]
- **3(b)** Solve inequalities with one absolute value expression. [1.7]

4. Linear equations in two variables

- **4(a)** Write a linear equation in standard form. [2.1]
- **4(b)** Find the intercepts of a linear equation. [2.1]
- **4(c)** Generate additional solutions of a linear equation. [2.1]
- **4(d)** Recognize horizontal and vertical lines. [2.1]

4(e) Interpret slope as rise over run. [2.2]

4(f) Compute the slope of a line from two of its points. [2.2]

4(g) Recognize parallel and perpendicular lines by comparing their slopes. [2.2]

4(h) Write a linear equation in slope-intercept form. [2.3]

4(i) Graph a linear equation in slope-intercept form. [2.3]

4(j) Find the equation of a line, given its slope and y-intercept. [2.3]

4(k) Use the point-slope form to find the equation of a line, given its slope and one point. [2.3]

4(l) Find the equation of a line, given two points. [2.3]

4(m) Write the equation of a line parallel or perpendicular to a given line, through a given point. [2.3]

4(n) **(Optional)** Model word problems using linear equations in two variables. [2.4]

5. Relations and functions

5(a) Write a relation as a set of ordered pairs. [2.5]

5(b) Describe the domain and range of a relation. [2.5]

5(c) Distinguish functions from more general relations. [2.6]

5(d) Recognize the graph of a function using the Vertical Line Test. [2.6]

5(e) Use function notation. [2.6]

5(f) Read function values from a graph. [2.6]

5(g) Find the largest possible domain of a function, given a formula for the function. [2.6]

5(h) Recognize constant, linear, and quadratic functions. [2.7]

5(i) Reproduce the graphs of the identity, squaring, cubing, absolute value, square root, and reciprocal functions. [2.7]

5(j) Find the x- and y-intercepts of a function, given a formula for the function. [2.7]

6. Systems of linear equations

6(a) Determine whether a point is a solution of a system of equations. [3.1]

6(b) Solve a linear system by graphing. [3.1]

6(c) Solve a linear system using the Substitution Method. [3.2]

6(d) Solve a linear system using the Addition Method (i.e. the Elimination Method). [3.3]

6(e) Recognize inconsistent and dependent systems. [3.2, 3.3]

6(f) **(Optional)** Model word problems with linear systems. [3.4]

7. Polynomials

7(a) Simplify expressions using the laws of exponents. [4.1]

7(b) Use scientific notation. [4.1]

7(c) Recognize monomial, binomial, trinomial, and polynomial expressions [4.2]

7(d) Add and subtract polynomial expressions. [4.2]

7(e) Recognize the degree of a polynomial expression. [4.2]

7(f) **(Optional)** Model word problems with polynomial functions. [4.2]

7(g) Multiply polynomials. [4.3]

7(h) Square a binomial. [4.3]

7(i) **(Optional)** Cube a binomial. [4.3]

7(j) **(Optional)** Divide a polynomial by a monomial. [4.4]

7(k) **(Optional)** Compute quotient and remainder using polynomial long division. [4.4]

7(l) Find the greatest common factor of several monomials. [4.5]

7(m) Factor the greatest common factor out of a polynomial. [4.5]

7(n) Factor a polynomial by grouping. [4.5]

7(o) Factor trinomials. [4.6]

7(p) Recognize and factor perfect square trinomials. [4.6]

7(q) Factor a difference of squares. [4.7]

7(r) **(Optional)** Factor a sum or difference of cubes. [4.7]

7(s) Write and explain the zero-product rule [4.8]

7(t) Solve polynomial equations by factoring. [4.8]

8. Rational expressions

8(a) Distinguish rational expressions from more general expressions. [5.1]

8(b) Reduce a rational expression to lowest terms. [5.1]

8(c) Multiply and divide rational expressions. [5.2]

8(d) Find the least common denominator of two rational expressions. [5.3]

8(e) Add and subtract rational expressions. [5.3]

8(f) Reduce compound fractions. [5.4]

8(g) Solve a rational equation in one variable. [5.5]

8(h) Solve for one variable in a rational equation with several variables. [5.5]

8(i) **(Optional)** Solve proportions and similar triangles. [5.6]

8(j) **(Optional)** Recognize direct and inverse variation. [5.7]

9. Radicals

9(a) Correctly interpret and evaluate $\sqrt{a}$ (the *principal* or non-negative square root of a non-negative real number a). [6.1]

9(b) Find all real solutions of equations of the form $x^2 = a$. [6.1]

9(c) Correctly interpret and evaluate $\sqrt[n]{a}$, where n is any positive integer and a is a non-negative real number. [6.1]

9(d) Find all real solutions of equations of the form $x^n = a$. [6.1]

9(e) Simplify expressions of the form $\sqrt[n]{a^n}$. [6.1]

9(f) Find the third side of a right triangle, given any two sides. [6.1]

9(g) Find the largest possible domain of a function involving radicals. [6.1]

9(h) Evaluate expressions of the form $a^{n/m}$. [6.2]

9(i) Convert between radical notation and rational exponents. [6.2]

9(j) Simplify expressions involving rational exponents by using the laws of exponents. [6.3]

9(k) Simplify radical expressions using the fact that $\sqrt[n]{ab} = \sqrt[n]{a}\,\sqrt[n]{b}$ when $a, b > 0$. [6.3]

9(l) Add and subtract radical expressions. [6.4]

9(m) Multiply radical expressions. [6.5]

9(n) Multiply radicals with different indices. [6.5]

9(o) Simplify radical expressions using the fact that $\sqrt[n]{a/b} = \sqrt[n]{a}/\sqrt[n]{b}$ when $a, b > 0$. [6.6]

9(p) Rationalize the denominator of a radical expression. [6.6]

9(q) Solve equations involving one or two radical expressions. [6.7]

10. Quadratic equations and quadratic functions

10(a) Solve quadratic equations by completing the square. [7.1]

10(b) Solve quadratic equations by using the Quadratic Formula. [7.2]

10(c) Calculate the discriminant of a quadratic expression. [7.2]

10(d) Use the discriminant to predict the number of real solutions of a quadratic equation. [7.2]

10(e) **(Optional)** Solve equations in quadratic form. [7.3]

10(f) Sketch the graph of a quadratic function. [7.4]

10(g) Find the vertex of a parabola. [7.5]

10(h) Solve quadratic optimization problems. [7.5]

11. Polynomial and rational inequalities (Optional)

11(a) **(Optional)** Solve polynomial inequalities. [7.6]

11(b) **(Optional)** Solve rational inequalities. [7.6]