Why MAES?

MAES is truly a familia that will help you become an exemplary leader within the community. You will never feel intimidated to speak to our professionals or to ask questions from any of our volunteer-based leadership team. We exist because of students and professionals like you. Get started, join the MAES familia! We have professional, student, and no fee associate memberships.

Objectives

Objective 1 - Participation: Latino scientists and engineers are key contributors to America's pursuit of global STEM leadership.

- Objective 1a - Family: Latino families encourage, drive, and support their children to pursue opportunities in STEM.
- Objective 1b - Pre-College: Latino students graduate high school with the academic skills necessary to pursue higher education in STEM.
- Objective 1c - College: Latino undergraduate and graduate students are technically accomplished, socially responsible, and capable leaders within their STEM fields.
- Objective 1d - Professional: Latino STEM professionals are globally competitive at every level of technical and managerial leadership.

Objective 2 - Advocacy: Socially responsible Latino scientists and engineers advocate for increased resources and involvement in STEM.

For more information visit:
www.mymaes.org

MAES
Latinos in Science and Engineering

MAES – Latinos in Science and Engineering

MISSION: To promote, cultivate, and honor excellence in education and leadership among Latino scientists and engineers.

VISION: MAES is the foremost Latino organization for the development of STEM leaders in the academic, executive, and technical communities.

WHO IS MAES: MAES was founded in Los Angeles in 1974 by a group of professional engineers to increase the number of Mexican Americans and other Hispanics in science, technology, engineering, and mathematics (STEM) by creating opportunities and fostering recognition through its professional, technical, and outreach activities. The idea to establish a professional society for engineers originated with Robert Von Hatten, an aerospace electronics engineer with TRW Defense Space Systems in Redondo Beach, California. He envisioned a national organization that would serve as a source of role models, address the needs of its members, and become a resource for industry and students. With our founder's vision in mind, MAES continues to cultivate and expand programs that contribute to America's pursuit of global STEM leadership. The MAES' brand has evolved over time as its programs and familia continue to grow to include a broader community. Originally called the "Mexican American Engineering Society," MAES changed its name to the "Society of Mexican American Engineers and Scientists" in 1989. Then, in 2012, MAES rebranded once again to align its name to the community it has served and continues to serve. We are "MAES – Latinos in Science and Engineering."

OUR EVENTS:

- MAES Annual Symposium
- MAES Leadership Academy
- MAES Chapter Development Summits

OUR OUTREACH:

- MAES Scholarship Program
- MAES Science Extravaganzas
- Texas Science and Engineering Festival
- MAES Junior Chapters
- MAES magazine

MAES – Latinos in Science and Engineering
2437 Bay Area Boulevard, #100
Houston, TX 77058
Tel: (281) 557-3677
Fax: (281) 715-5100
questions@mymaes.org

Algebra Cheat Sheet

Basic Properties & Facts

Arithmetic Operations

$ab+ac=a(b+c)$ $\qquad a\left(\frac{b}{c}\right)=\frac{ab}{c}$

$\frac{\left(\frac{a}{b}\right)}{c}=\frac{a}{bc}$ $\qquad \frac{a}{\left(\frac{b}{c}\right)}=\frac{ac}{b}$

$\frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}$ $\qquad \frac{a}{b}-\frac{c}{d}=\frac{ad-bc}{bd}$

$\frac{a-b}{c-d}=\frac{b-a}{d-c}$ $\qquad \frac{a+b}{c}=\frac{a}{c}+\frac{b}{c}$

$\frac{ab+ac}{a}=b+c,\ a\neq0$ $\qquad \frac{\left(\frac{a}{b}\right)}{\left(\frac{c}{d}\right)}=\frac{ad}{bc}$

Exponent Properties

$a^na^m=a^{n+m}$ $\qquad \frac{a^n}{a^m}=a^{n-m}=\frac{1}{a^{m-n}}$

$\left(a^n\right)^m=a^{nm}$ $\qquad a^0=1,\ a\neq0$

$(ab)^n=a^nb^n$ $\qquad \left(\frac{a}{b}\right)^n=\frac{a^n}{b^n}$

$a^{-n}=\frac{1}{a^n}$ $\qquad \frac{1}{a^{-n}}=a^n$

$\left(\frac{a}{b}\right)^{-n}=\left(\frac{b}{a}\right)^n=\frac{b^n}{a^n}$ $\qquad a^{\frac{n}{m}}=\left(a^{\frac{1}{m}}\right)^n=\left(a^n\right)^{\frac{1}{m}}$

Properties of Radicals

$\sqrt[n]{a}=a^{\frac{1}{n}}$ $\qquad \sqrt[n]{ab}=\sqrt[n]{a}\sqrt[n]{b}$

$\sqrt[m]{\sqrt[n]{a}}=\sqrt[nm]{a}$ $\qquad \sqrt[n]{\frac{a}{b}}=\frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

$\sqrt[n]{a^n}=a$, if n is odd

$\sqrt[n]{a^n}=|a|$, if n is even

Properties of Inequalities

If $a<b$ then $a+c<b+c$ and $a-c<b-c$

If $a<b$ and $c>0$ then $ac<bc$ and $\frac{a}{c}<\frac{b}{c}$

If $a<b$ and $c<0$ then $ac>bc$ and $\frac{a}{c}>\frac{b}{c}$

Properties of Absolute Value

$|a|=\begin{cases}a & \text{if } a\geq0\\ -a & \text{if } a<0\end{cases}$

$|a|\geq0$ $\qquad |-a|=|a|$

$|ab|=|a||b|$ $\qquad \left|\frac{a}{b}\right|=\frac{|a|}{|b|}$

$|a+b|\leq|a|+|b|$ Triangle Inequality

Distance Formula

If $P_1=(x_1,y_1)$ and $P_2=(x_2,y_2)$ are two points the distance between them is

$$d(P_1,P_2)=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

Complex Numbers

$i=\sqrt{-1}$ $\qquad i^2=-1$ $\qquad \sqrt{-a}=i\sqrt{a},\ a\geq0$

$(a+bi)+(c+di)=a+c+(b+d)i$

$(a+bi)-(c+di)=a-c+(b-d)i$

$(a+bi)(c+di)=ac-bd+(ad+bc)i$

$(a+bi)(a-bi)=a^2+b^2$

$|a+bi|=\sqrt{a^2+b^2}$ Complex Modulus

$\overline{(a+bi)}=a-bi$ Complex Conjugate

$\overline{(a+bi)}(a+bi)=|a+bi|^2$

Logarithms and Log Properties

Definition

$y=\log_b x$ is equivalent to $x=b^y$

Example

$\log_5 125=3$ because $5^3=125$

Special Logarithms

$\ln x=\log_e x$ natural log

$\log x=\log_{10} x$ common log

where $e=2.718281828\text{K}$

Logarithm Properties

$\log_b b=1$ $\qquad \log_b 1=0$

$\log_b b^x=x$ $\qquad b^{\log_b x}=x$

$\log_b\left(x^r\right)=r\log_b x$

$\log_b(xy)=\log_b x+\log_b y$

$\log_b\left(\frac{x}{y}\right)=\log_b x-\log_b y$

The domain of $\log_b x$ is $x>0$

Factoring and Solving

Factoring Formulas

$x^2-a^2=(x+a)(x-a)$

$x^2+2ax+a^2=(x+a)^2$

$x^2-2ax+a^2=(x-a)^2$

$x^2+(a+b)x+ab=(x+a)(x+b)$

$x^3+3ax^2+3a^2x+a^3=(x+a)^3$

$x^3-3ax^2+3a^2x-a^3=(x-a)^3$

$x^3+a^3=(x+a)\left(x^2-ax+a^2\right)$

$x^3-a^3=(x-a)\left(x^2+ax+a^2\right)$

$x^{2n}-a^{2n}=\left(x^n-a^n\right)\left(x^n+a^n\right)$

If n is odd then,

$x^n-a^n=(x-a)\left(x^{n-1}+ax^{n-2}+\cdots+a^{n-1}\right)$

x^n+a^n

$=(x+a)\left(x^{n-1}-ax^{n-2}+a^2x^{n-3}-\cdots+a^{n-1}\right)$

Quadratic Formula

Solve $ax^2+bx+c=0$, $a\neq0$

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

If $b^2-4ac>0$ - Two real unequal solns.

If $b^2-4ac=0$ - Repeated real solution.

If $b^2-4ac<0$ - Two complex solutions.

Square Root Property

If $x^2=p$ then $x=\pm\sqrt{p}$

Absolute Value Equations/Inequalities

If b is a positive number

$|p|=b \quad\Rightarrow\quad p=-b$ or $p=b$

$|p|<b \quad\Rightarrow\quad -b<p<b$

$|p|>b \quad\Rightarrow\quad p<-b$ or $p>b$

Completing the Square

Solve $2x^2-6x-10=0$

(1) Divide by the coefficient of the x^2

$$x^2-3x-5=0$$

(2) Move the constant to the other side.

$$x^2-3x=5$$

(3) Take half the coefficient of x, square it and add it to both sides

$$x^2-3x+\left(-\frac{3}{2}\right)^2=5+\left(-\frac{3}{2}\right)^2=5+\frac{9}{4}=\frac{29}{4}$$

(4) Factor the left side

$$\left(x-\frac{3}{2}\right)^2=\frac{29}{4}$$

(5) Use Square Root Property

$$x-\frac{3}{2}=\pm\sqrt{\frac{29}{4}}=\pm\frac{\sqrt{29}}{2}$$

(6) Solve for x

$$x=\frac{3}{2}\pm\frac{\sqrt{29}}{2}$$

Functions and Graphs

Constant Function

$y=a$ or $f(x)=a$

Graph is a horizontal line passing through the point $(0,a)$.

Line/Linear Function

$y=mx+b$ or $f(x)=mx+b$

Graph is a line with point $(0,b)$ and slope m.

Slope

Slope of the line containing the two points (x_1,y_1) and (x_2,y_2) is

$$m=\frac{y_2-y_1}{x_2-x_1}=\frac{\text{rise}}{\text{run}}$$

Slope – intercept form

The equation of the line with slope m and y-intercept $(0,b)$ is

$$y=mx+b$$

Point – Slope form

The equation of the line with slope m and passing through the point (x_1,y_1) is

$$y=y_1+m(x-x_1)$$

Parabola/Quadratic Function

$y=a(x-h)^2+k$ $\qquad f(x)=a(x-h)^2+k$

The graph is a parabola that opens up if $a>0$ or down if $a<0$ and has a vertex at (h,k).

Parabola/Quadratic Function

$y=ax^2+bx+c$ $\qquad f(x)=ax^2+bx+c$

The graph is a parabola that opens up if $a>0$ or down if $a<0$ and has a vertex at $\left(-\frac{b}{2a},f\left(-\frac{b}{2a}\right)\right)$.

Parabola/Quadratic Function

$x=ay^2+by+c$ $\qquad g(y)=ay^2+by+c$

The graph is a parabola that opens right if $a>0$ or left if $a<0$ and has a vertex at $\left(g\left(-\frac{b}{2a}\right),-\frac{b}{2a}\right)$.

Circle

$(x-h)^2+(y-k)^2=r^2$

Graph is a circle with radius r and center (h,k).

Ellipse

$\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$

Graph is an ellipse with center (h,k) with vertices a units right/left from the center and vertices b units up/down from the center.

Hyperbola

$\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1$

Graph is a hyperbola that opens left and right, has a center at (h,k), vertices a units left/right of center and asymptotes that pass through center with slope $\pm\frac{b}{a}$.

Hyperbola

$\frac{(y-k)^2}{b^2}-\frac{(x-h)^2}{a^2}=1$

Graph is a hyperbola that opens up and down, has a center at (h,k), vertices b units up/down from the center and asymptotes that pass through center with slope $\pm\frac{b}{a}$.

Common Algebraic Errors

Error	Reason/Correct/Justification/Example
$\frac{2}{0}\neq0$ and $\frac{2}{0}\neq2$	Division by zero is undefined!
$-3^2\neq9$	$-3^2=-9$, $(-3)^2=9$ Watch parenthesis!
$\left(x^2\right)^3\neq x^5$	$\left(x^2\right)^3=x^2x^2x^2=x^6$
$\frac{a}{b+c}\neq\frac{a}{b}+\frac{a}{c}$	$\frac{1}{2}=\frac{1}{1+1}\neq\frac{1}{1}+\frac{1}{1}=2$
$\frac{1}{x^2+x^3}\neq x^{-2}+x^{-3}$	A more complex version of the previous error.
$\frac{\not{a}+bx}{\not{a}}\neq1+bx$	$\frac{a+bx}{a}=\frac{a}{a}+\frac{bx}{a}=1+\frac{bx}{a}$ Beware of incorrect canceling!
$-a(x-1)\neq-ax-a$	$-a(x-1)=-ax+a$ Make sure you distribute the "-"!
$(x+a)^2\neq x^2+a^2$	$(x+a)^2=(x+a)(x+a)=x^2+2ax+a^2$
$\sqrt{x^2+a^2}\neq x+a$	$5=\sqrt{25}=\sqrt{3^2+4^2}\neq\sqrt{3^2}+\sqrt{4^2}=3+4=7$
$\sqrt{x+a}\neq\sqrt{x}+\sqrt{a}$	See previous error.
$(x+a)^n\neq x^n+a^n$ and $\sqrt[n]{x+a}\neq\sqrt[n]{x}+\sqrt[n]{a}$	More general versions of previous three errors.
$2(x+1)^2\neq(2x+2)^2$	$2(x+1)^2=2\left(x^2+2x+1\right)=2x^2+4x+2$ $(2x+2)^2=4x^2+8x+4$ Square first then distribute!
$(2x+2)^2\neq2(x+1)^2$	See the previous example. You can not factor out a constant if there is a power on the parethesis!
$\sqrt{-x^2+a^2}\neq-\sqrt{x^2+a^2}$	$\sqrt{-x^2+a^2}=\left(-x^2+a^2\right)^{\frac{1}{2}}$ Now see the previous error.
$\frac{a}{\left(\frac{b}{c}\right)}\neq\frac{ab}{c}$	$\frac{a}{\left(\frac{b}{c}\right)}=\frac{\left(\frac{a}{1}\right)}{\left(\frac{b}{c}\right)}=\left(\frac{a}{1}\right)\left(\frac{c}{b}\right)=\frac{ac}{b}$
$\frac{\left(\frac{a}{b}\right)}{c}\neq\frac{ac}{b}$	$\frac{\left(\frac{a}{b}\right)}{c}=\frac{\left(\frac{a}{b}\right)}{\left(\frac{c}{1}\right)}=\left(\frac{a}{b}\right)\left(\frac{1}{c}\right)=\frac{a}{bc}$