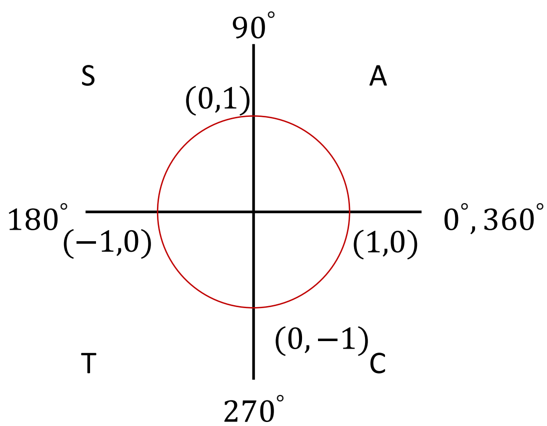
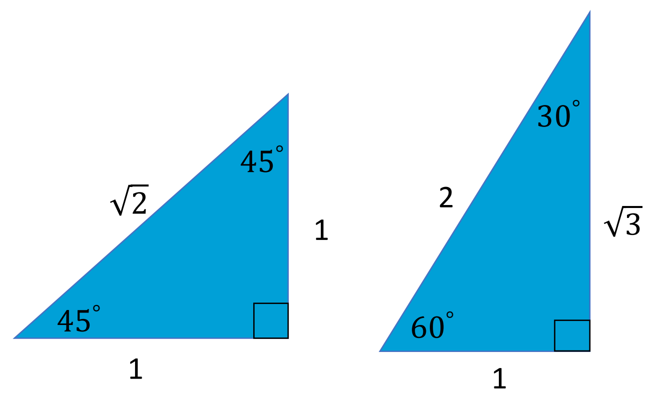
Algebra 2/Trig. Cheat Sheet

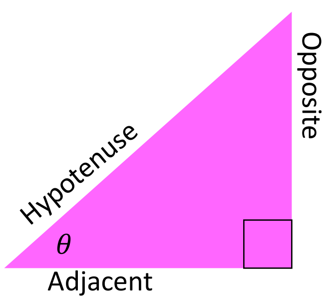
Unit Circle:



Special Triangles:



Trigonometric Functions: (SOH CAH TOA)
(Only work on right triangles.)



$$sin(\theta) = \frac{opposite}{hypotenuse}$$

$$cos(\theta) = \frac{adjacent}{hypotenuse}$$

$$tan(\theta) = \frac{opposite}{adjacent}$$

Trigonometric Inverses/Identities:

$$csc(\theta) = \frac{1}{sin(\theta)} \qquad sec(\theta) = \frac{1}{cos(\theta)}$$

$$cot(\theta) = \frac{cos(\theta)}{sin(\theta)} \qquad cot(\theta) = \frac{1}{tan(\theta)}$$

$$tan(\theta) = \frac{sin(\theta)}{cos(\theta)}$$

Co-function Identities:

$$sin\left(\frac{\pi}{2} - \theta\right) = cos(\theta) \qquad csc\left(\frac{\pi}{2} - \theta\right) = sec(\theta) \qquad tan\left(\frac{\pi}{2} - \theta\right) = cot(\theta)$$

$$cos\left(\frac{\pi}{2} - \theta\right) = sin\theta \qquad sec\left(\frac{\pi}{2} - \theta\right) = csc(\theta) \qquad cot\left(\frac{\pi}{2} - \theta\right) = tan(\theta)$$

Pythagorean Identities:

$$sin^2\theta + cos^2\theta = 1$$

$$1 + tan^2\theta = sec^2\theta$$

$$1 + cot^2\theta = csc^2\theta$$

Trig. Proofs:

$$tan\theta = sin\theta sec\theta$$

$$tan\theta = sin\theta \times \frac{1}{cos\theta}$$

$$tan\theta = \frac{sin\theta}{cos\theta}$$

$$tan\theta = tan\theta$$

Converting Degrees to Radians:

$$60^\circ \times \frac{\pi}{180} = \frac{\pi}{3}$$

Converting Radians to Degrees:

$$\frac{\pi}{3} \times \frac{180}{\pi} = 60^\circ$$

Distance Formula:

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

Law of Cosines: $c^2 = a^2 + b^2 - 2abcos(c)$

Product of Roots: $\frac{c}{a}$

Sum of Roots: $\frac{-b}{a}$

Law of Sines:

(This will be included on reference table)

$$\frac{sin(A)}{a} = \frac{sin\ (B)}{b} = \frac{sin(C)}{c}$$

OR

$$\frac{a}{sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)}$$

Solving Trig. Functions Algebraically:

$Solve\ for\ \theta, in\ the\ interval - 2\pi < \theta < 2\pi$

$$sin^2\theta - 1 = 0$$

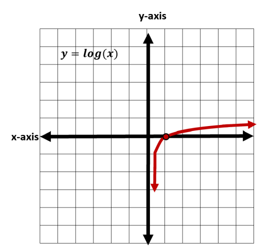
$$(sin\theta + 1)(sin\theta - 1) = 0$$

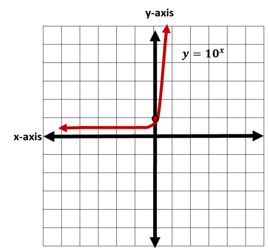
$sin\theta + 1 = 0$	$sin\theta - 1 = 0$
$sin\theta = -1$	$sin\theta = 1$
$sin^{-1}(-1) =$	$sin^{-1}(1) =$
$\theta = -90^\circ, 270^\circ$	$\theta = -270^\circ, 90^\circ$

$$\theta = -270^\circ, -90^\circ, 90^\circ, 270^\circ$$

Logarithms are Inverses of Exponential Equations:

$y = \log_{10}(x)$ $\qquad$ $y = 10^x$





Logarithm Rules:

$log_{10}(100) = 2 \longrightarrow 10^2 = 100$

$\log(ab) = \log(a) + \log(b)$

$\log\left(\frac{a}{b}\right) = \log(a) - \log(b)$

$\log a^b = b \cdot log(a)$

$ln_e(x) = e^x$

To Change Log Base:

$$log_a(x) = \frac{lob_b(x)}{log_b(a)}$$

Logarithmic Equations:

$$log_4(x) + log_4(x+6) = 2$$
$$log_4(x(x+6)) = 2$$
$$log_4(x^2 + 6x) = 2$$
$$4^2 = x^2 + 6x$$
$$x^2 + 6x - 16 = 0$$
$$(x+8)(x-2) = 0$$

$x + 8 = 0$	$x - 2 = 0$
$x = -8$	$x = 2$

$$x = -8, 2$$

Radical Equations:

$$\frac{10\sqrt{x+4}}{10} = \frac{100}{10}$$
$$\sqrt{x+4} = 10$$
$$(\sqrt{x+4})^2 = 10^2$$
$$x + 4 = 100$$
$$x = 96$$

Simplifying Radical Expressions:

$$\sqrt{40} = \sqrt{4 \cdot 10} = \sqrt{4}\sqrt{10} = 2\sqrt{10}$$

$$\sqrt[4]{256m^4n^8} = 4mn^2$$

$$25^{-\frac{1}{2}} = \frac{1}{\sqrt{25}} = \frac{1}{5}$$

Rationalizing Radical in denominator:

$$\frac{1}{\sqrt{x}} \times \frac{\sqrt{x}}{\sqrt{x}} = \frac{\sqrt{x}}{x}$$

Radical Rules:

$$\sqrt[n]{x} = x^{\frac{1}{n}}$$

$$x^{\frac{m}{n}} = (\sqrt[n]{x})^m$$

Imaginary Numbers:

$i^0 = 1$
$i^1 = i$
$i^2 = -1$
$i^3 = -i$
$a + bi$

Given i^{64} divide by 4 using long division, get remainder 0, then use as exponent.
$i^{64} \rightarrow i^0 = 1$

Sequences:

Arithmetic Sequence: (add or subtract)

$$a_n = a_1 + (n-1)d$$

Geometric Sequence: (multiply or divide)

$$a_n = a_1 \cdot r^{n-1}$$

Binomial Theorem:

$$(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k$$

Equation of a Circle:

$$(x-4)^2 + (y+2)^2 = 16$$

Center= (4, -2)

Radius=$\sqrt{16} = 4$

Probability:

Binomial Probability= ${}_nC_r \cdot p^r \cdot q^{n-r}$

Permutation= ${}_nP_r = \frac{n!}{(n-r)!}$
(Order matters)

Combinations= ${}_nC_r = \frac{n!}{r!(n-r)!}$
(Order doesn't matter)

Conditional= $\frac{P(A \cap B)}{P(A)}$=P($B|A$)

Dependent Events= $P(A) \cdot P(\frac{B}{A})$
P (A and B)

Independent Events=$P(A) \cdot P(B)$
P (A and B)

Not mutually Exclusive= $P(A) + P(B) - P\ (A)$
P (A or B)

Mutually Exclusive=$P(A) + P\ (B)$
P (A or B)

Population Mean (μ):

$$\mu = \frac{1}{n}\sum_{i=1}^{n} x_i$$

Population Standard Deviation (σ):

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x-\mu)^2}{N}}$$

Z-Score:

$$z = \frac{x-\mu}{\sigma}$$

Sample Mean ($\bar{x}$):

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

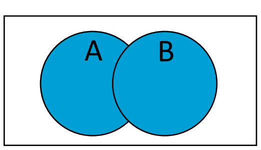
Sample Standard Deviation (S):

$$S = \sqrt{\frac{\sum_{i=1}^{n}(x-\bar{x})^2}{n-1}}$$

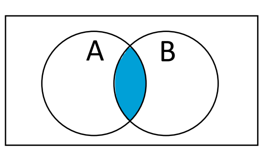
Margin of Error:

$$MOE = z \times \frac{s}{\sqrt{n}}$$

Venn Diagram:



$A \cup B$



$A \cap B$

Absolute Value: When solving for *x* create two equations. One with a positive answer, one with a negative. Then solve as normal. Ex:

$$|-125 + 2x| = 45$$

$-125 + 2x = \mathbf{45}$
$x = 85$

$-125 + 2x = \mathbf{-45}$
$x = 40$

Factoring Methods to Know:

1) Greatest Common Factor (GCF)
2) Quadratic Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
2) Completing the Square
3) Difference of Two Squares (DOTS)
4) Factor by Grouping

Binomial Expansion:

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

$a^3 + b^3 = (a + b)(a^2 + 2ab + b^2)$

$a^3 - b^3 = (a - b)(a^2 - 2ab + b^2)$

Discriminant Rules:

$b^2 - 4ac$

$b^2 - 4ac > 0$	2 real roots
$b^2 - 4ac = 0$	1 real root
$b^2 - 4ac < 0$	2 imaginary roots

Dividing Polynomials:

$$
\begin{array}{r|l}
 & 3x^2 + x + 1 \\
2x + 1 & 6x^3 + 5x^2 + 3x + 4 \\
 & -\ (6x^3 + 3x^2) \\
 & 2x^2 + 3x + 4 \\
 & -\ (2x^2 + x) \\
 & 2x + 4 \\
 & -\ (2x + 1) \\
 & R: 3
\end{array}
$$

$Answer: 3x^2 + x + 1 + \frac{3}{2x + 1}$

Standard Form of a Parabola:

$y = ax^2 + bx + c$

Axis of Symmetry: $-\frac{b}{2a}$

Vertex Form of a Parabola:

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

Vertex: (h, k)

$0 < a < 1$, then parabola gets bigger

$a > 0$, then parabola gets narrow

Remainder Theorem: If polynomial $f(x)$ is divided by $(x - a)$, then remainder is equal to $f(a)$. Ex:

If $f(x) = 4x^2 + 6x + 15$ is divided by $(x - 1)$

The remainder will be…

$f(1) = 4(1)^2 + 6(1) + 15 = 25$

Simplifying Rational Expressions:

$$\frac{9y^3 - y}{3y - 1} = \frac{y(9y^2 - 1)}{3y - 1} = \frac{y(3y - 1)(3y + 1)}{3y - 1} = y(3y + 1)$$

Compound Interest Formula:

$A = P(1 + \frac{r}{n})^{nt}$

$P = Principle$

$r = Interest\ rate$

$n = number\ of\ compoundings\ per\ year$

$t = Total\ number\ of\ years$

Exponential Equation:

$y = ab^x$

Exponential Growth:

$b > 1$

Exponential Decay:

$0 < b < 1$

Power Functions:

$$y = kx^n$$

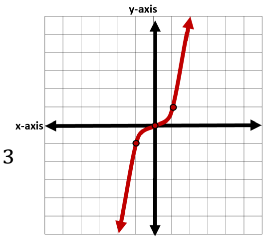
where, k and n are known number constants.

Odd Power Functions: $y = kx^n$

where n is equal to any odd number $\{1,3,5,7, \ldots \ldots \ldots\}$

Ex:

$y = x^3$

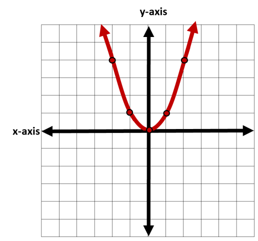


Even Power Functions: $y = kx^n$

where n is equal to any even number $\{2, 4, 6, 8, \ldots \ldots \ldots\}$

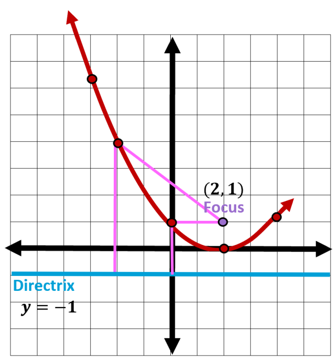
Ex:

$y = x^2$



Focus and Directrix:

A parabola is equi-distant between both focus and directrix.



To find an equation of parabola, given focus $(2,1)$ and directrix $y = -1$:

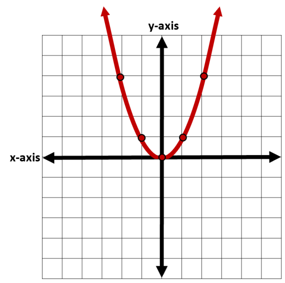
$$\sqrt{(y - directrix)^2} = \sqrt{(x - a)^2 + (y - b)^2}$$

(where a and b are from focus)

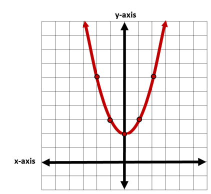
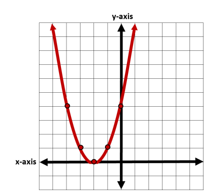
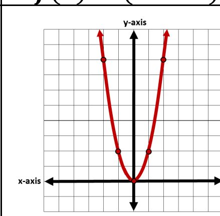
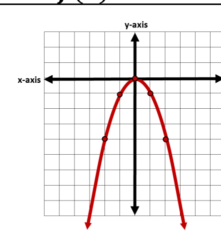
$$\sqrt{(y + 1)^2} = \sqrt{(x - 2)^2 + (y - 1)^2}$$

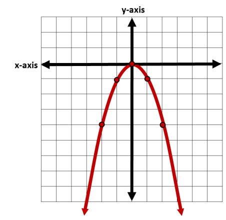
$$y = \frac{(x - 2)^2}{4}$$

Transformations of Function $f(x) = x^2$, where $C = 2$:



$f(x) = x^2$

Function Transformation	What does it do to the graph?	Graph
$y = f(x) + C$	$C > 0$ *moves up* $C < 0$ *moves down*	 $f(x) = x^2 + 2$
$y = f(x + C)$	$C > 0$ *moves left* $C < 0$ *moves right*	 $f(x) = (x^2 + 2)$
$y = Cf(x)$	$C > 1$ *moves closer to* $y - axis$ $0 < C < 1$ *moves further from* $y - axis$	 $f(x) = 2x^2$
$y = -f(x)$	*Reflection in the* $x - axis$	 $f(x) = -x^2$

$\boldsymbol{y = f(-x)}$	$Reflection\ in\ the\ y - axis$	 $\boldsymbol{f(x) = -x^2}$