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Algebra 2 - REA's Quick Access Reference Chart (Quick Access Reference Charts)

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ALGEBRA II

SYSTEMS OF LINEAR EQUATIONS

A. DEFINITION – A system of linear equations is a collection of equations where each equation only contains terms that are either constants or variables raised to the first power.

$$2x + 3y = 10 \quad (1)$$

$$4x - 5y = 12 \quad (2)$$

$$-3x + 2y = 8 \quad (3)$$

B. MATRICES – Rewrite the coefficients of the system as an augmented matrix. Then perform row operations to get the matrix into row echelon form. The rightmost column is equal to the identity matrix. The rightmost column gives you the solutions for each variable.

Augmented matrix:
$$\left[\begin{array}{ccc|c} 2 & 3 & 10 & 1 \\ 4 & -5 & 12 & 2 \\ -3 & 2 & 8 & 3 \end{array} \right]$$

C. CRAMER'S RULE – Let A be the square matrix of coefficients (all the last columns of the augmented matrix). Each column represents the coefficients of one variable. Let A_i be the matrix A with the i th column replaced with the last column of the augmented matrix. Then the value of each variable is as follows:

$$x_i = \frac{\det A_i}{\det A}$$

where x_i is the i th variable, and $\det A$ denotes the determinant.

D. ELIMINATION – Scale each equation so that they can be added or subtracted to eliminate variables.

$$2x + 3y = 10 \quad (1)$$

$$4x - 5y = 12 \quad (2)$$

$$-3x + 2y = 8 \quad (3)$$

E. SUBSTITUTION – Solve one equation for one of the variables then substitute that into another equation. Repeat until all variables are found.

$$2x + 3y = 10 \quad (1)$$

$$4x - 5y = 12 \quad (2)$$

$$2x + 3(4x - 12) = 10$$

$$2x + 12x - 36 = 10$$

$$14x = 46$$

$$x = \frac{23}{7}$$

QUADRATIC EQUATIONS

A. DEFINITION – An equation of the form $ax^2 + bx + c = 0$ where $a \neq 0$, and a , b , and c are constants.

B. GRAPHING QUADRATIC EQUATIONS – The solutions, or roots, of a quadratic equation are the values of x that satisfy the equation. A quadratic equation has two roots that may be rational, irrational, imaginary, or complex.

A. Direct Solution – Solve for the variable and solve directly.

$$x^2 = 9 \Rightarrow x = \pm 3$$

$$x^2 = 9 \Rightarrow x = 3$$

B. Factoring

Factor the quadratic equation as a product set equal to 0.

$$ax^2 + bx + c = a(x - r_1)(x - r_2)$$

By the Zero Product Property, $x = r_1$ and $x = r_2$ are roots of the equation.

Then solve factoring.

$$x_1, x_2 = -\frac{b}{2a} \text{ and } x_1, x_2 = \pm \sqrt{\frac{b^2 - 4ac}{4a}}$$

C. Completing the Square

$$x^2 - 12x + 36 = 0$$

$$x^2 - 12x = -36$$

$$x^2 - 12x + \frac{144}{4} = -36 + \frac{144}{4}$$

$$x^2 - 12x + \left(\frac{12}{2}\right)^2 = -36 + \left(\frac{12}{2}\right)^2$$

$$x^2 - 12x + 36 = -36 + 36$$

$$x^2 - 12x + 36 = 0$$

Isolate the variables on one side.

$$x^2 - 12x + 36 = 0$$

$$x^2 - 12x + 36 = 0$$

$$x^2 - 12x + \left(\frac{12}{2}\right)^2 = 0$$

$$x^2 - 12x + 36 = 0$$

$$x^2 - 12x + 36 = 0$$

D. QUADRATIC FORMULA – The quadratic formula is a general formula for finding the roots of a quadratic equation.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

E. Discriminant – $b^2 - 4ac$ is the expression under the radical sign. It can be used to determine the number of real roots of a quadratic equation. This is because the square root of a negative number is always imaginary, and if you add or subtract it you always get the same number.

- $b^2 - 4ac < 0$ – the equation has 2 complex roots
- $b^2 - 4ac = 0$ – the equation has 1 double root
- $b^2 - 4ac > 0$ – the equation has 2 real roots

B. SOLVING SYSTEMS OF EQUATIONS WITH QUADRATICS

- 1. Linear + Quadratic** – Solve the linear and substitute in quadratics.
- 2. Quadratic + Quadratic** – Isolate one variable, solve for one variable, and substitute.
- 3. Quadratic, Exponential, or Logarithmic** – Factor and set each factor equal to zero, substitute, and solve to find appropriate solutions.
- 4. Quadratic Equations of the Form $ax^2 + bx + c = 0$ where $a \neq 0$, a , b , and c are real numbers** – Factor the two equations and solve the two homogeneous equations as indicated above.
- 5. 2-Quadratic Equations, Each Symmetrical** – Factor and substitute $x = -b/a$ and $x = -b/a$ into the equations and solve the resulting equations for x and y .

C. EQUATIONS OF HIGHER ORDER

A. METHODS TO SOLVE EQUATIONS – ORDER > 3

- 1. Factorization**
- 2. Write 3rd order equation as:** $x^3 + 8x^2 + 8x + 8 = 0$, where $-8 = a$, $8 = b$, $8 = c$, and $8 = d$. a, b, c, d are real numbers.
- 3. Roots of products of roots taken two at a time** – $-8 = \text{product of the roots}$.
- 4. Graphing the roots of an equation $f(x) = 0$** – are the values of x where the graph of $y = f(x)$ intersects the x -axis. The roots are the x -intercepts of the function and correspond to the roots of the equation.
- 5. After factoring as much as possible, the quadratic formula and polynomial long division can also be used.**

B. THEORY OF EQUATIONS

- 1. Remainder Theorem** – If $P(x)$ is divided by $(x - a)$, then the remainder is $P(a)$. This implies that if $P(a) = 0$, then $(x - a)$ divides evenly into $P(x)$ and a is a root of the equation.
- 2. Factor Theorem** – If a is a root of the equation $f(x) = 0$, then $(x - a)$ is a factor of $f(x)$.

D. DESCARTES' RULE OF SIGNS – The number of positive and negative roots of a polynomial equation $f(x) = 0$ with real coefficients can be determined by examining the variation of signs.

$$\text{pos. roots} = \text{sign changes of } f(x)$$

$$\text{neg. roots} = \text{sign changes of } f(-x)$$

- 1. The number of positive roots cannot exceed the number of variations in sign of $f(x)$. The difference between the number of variations and the number of positive roots is an even number.**
- 2. The number of negative roots cannot exceed the number of variations in sign of $f(-x)$. The difference between the number of variations and the number of negative roots is an even number.**

QUADRATIC FUNCTIONS

A. DEFINITION – The function $f(x) = ax^2 + bx + c$, where $a \neq 0$ and a , b , and c are real numbers, is called a quadratic function or a function of quadratic equations in one variable.

B. GRAPH

- 1. The graph of $y = ax^2 + bx + c$ is a curve known as a parabola.**
- 2. The vertex of the parabola is the point $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$. The parabola's line of symmetry is the line $x = -\frac{b}{2a}$.**

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This is a wonderful reference chart. This would be useful for anyone taking psychology, sociology, social work etc. This chart does a wonderful job breaking down the basic essentials of psychology. This chart was extremely helpful in getting me through human behavior 1 and 2 for SW. This price was extremelyordable in the item came extremely fast in the mail. (less the a week)

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High quality and delivered on time.

High quality and delivered on time.

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