Refresher of Math Basics

Arithmetic Operations

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

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

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

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

$$\frac{ab + ac}{a} = b + c, \ a \neq 0 \qquad \frac{\left(\frac{a}{b}\right)}{\left(\frac{c}{d}\right)} = \frac{ad}{bc}$$

Exponent Properties

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

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

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

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

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

Properties of Absolute Value

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

$$|a| \geq 0 \qquad |-a| = |a|$$

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

Properties of Radicals

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

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

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

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

Some Trigonometry

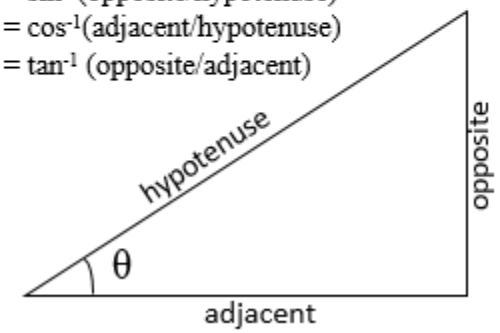
"SOHCAHTOA":

Sine = Opposite/Hypotenuse = "sin(θ)"

Cosine = Adjacent/Hypotenuse = "cos(θ)"

Tangent = Opposite/Adjacent = "tan(θ)"

$\theta = \sin^{-1}(\text{opposite/hypotenuse})$
$\theta = \cos^{-1}(\text{adjacent/hypotenuse})$
$\theta = \tan^{-1}(\text{opposite/adjacent})$



Common Algebra Mistakes

Error	Reason for Error
$\frac{2}{0}\neq 0$ and $\frac{2}{0}\neq 2$	Division by zero is undefined!
$-3^2\neq 9$	$-3^2=-9$, $(-3)^2=9$ 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.
$\frac{\cancel{a}+bx}{\cancel{a}}\neq 1+bx$	$\frac{a+bx}{a}=\frac{a}{a}+\frac{bx}{a}=1+\frac{bx}{a}$ 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.
$2(x+1)^2\neq(2x+2)^2$	$2(x+1)^2=2(x^2+2x+1)=2x^2+4x+2$ $(2x+2)^2=4x^2+8x+4$ Square first then distribute!
$(2x+2)^2\neq 2(x+1)^2$	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.
$\frac{a}{\left(\frac{b}{c}\right)}\neq\frac{ab}{c}$	$\frac{a}{\left(\frac{b}{c}\right)}=\frac{\left(\frac{a}{1}\right)}{\left(\frac{b}{c}\right)}=\left(\frac{a}{1}\right)\left(\frac{c}{b}\right)=\frac{ac}{b}$