Advanced Placement Calculus AB

2023-2024

Summer Assignment

Welcome to Calc AB!

1. Read through section 1 of this packet. It contains the material that you need to know and understand. It should look familiar and will be a valuable resource for you throughout the upcoming year.

2. Create an account on www.khanacademy.org. Then go to www.khanacademy.org/join and enter the class code **MEPXRVKQ**.

3. Complete the assigned unit on Limits on Khan Academy. Please make sure you are signed in so that I can see your progress and give you credit. The grading for the Khan Academy assignments will be based on the 34 skills in the Limits and Continuity Unit. Each skill is worth 3 points. You will earn 3 points if you reach proficient or mastered; 2 points for familiar and 1 point for attempted. You must complete the quizzes and the unit test.

I look forward to working with you next year!

If you need help on this assignment over the summer, please send me an email (carrie.odonnell@sno.wednet.edu). If this seems overwhelming, don't panic and certainly don't quit on Calculus. Just get in touch with me and I'll gladly help you out. This goes for the entire year.

Best regards,

Ms. O'Donnell

Section 1 (pg.1) - Review

Stuff You Must Know Cold from Algebra 1

Powers of 2

$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$
$2^9 = 512$
$2^{10} = 1024$
$2^{11} = 2048$
$2^{12} = 4096$

Squares

$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 81$
$10^2 = 100$
$11^2 = 121$
$12^2 = 144$
$13^2 = 169$
$14^2 = 196$
$15^2 = 225$
$16^2 = 256$
$17^2 = 289$
$18^2 = 324$
$19^2 = 361$
$20^2 = 400$
$21^2 = 441$
$22^2 = 484$
$23^2 = 529$
$24^2 = 576$
$25^2 = 625$

Cubes

$3^3 = 27$
$4^3 = 64$
$5^3 = 125$
$6^3 = 216$
$7^3 = 343$
$8^3 = 512$
$9^3 = 729$
$10^3 = 1000$
$11^3 = 1331$
$12^3 = 1728$

Factorials

$0! = 1$
$1! = 1$
$2! = 2$
$3! = 6$
$4! = 24$
$5! = 120$

Inequality Meanings

$<$ *less than*

$\leq$ *less than or equal to*

$>$ *greater than*

$\geq$ *greater than or equal to*

Linear Equations

Parent Function:

$$y = x$$

Standard Form:

$$ax + by = c$$

Slope-Intercept Form:

$$y = mx + b$$

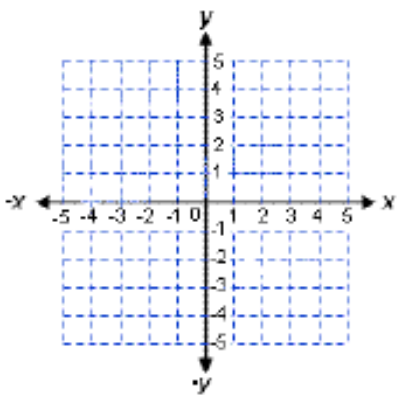
Point-Slope Form:

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

Slope:

$$\frac{rise}{run} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Graph: $y =$
(label 3 points)



Section 1 (pg.2) - Review

Stuff You Must Know Cold from Geometry

Quadratic Equations

Parent Function:

$$y = x^2$$

Standard Form (Vertex Form):

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

General Form:

$$y = ax^2 + bx + c$$

Vertex:

$$(h, k)$$

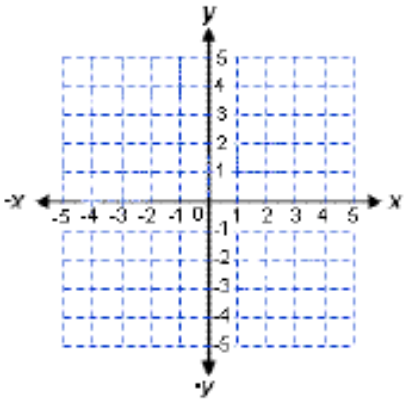
Axis of Symmetry:

$$x = \frac{-b}{2a}$$

Quadratic Formula:

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

Graph: $y =$
(label 3 points)



Order of Operations

1. Brackets
2. Exponents
3. Multiply & Divide (left to right)
4. Add & Subtract (left to right)

Function Definitions

Domain: *The set of all possible input values (usually x)*

Range: *The set of all possible output values (usually y)*

Function: *A relation where each element in the domain (x) matches with exactly one element of the range (y)*

Direct Variation:

$$y = kx$$

Indirect Variation:

$$y = \frac{k}{x}$$

Roots:

The x-intercepts of a function, where the function (y) equals zero. Roots are also known as solutions, zeros, and x-intercepts.

Midpoint Formula

$$(m_1, m_2) =$$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Use a, b, and c to describe the following properties:

Commutative Property

Addition:

$$a + b = b + a$$

Multiplication:

$$a \cdot b = b \cdot a$$

Associative Property

Addition:

$$a + (b + c) = (a + b) + c$$

Multiplication:

$$a \cdot (b \cdot c) = (a \cdot b) \cdot c$$

Distributive Property

$$a(b + c) = ab + ac$$

Absolute Value

$a \geq 0$

$|a| = a$

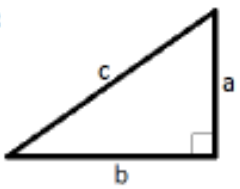
$|-a| = a$

Distance Formula

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

Pythagorean Theorem

$$c^2 = a^2 + b^2$$



Section 1 (pg.3) - Review

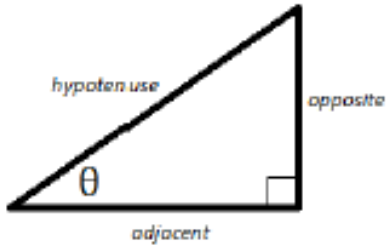
Stuff You Must Know Cold from Trigonometry

Trigonometric Ratios

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

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

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



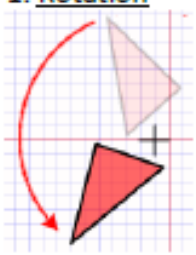
Triangle Congruence

1. Side-Side-Side *(SSS)*
2. Side-Angle-Side *(SAS)*
3. Angle-Side-Angle *(ASA)*
4. Angle-Angle-Side *(AAS)*
5. Hypotenuse-Leg *(HL)*

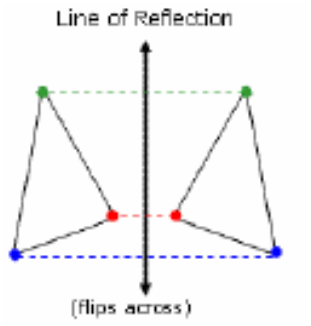
http://www.mathopenref.com/congruenttriangles.html

Transformations

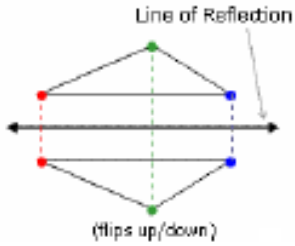
1. Rotation



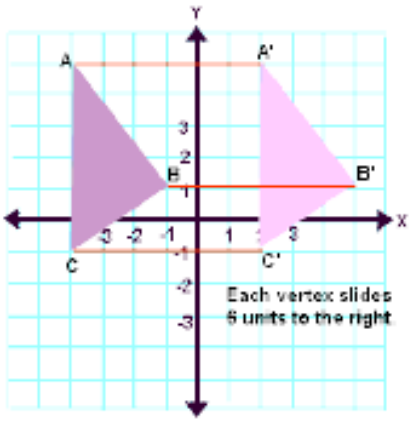
2. Horizontal Reflection



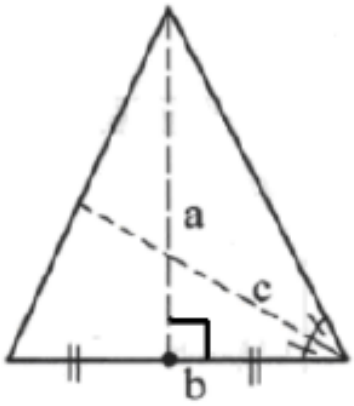
3. Vertical Reflection



4. Translation



Parts of a Triangle



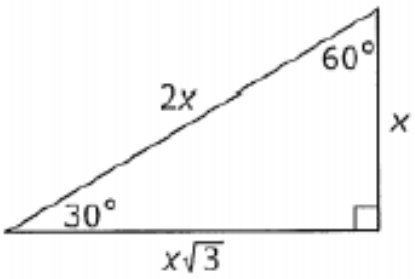
a: *altitude (height)*

b: *base (with midpoint)*

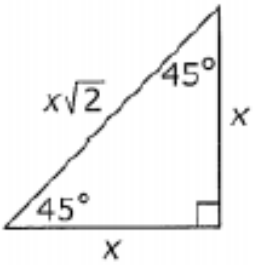
c: *angle bisector*

Special Right Triangles

30° – 60° – 90° triangle



45° – 45° – 90° triangle



Similarity

Ratio of Sides: $m:n$

Ratio of Perimeters: $m:n$

Ratio of Areas: $m^2:n^2$

Ratio of Volumes: $m^3:n^3$

Section 1 (pg.4) - Review

Other Stuff You Must Know Cold from Geometry

Perimeter Formulas

Square: $P = 4s$

Rectangle: $P = 2l + 2w$

Circumference: $C = \pi r^2$

Roots to Know

$\sqrt{2} \approx 1.41$

$\sqrt{3} \approx 1.73$

Area Formulas

Square: $A = s^2$

Rectangle: $A = l \cdot w$

Parallelogram: $A = b \cdot h$

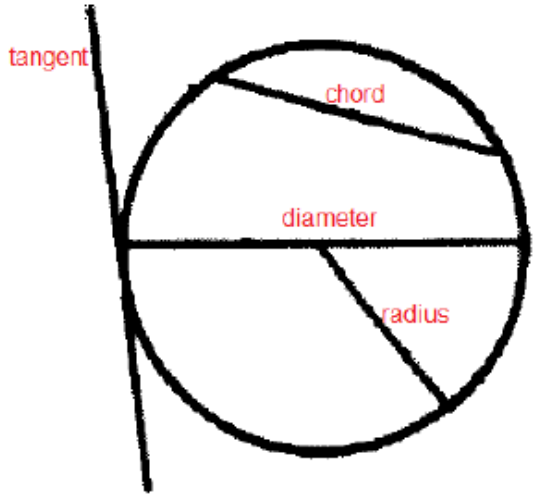
Trapezoid: $A = \frac{1}{2}(b_1 + b_2)h$

Circle: $A = \pi r^2$

Triangle: $A = \frac{1}{2}b \cdot h$

Regular Polygon: $A = \frac{1}{2}a \cdot p$

Parts of a Circle



Surface Area Formulas

Cube: $S = 6s^2$

Sphere: $S = 4\pi r^2$

Cylinder: $S = 2B + Ch$

Volume Formulas

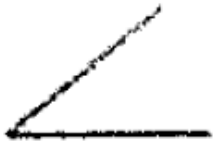
Cube: $V = s^3$

Prism/Cylinder: $V = B \cdot h$

Pyramid/Cone: $V = \frac{1}{3}B \cdot h$

Sphere: $V = \frac{4}{3}\pi r^3$

Types of Angles:



is acute

is obtuse

Complementary angles add up equal 90° .

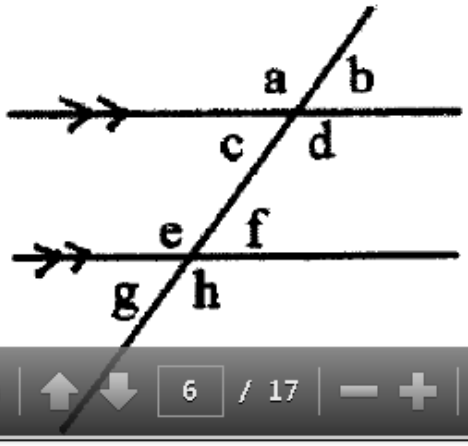
Supplementary angles add up equal 180° .

Sum of Interior Angles

Triangle = 180°

Quadrilateral = 360°

Regular Polygon = 180° (n-2)



Angle a is congruent to:

Angles d, e, and h

Angle a is supplementary to:

Angles b, c, f, and g

Section 1 (pg.5) - Review

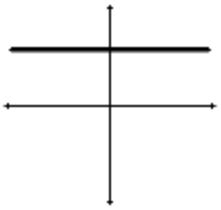
www.khanacademy.org/math/algebra/algebra-functions

Toolkit of Functions

Students should know the basic shape of these functions and be able to graph their transformations without the assistance of a calculator.

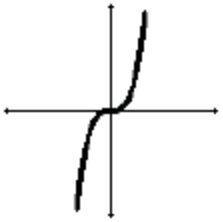
Constant

$f(x) = a$



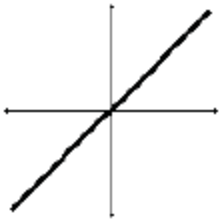
Cubic

$f(x) = x^3$



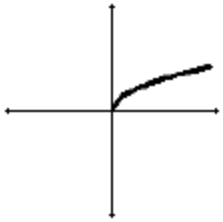
Identity

$f(x) = x$



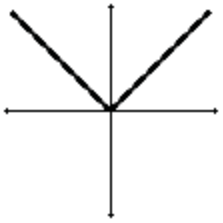
Square Root

$f(x) = \sqrt{x}$



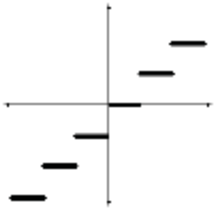
Absolute Value

$f(x) = |x|$



Greatest Integer

$f(x) = [x]$



Reciprocal

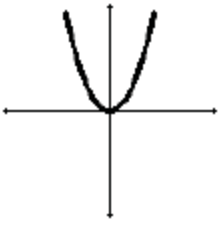
$f(x) = \frac{1}{x}$

Exponential

$f(x) = a^x$

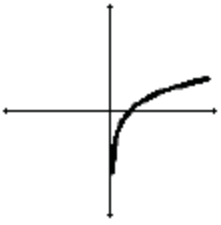
Quadratic

$f(x) = x^2$



Logarithmic

$f(x) = \ln x$

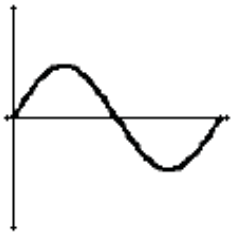


Section 1 (pg.6) - Review

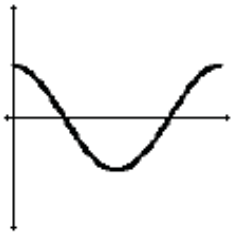
http://www.khanacademy.org/math/trigonometry

Trig Functions

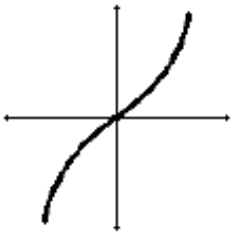
$f(x) = \sin x$



$f(x) = \cos x$



$f(x) = \tan x$



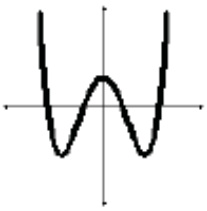
Polynomial Functions:

A function P is called a polynomial if $P(x) = a_n x^n + a_{n-1} x^{n-1} + \ldots + a_2 x^2 + a_1 x + a_0$
Where n is a nonnegative integer and the numbers $a_0, a_1, a_2, \ldots a_n$ are constants.

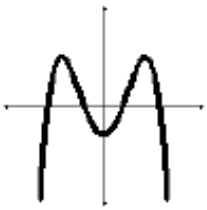
Even degree

Leading coefficient sign

Positive



Negative



Odd degree

Leading coefficient sign

Positive

Negative

- Number of roots equals the degree of the polynomial.
- Number of x intercepts is less than or equal to the degree.
- Number of "turns" is less than or equal to (degree – 1).

Section 1 (pg.7) - Review

Trigonometric Identities

** Memorize the marked families of Identities

**** Reciprocal Identities**

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

**** Quotient Identities**

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

**** Pythagorean Identities**

$$\sin^2 X + \cos^2 X = 1$$
$$1 + \tan^2 X = \sec^2 X$$
$$1 + \cot^2 X = \csc^2 X$$

**** Even Identities**

$$\cos(X) = \cos(-X)$$
$$\sec(X) = \sec(-X)$$

**** Odd Identities**

$$\sin(-X) = -\sin(X)$$
$$\csc(-X) = -\csc(X)$$
$$\tan(-X) = -\tan(X)$$
$$\cot(-X) = -\cot(X)$$

Co-Function Identities

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

Power Reducing Formulas

$$\sin^2 u = \frac{1 - \cos 2u}{2}$$
$$\cos^2 u = \frac{1 + \cos 2u}{2}$$
$$\tan^2 u = \frac{1 - \cos 2u}{1 + \cos 2u}$$

Sum and Difference Formulas

$$\sin(u + v) = \sin u \cos v + \cos u \sin v$$
$$\sin(u - v) = \sin u \cos v - \cos u \sin v$$
$$\cos(u + v) = \cos u \cos v - \sin u \sin v$$
$$\cos(u - v) = \cos u \cos v + \sin u \sin v$$
$$\tan(u + v) = \frac{\tan u + \tan v}{1 - \tan u \tan v}$$
$$\tan(u - v) = \frac{\tan u - \tan v}{1 + \tan u \tan v}$$

Double Angle Formulas

$$\sin 2u = 2 \sin u \cos u$$
$$\tan 2u = \frac{2 \tan u}{1 - \tan^2 u}$$
$$\cos 2u = \cos^2 u - \sin^2 u$$
$$\cos 2u = 2 \cos^2 u - 1$$
$$\cos 2u = 1 - 2 \sin^2 u$$

Half Angle Formulas

$$\sin\frac{u}{2} = \pm\sqrt{\frac{1 - \cos u}{2}}$$
$$\cos\frac{u}{2} = \pm\sqrt{\frac{1 + \cos u}{2}}$$
$$\tan\frac{u}{2} = \frac{1 - \cos u}{\sin u} = \frac{\sin u}{1 + \cos u}$$

The signs of $\sin\frac{u}{2}$ and $\cos\frac{u}{2}$ depend on the quadrant in which $\frac{u}{2}$ lies.

Product to Sum Formulas

$$\sin u \sin v = \frac{1}{2}[\cos(u - v) - \cos(u + v)]$$
$$\cos u \cos v = \frac{1}{2}[\cos(u - v) + \cos(u + v)]$$
$$\sin u \cos v = \frac{1}{2}[\sin(u + v) + \sin(u - v)]$$
$$\cos u \sin v = \frac{1}{2}[\sin(u + v) - \sin(u - v)]$$

Sum to Product Formulas

$$\sin u + \sin v = 2 \sin\left(\frac{u + v}{2}\right) \cos\left(\frac{u - v}{2}\right)$$
$$\sin u - \sin v = 2 \cos\left(\frac{u + v}{2}\right) \sin\left(\frac{u - v}{2}\right)$$
$$\cos u + \cos v = 2 \cos\left(\frac{u + v}{2}\right) \cos\left(\frac{u - v}{2}\right)$$
$$\cos u - \cos v = -2 \sin\left(\frac{u + v}{2}\right) \sin\left(\frac{u - v}{2}\right)$$

Section 1 (pg.8) - Review

Unit Circle

You must be able to use the unit circle... from memory!