AP Calculus AB is a college level course covering material traditionally taught in the first semester of college calculus. All students need a strong foundation to be ready for the rigorous work required throughout the year. Often, Calculus students get frustrated with incorrect answers that stem from Algebra and not by Calculus. Completing the review packet before the beginning of the course will be helpful.

**This packet consists of review topics studied in the pre-requisite math courses. There are many examples of each type of problem. You should try each type of problem and mark those problems you still have questions over. We will take some time during each class in the first week to go over some problems from this packet. Because we also must begin on the Calculus curriculum right away, this time to review will be limited. All students are encouraged to come in before and after school for any additional help on this packet. Even though this packet will not be collected, the first assessment for this course will be over these topics. (The test over these pre-requisite skills will be given by the end of the second week of classes.)

Half of the AP exam will be taken without a calculator so it is best if you can do the majority of this work using a pencil, paper, and your brain. (**Trigonometry values at special angles such as those found on the unit circle will need to be memorized**. Consider putting these on flashcards to help you.) Parts of this course will focus on how to use the graphing calculators. You are strongly encouraged to get one of your own (preferably a TI-83 or TI-84). The school has a limited number of graphing calculators for check out.

All students will have the opportunity to take the AP Calculus AB Exam in May for a fee. Some colleges will award college credit depending on the AP Exam score. You are encouraged to research different Advanced Placement and concurrent credit policies of universities and colleges for more information.

If you feel you need help with some of these topics, the best resource may be the internet. There are great sites where you can just type in the topics to get help. There are some sites listed below.

Some websites for reference:

https://www.khanacademy.org/

http://www.purplemath.com/modules/index.htm

https://www.coolmath.com/precalculus-review-calculus-intro

Online Calculators:

desmos.com

Precalculus Book:

Holt Precalculus

See you in August!
Mrs. Cunningham

Formula Sheet

Slope-intercept form $y = mx + b$

Point-slope form $y - y_1 = m(x - x_1)$

Standard form $Ax + By = C$

Quadratic Standard Form $ax^2 + bx + c = 0$

Quadratic Intercept Form $y = a(x - p)(x - q)$ where p and q are x-intercepts.

Quadratic Vertex Form $y = a(x - h)^2 + k$ where $(h, k)$is the vertex.

The x-coordinate of the vertex, if in standard form, is $x = \frac{-b}{2a}$ (also used to find the axis of symmetry). Substitute this value into the function and solve for y for the y-coordinate.

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

Fractional exponent $\sqrt[b]{x^a} = x^{a/b}$

Negative exponent $x^{-a} = \frac{1}{x^a}$

Zero exponent $x^0 = 1 \; for \; x \neq 0$

Product rule $b^m \cdot b^n = b^{m+n}$

Quotient rule $\frac{b^m}{b^n} = b^{m-n}$

Power rule $(b^m)^k = b^{mk}$

Power of product $(ab)^m = a^m \cdot b^m$

Power of quotient $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

Logarithms $x = log_b N$ is equivalent to $b^x = N$.

Equality property If $log_b m = log_b n$, then $m = n$.

Product rule $log_b mn = log_b m + log_b n$

Quotient rule $log_b \frac{m}{n} = log_b m - log_b n$

Power rule $log_b m^k = k log_b m$

Change of base formula $log_b N = \frac{\log N}{\log b}$

Trigonometry Identities

$\csc x = \frac{1}{\sin x}$ $\sec x = \frac{1}{\cos x}$ $\cot x = \frac{1}{\tan x}$

$\tan x = \frac{\sin x}{\cos x}$ $\cot x = \frac{\cos x}{\sin x}$

$sin^2 x + cos^2 x = 1$

$tan^2 x + 1 = sec^2 x$

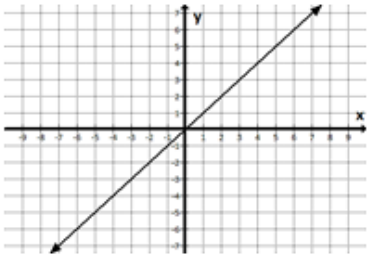
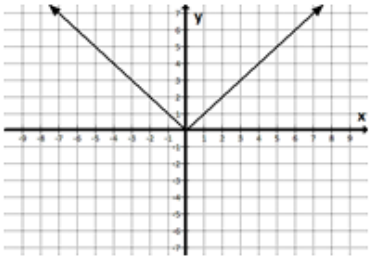
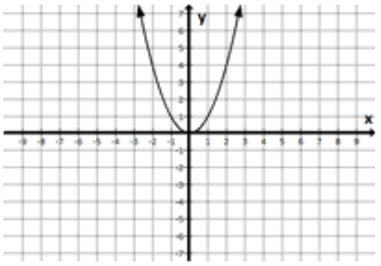
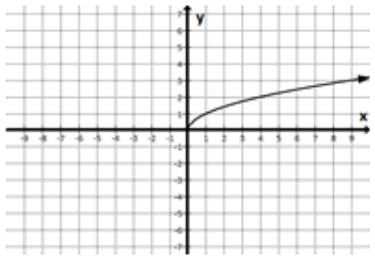
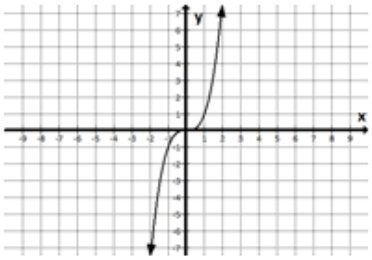
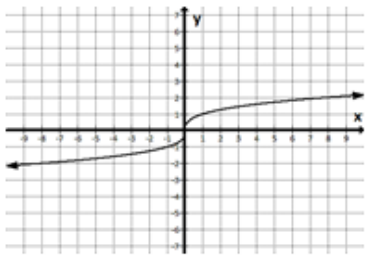
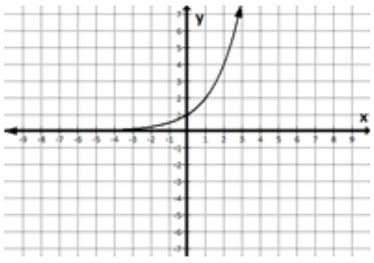
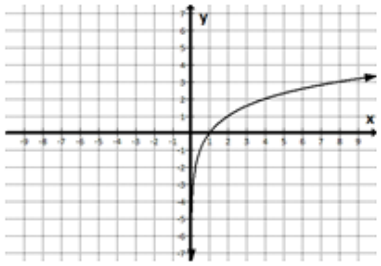
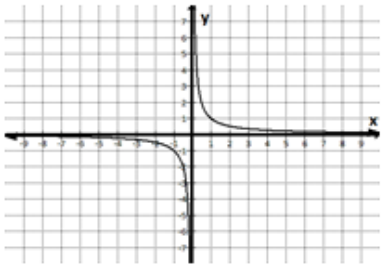
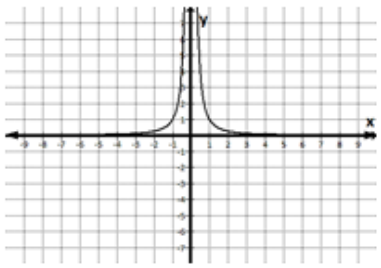
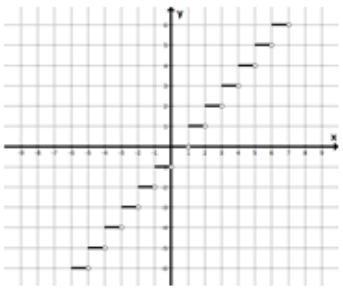
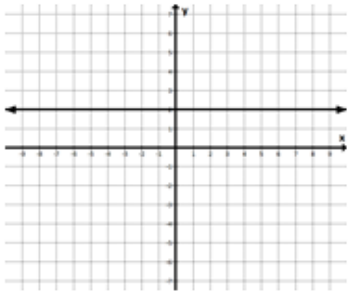
$1 + cot^2 x = csc^2 x$

For $-1 \leq x \leq 1$, $\arcsin x$ or $sin^{-1} x = u$ where $\frac{-\pi}{2} \leq u \leq \frac{\pi}{2}$.

For $-1 \leq x \leq 1$, $\arccos x$ or $cos^{-1} x = u$ where $0 \leq u \leq \pi$.

For all real numbers x, $\arctan x$ or $tan^{-1} x = u$ where $\frac{-\pi}{2} \leq u \leq \frac{\pi}{2}$.

PARENT FUNCTIONS

Parent Function	Graph	Parent Function	Graph
$y = x$ **Linear**, Odd Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \to -\infty,\ y \to -\infty$ $x \to \infty,\ y \to \infty$		$y = \lvert x \rvert$ **Absolute Value**, Even Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ End Behavior: $x \to -\infty,\ y \to \infty$ $x \to \infty,\ y \to \infty$	
$y = x^2$ **Quadratic**, Even Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ End Behavior: $x \to -\infty,\ y \to \infty$ $x \to \infty,\ y \to \infty$		$y = \sqrt{x}$ **Radical**, Neither Domain: $[0, \infty)$ Range: $[0, \infty)$ End Behavior: $x \to \infty,\ y \to \infty$	
$y = x^3$ **Cubic**, Odd Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \to -\infty,\ y \to -\infty$ $x \to \infty,\ y \to \infty$		$y = \sqrt[3]{x}$ **Cube Root**, Odd Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \to -\infty,\ y \to -\infty$ $x \to \infty,\ y \to \infty$	
$y = b^x,\ b > 1$ **Exponential**, Neither Domain: $(-\infty, \infty)$ Range: $(0, \infty)$ End Behavior: $x \to -\infty,\ y \to 0$ $x \to \infty,\ y \to \infty$		$y = \log_b(x),\ b > 1$ **Log**, Neither Domain: $(0, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \to 0^+,\ y \to -\infty$ $x \to \infty,\ y \to \infty$	
$y = \frac{1}{x}$ **Rational (Inverse)**, Odd Domain: $(-\infty, 0) \cup (0, \infty)$ Range: $(-\infty, 0) \cup (0, \infty)$ End Behavior: $x \to -\infty,\ y \to 0$ $x \to \infty,\ y \to 0$		$y = \frac{1}{x^2}$ **Rational (Inverse Squared)**, Even Domain: $(-\infty, 0) \cup (0, \infty)$ Range: $(0, \infty)$ End Behavior: $x \to -\infty,\ y \to 0$ $x \to \infty,\ y \to 0$	
$y = \text{int}(x) = [x]$ **Greatest Integer**, Neither Domain: $(-\infty, \infty)$ Range: $\{y : y \in \mathbb{Z}\}$ (integers) End Behavior: $x \to -\infty,\ y \to -\infty$ $x \to \infty,\ y \to \infty$		$y = C$ ($y = 2$ in the graph) **Constant**, Even Domain: $(-\infty, \infty)$ Range: $\{y : y = C\}$ End Behavior: $x \to -\infty,\ y \to C$ $x \to \infty,\ y \to C$	

I. EQUATIONS OF LINES

a) Find the equation of the line passing through the point (5, -3) with a slope of 4/5 in slope-intercept form.

b) Find the equation of the line passing through the points (-3, 6) and (1, 2) in slope-intercept form.

c) In point-slope form, find the equation of the line with x-intercept (2, 0) and y-intercept (0, -3).

d) Find the equation of the line that passes through the point (2, 8) and parallel to the line $y = \frac{5}{6}x - 1$.

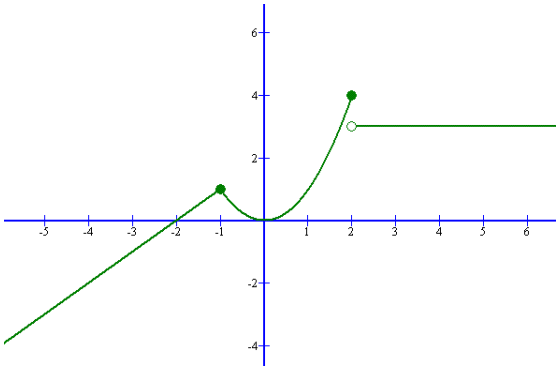
e) Find the equation of the line that is perpendicular to the y-axis and passes through the point (4, 7).

II. FUNCTIONS

Let $f(x) = x^2$ *and* $g(x) = 2x + 5$. Evaluate each.

a) $f(2)$ b) $g(-3)$ c) $f(4m - 1)$ d) $g(f(x))$ e) $f(g(1))$

Below is the graph of the piecewise function $h(x)$. Evaluate each.



a) $h(2)$

b) $h(-1)$

c) For what x does $h(x) = 0$?

Find $\frac{f(x+h)-f(x)}{h}$ for each function.

a) $f(x) = 9x + 3$ b) $f(x) = x^2 - 4$

III. INEQUALITIES AND INTERVAL NOTATION

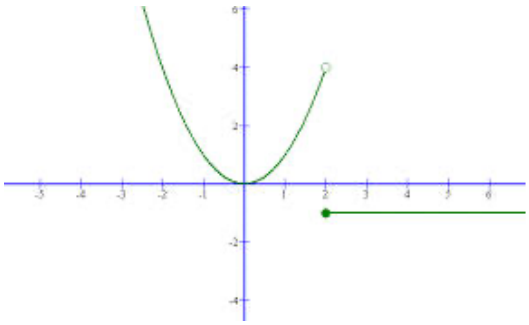
Complete the table with appropriate notation or graph.

Solution	Interval Notation	Graph
a) $-2 < x \leq 4$		
b)	[-1, 7)	
c)		
d)	$(3, \infty)$	

IV. DOMAIN AND RANGE OF FUNCTIONS

Using interval notation or inequalities, state the domain and range for each function.

a) $f(x) = (x-3)^2 - 1$ b) $g(x) = \sqrt{x+6} + 2$ c)



V. ANALYZING GRAPHS



Graph these on your calculator.

On what interval are these functions increasing, decreasing, and constant? Approximate your answers.

a) $f(x) = -x^3 - 8x^2 + 8x + 5$ b) $g(x) = x^4 - 2x^2$

VI. INTERCEPTS AND INTERSECTIONS



Graph these on your calculator.

Find the x and y-intercepts of each. Round your answers to four decimal places.

a) $f(x) = x^4 + x - 3$ b) $y^2 = x^3 - 4x$

Find the points of intersection for each. (HINT: Graph each side of the equation first.) Round your answers to four decimal places.

a) $x^5 + x^2 = x^3 + 5$ b) $x^2 + x - 16x + 39 = x^2 - x - 9$

VII. SYMMETRY

To check for symmetry about the x-axis, substitute –y in for y and simplify. Do you have the original function?
To check for symmetry about the y-axis, substitute –x in for x and simplify. Do you have the original function?
To check for symmetry about the origin, substitute –x in for x and –y in for y and simplify. Do you have the original function?

Algebraically verify that the function is symmetric with respect to the y-axis.

a) $h(x) = x^4 - 5x^2 + 3$

Algebraically verify that the function is symmetric with respect to the x-axis.

b) $y = 4x - 12$

Algebraically verify that the function is symmetric with respect to the origin.

c) $f(x) = \frac{x^3}{10} - x$

VIII. TRANSFORMATIONS OF GRAPHS

For each function below:

i. identify the parent function
ii. describe the sequence of transformations that transform the parent graph *f* into the graph of function *g*.

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

b) $g(x) = -4\sqrt{x}$

c) $h(x) = \left(\frac{1}{2}x\right)^2$

d) $s(x) = \frac{1}{x-6} - 1$

e) $p(x) = \log(-x)$

f) $r(x) = 3 \cdot 2^x + 10$

IX. FACTORING

Factor each expression completely.

a) $ac + cd - ab - bd$
(HINT: Factor by grouping.)

b) $x^2 - 36$

c) $3x^2 - 11x - 4$

d) $x^3 - 8$

e) $x^4 + 11x^2 - 42$
(HINT: Factor using u-substitution.)

f) $x^{3/2} + x^{1/2}$

g) $e^{2x} - 4e^x + 4$
(HINT: Factor using u-substitution.)

h) Factor using the GCF and simply.

$$\frac{3x^2(12x+18)\sec(3x^2)+6x\sec(3x^2)}{(6x^2-24)}$$

X. QUADRATIC FUNCTIONS

For each quadratic function:

i. Identify whether the graph of the parabola opens upward or downward.
ii. Identify the coordinates of its vertex.
iii. State whether there is a minimum or maximum. Give this value.
iv. State the axis of symmetry.
v. Describe any transformations from the parent graph, $f(x) = x^2$.
vi. Give the x and y-intercepts as coordinate points.

a) $f(x) = -3x^2 + 4x$

b) $g(x) = 2x^2 + 7x + 6$

Solve each equation. Use any appropriate method.

a) $8x^2 - 4 = 68$

b) $3x^2 + 5x = 2$

c) $x^2 - 10x + 4 = 0$

For each quadratic function, complete the square. Then identify the vertex of each parabola.

a) $y = x^2 + 6x + 13$

b) $y = x^2 - 4x - 7$

XI. EXPONENTS AND LOGARITHMS

Simplify each expression.

a) $log_4 \frac{1}{16}$

b) $log_{10} 10^{1/2}$

c) $3log_3 3 - \frac{3}{4} log_3 81 + \frac{1}{3} log_3 \frac{1}{27}$

d) $2log_{10}\sqrt{x} + log_{10} x^{1/3}$

e) $3^{2log_3 5}$

f) $e^{\ln 2x+5}$

Solve each equation. Identify extraneous solutions is applicable.

a) $5^{x+1} = 25$

b) $\frac{1}{3} = 3^{2x+2}$

c) $log_2 x^2 = 3$

d) $log_6(x + 3) + log_6(x + 4) = 1$

XII. OPERATIONS OF RATIONAL EXPRESSIONS

Add or subtract. You may need to factor the numerators or denominators first. Simplify your answers.

a) $\frac{8}{x^2+3x-10} + \frac{3}{x-2}$

b) $\frac{3}{x} - \frac{x+8}{x^2+5x}$

c) $\sqrt{x+3} + \frac{1}{\sqrt{x+3}}$

Multiply or divide. You may need to factor the numerators or denominators first. Simplify your answers.

a) $\frac{x^2+5x+6}{8x^4} \cdot \frac{15x}{7x+21}$

b) $\frac{8a^2}{a+3} \div \frac{3a}{a^2-9}$

XIII. RATIONAL FUNCTIONS

For each function, find

i. the x and y-intercepts
ii. the vertical and horizontal asymptotes
iii. graph the function

a) $g(x) = \frac{3x-2}{x+3}$ b) $f(x) = \frac{-7}{x-6}$ c) $h(x) = \frac{x+2}{x^2-1}$

Solve each equation.

a) $\frac{x}{5} + \frac{x+4}{3} = 4$ b) $\frac{7}{n+4} - \frac{2}{n-3} = \frac{2n-9}{n^2+n-12}$ c) $\frac{2}{p} + 3 = \frac{7}{p+6}$

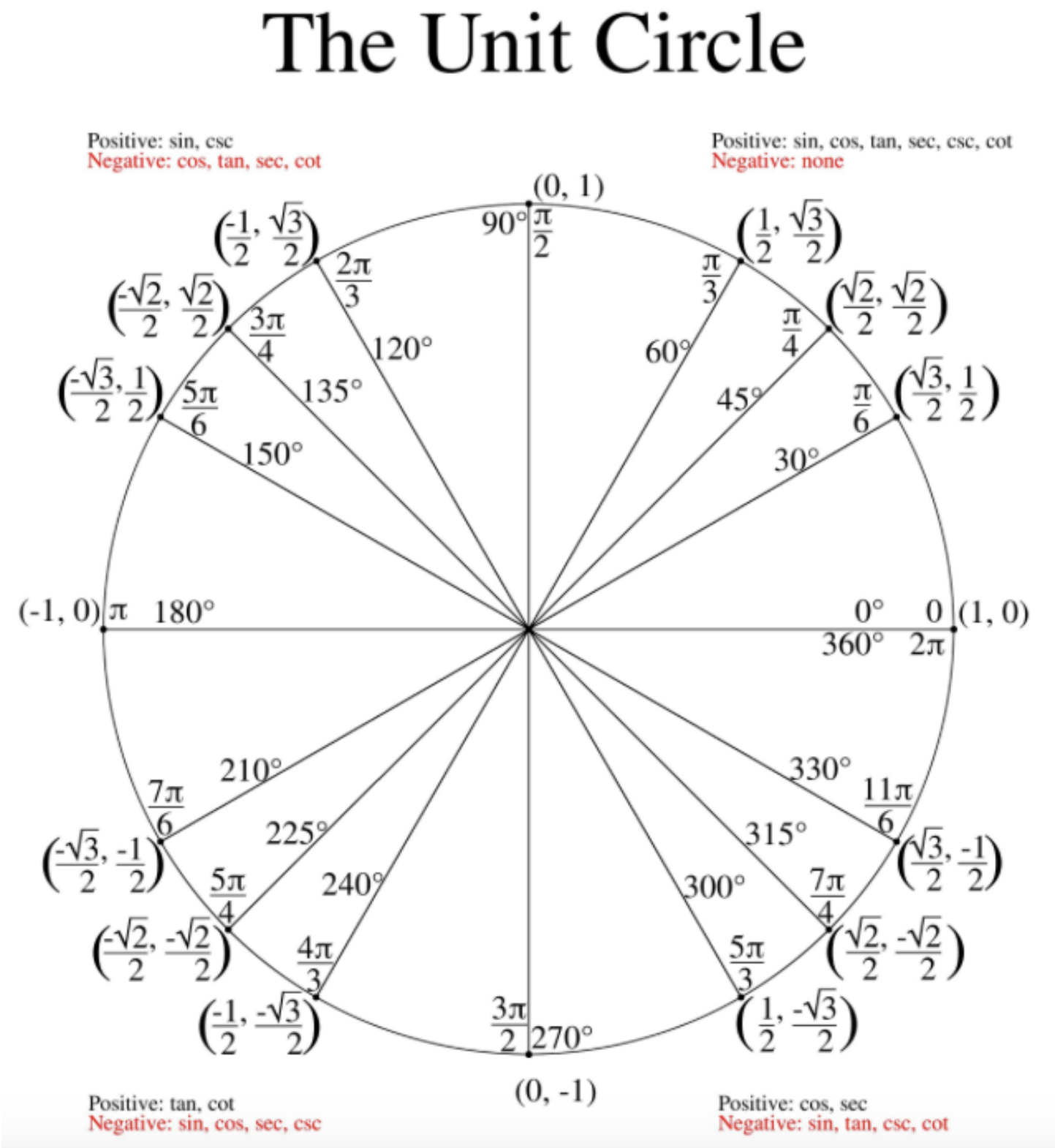
XIV. COMPLEX FRACTIONS

Simplify.

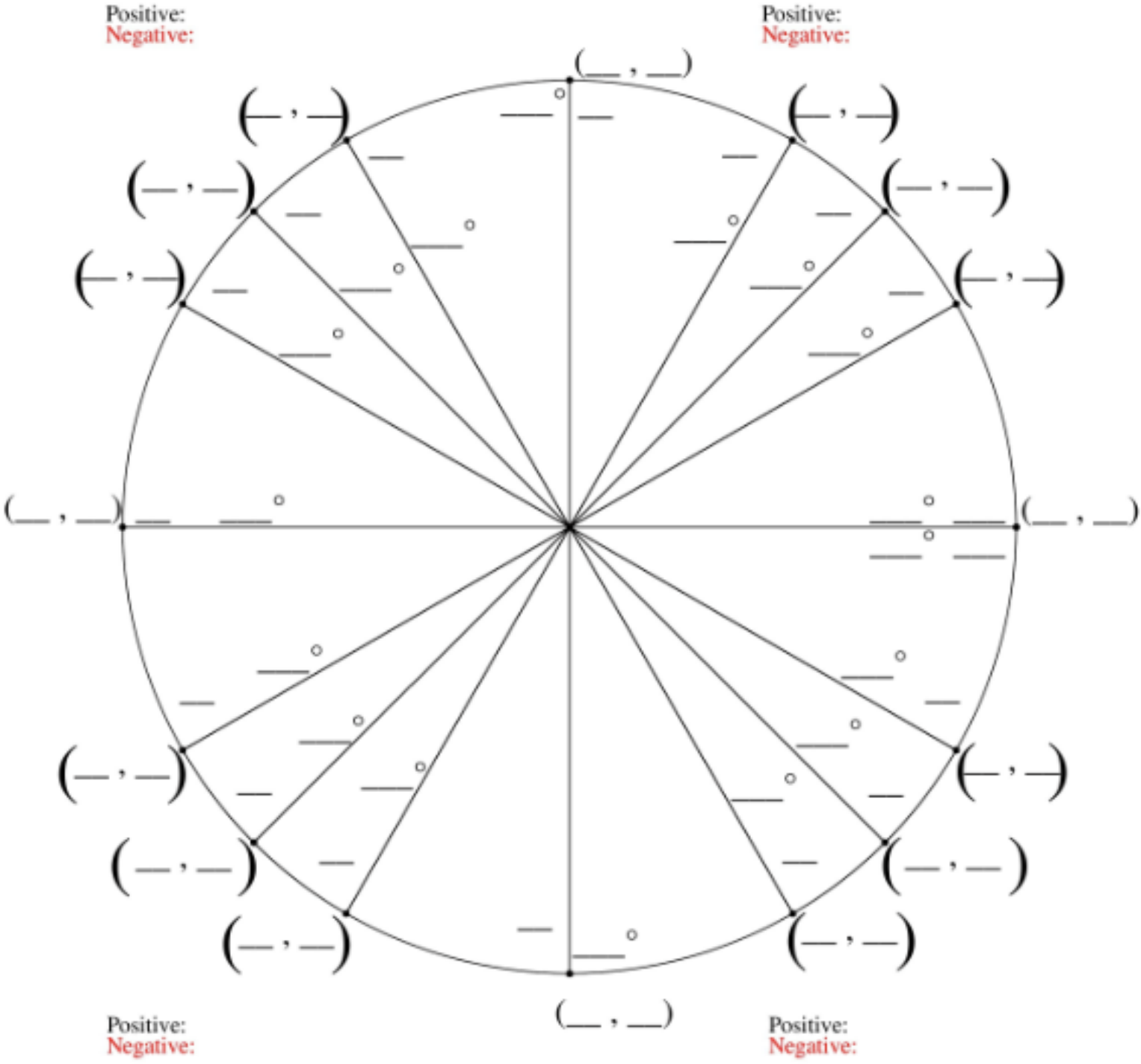
a) $\frac{\frac{25}{a} - a}{5+a}$ b) $\frac{2 - \frac{4}{x+2}}{5+\frac{10}{x+2}}$ c) $\frac{\frac{x}{x+1} - \frac{1}{x}}{\frac{x}{x+1} + \frac{1}{x}}$

XV. TRIGONOMETRY

Unit Circle—Below is a unit circle with all values between 0 and 2π. Memorize it and try to fill out the blank unit circle on the following page. Can you use the values of sin and cos to calculate each tangent value?



Fill in The Unit Circle



IF YOU NEED HELP MEMORIZING THESE VALUES, PLEASE SEE BELOW...

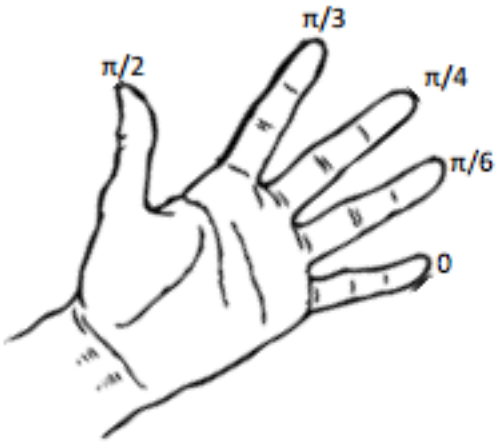
Trigonometric Hand Trick

This is an easy way to remember the values of common values of trigonometric functions in the first quadrant. It's a lengthy explanation, but once you know this by heart, you can use this trick for all four quadrants. All you need is your non-dominant hand.

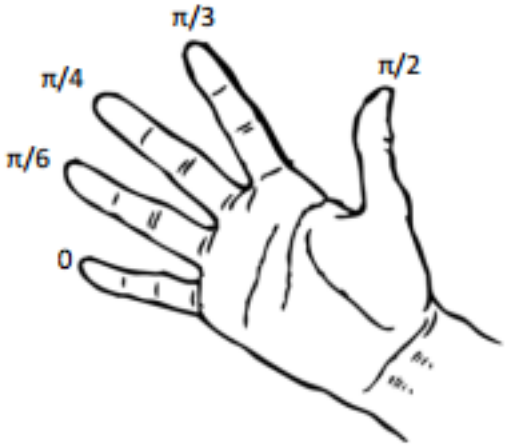
Step 1: Hold out your non-dominant hand.

Step 2: "Assign" the following values to your fingers.

If your non-dominant hand is your left hand…



If your non-dominant hand is your right hand…



Step 3: Find a trig problem.

For example: cos (π/6)

Step 4: Hold down the finger assigned for that angle.

For example: Hold down your ring finger for π/6.

Step 5: Know the following formulas.

$$\sin\theta = \frac{\sqrt{bottom\ fingers}}{2} \qquad \cos\theta = \frac{\sqrt{top\ fingers}}{2} \qquad \tan\theta = \frac{\sqrt{bottom\ fingers}}{\sqrt{top\ fingers}}$$

"Bottom fingers" refer to how many fingers are "below" the finger you've held down. "Top fingers" refer to how many fingers "above" the finger you've held down. Your thumb counts.

Step 6: Calculate the values for your trig expression using the appropriate formula.

For example: When you hold down your ring finger, there is *1* finger below your ring finder (your pinkie), and there are *3* fingers above your ring finger (your thumb, your index finger, and your middle finger.) Therefore, $\cos(\pi/6) = \frac{\sqrt{3}}{2}$. If you need sine, $\sin(\pi/6) = \frac{\sqrt{1}}{2} = \frac{1}{2}$.

Using your unit circle, give the exact answer for each. (Try these from memory.)

a) $\cos\frac{\pi}{6}$ b) $\sin\frac{\pi}{4}$ c) $\tan\frac{\pi}{3}$

d) $\sin\frac{\pi}{3}$ e) $\tan\frac{\pi}{6}$ f) $\cos\frac{\pi}{4}$

g) $\cot\frac{\pi}{4}$ h) $\csc\frac{\pi}{3}$ i) $\sec\frac{\pi}{6}$

j) $\cos\frac{\pi}{2}$ k) $\sin\frac{11\pi}{4}$ l) $\tan\frac{-5\pi}{2}$

m) $\sin(-3\pi)$ n) $\tan\frac{9\pi}{4}$ o) $\cos\frac{-7\pi}{6}$

p) $\sec\frac{\pi}{3}$ q) $\csc\frac{-\pi}{6}$ r) $\cot\frac{3\pi}{2}$

Evaluate each inverse trigonometric expression. Note: Some values may not exist.

a) $arctan\ \frac{\sqrt{3}}{3}$ b) $cos^{-1}\left(\frac{-\sqrt{2}}{2}\right)$ c) $sin^{-1}2$ d) $\arcsin\frac{\sqrt{3}}{2}$

e) $\tan(\arctan\sqrt{3})$ f) $\sin(sin^{-1}\frac{1}{2})$ g) $cos^{-1}(\cos\frac{3\pi}{4})$ h) $\tan(\arccos\frac{2}{3})$
(HINT: Draw a reference triangle.)

Solve each equation on the interval $[0,2\pi)$. Give exact answers.

a) $\sin x = \frac{-1}{2}$ b) $\tan x = \sqrt{3}$ c) $2\cos x = -\sqrt{2}$

Graph 1 period for each function.

a) $y = -2\sin(4x)$ b) $g(x) = \frac{1}{3}\cos\frac{x}{2}$ c) $h(x) = \tan 3x$

XVI. SIMPLIFYING EXPRESSIONS

Simplify each expression.

a) $\frac{(x+1)^3(x-2)+3(x+1)^2}{(x+1)^4}$

b) $2\left(\frac{x^2}{x^3+2}\right)\left(\frac{(x^3+2)(2x)-(x^2)(3x^2)}{(x^3+2)^2}\right)$

Rationalize the denominator or numerator.

a) $\frac{x}{1-\sqrt{x-2}}$

b) $\frac{\sqrt{x+1}+1}{x}$

XVII. LONG DIVISION AND SYNTHETIC DIVISION FOR POLYNOMIALS

Divide using long division or synthetic division for polynomials. Make sure to express your answers in polynomial form.

a) $\frac{x^3-4x^2+2x+5}{x-2}$

b) $\frac{2x^3+4x^2-5}{x+3}$

c) $\frac{2x^3-4x+7x^2+7}{x^2+2x-1}$

d) $\frac{4x^3-2x^2-3}{2x^2-1}$

e) $\frac{12x^3-11x^2+9x+18}{4x+3}$