

**AP Calculus AB
Summer Assignment 2022**

Complete Parts 1-4 and show all work on loose leaf paper. This assignment is to be turned in to Mr. Iannizzotto on the first day of school and will be graded. You will be tested on this material, including the attached definitions, within the first two weeks of school. If you have any questions pertaining to the problems, you may email me at jiannizzotto@moorechs.org.

Part 1: Solve algebraically and check.

1. $\frac{1}{4}(4x - 20) = -12$
2. $9^{2x-1} = 3^{3(x+1)}$
3. $\sqrt{x^2 - 4x} = x - 4$
4. $4x^5 + 8x^4 + 3x^3 = 0$
5. $\log_2 4 + \log_2(x - 3) = 3$
6. $2x^{-4} = \frac{1}{8}$
7. $\log x + \log(x + 2) = \log(x + 6)$
8. $2(5x + 2) - 2x = 3(2x + 3) + 7$
9. $\frac{x}{5} = \frac{3}{35} + \frac{x+1}{7}$
10. $\frac{2}{x-2} + \frac{1}{x+1} = \frac{1}{x^2-x-2}$

Part 2: Solve each equation using factoring.

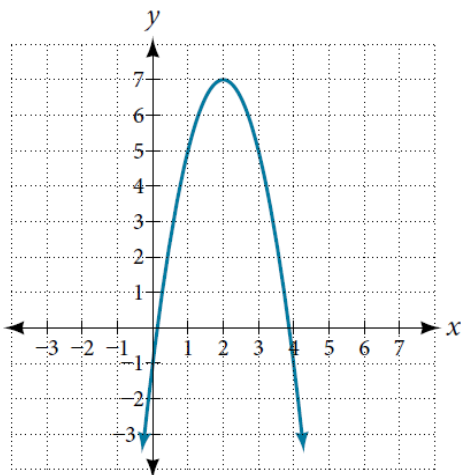
1. $8x^6 - 24x^5 + 16x^4 = 0$
2. $x^2 + x - 42 = 0$
3. $2x^2 + 7x - 4 = 0$
4. $x^2 - 144 = 0$
5. $x^4 - 49 = 0$
6. $x^3 - x^2 - 4x + 4 = 0$
7. $x^2 + 47x - 98 = 0$
8. $2x^2 - 44x + 240 = 0$
9. $9x^2 - 225 = 0$
10. $\frac{x^2-15x+36}{x-3} = 0$

Part 3: Given $f(x) = x^2 - 9x - 36$ and $g(x) = x + 3$, evaluate each of the following items.

1. $(f + g)(x)$
2. $(f - g)(x)$
3. $(f \cdot g)(x)$
4. $\left(\frac{f}{g}\right)(x)$
5. $f(10)$
6. $g(-18)$
7. $f(g(x))$
8. $g(f(x))$
9. $g(g(x))$
10. $f(8) + g(-5)$

Part 4: Miscellaneous Problems

1. Find the equation of the line that is perpendicular to $y = \frac{1}{3}x + 1$ and travels through $(-9, -8)$.
2. Find the equation of the line that travels through the points $(6, 16)$ and $(-10, 20)$.
3. Find the equation of the line that is parallel to $-2x + 5y = 5$ and travels through $(15, -4)$.
4. Write the standard form equation of a circle whose diameter has endpoints $(11, 8)$ and $(5, 10)$.
5. Write the standard form equation of a circle centered at $(-7, 3)$ with a radius of 14 units.
6. To the nearest tenth, find the length of the edge of a cube, given that its volume is 80 cm^3 .
7. Find, in terms of π , the volume of a sphere with a radius of 13 centimeters.
8. Find, in terms of π , the volume of a hemisphere with a diameter of 1 meter.
9. Find, in terms of π , the surface area of a cylinder with a radius of 2.5 cm and a height of 30 cm.
10. Algebraically, find the exact value of $\sin 150^\circ$.
11. Find the exact value of $\sin\left(\frac{\pi}{3} - \frac{\pi}{4}\right)$ using a difference formula.
12. Find the exact value of $\cos(75^\circ)$ using a sum formula.
13. Given $\sin \alpha = \frac{3}{5}$ with $\alpha \in \text{QI}$ and $\cos \beta = -\frac{5}{13}$ with $\beta \in \text{QIII}$, find $\sin(\alpha + \beta)$ in simplest form.
14. Sketch the graph of $y = 3 \cos(2x)$ over $[0, 2\pi]$.
15. Find the equation, in standard form $y = a(x - h)^2 + k$, of the parabola shown below. Show all work.



Definitions

abscissa - The horizontal or x -coordinate of a two-dimensional coordinate system.

absolute value - The distance from 0 to a number n on a number line. Indicated by $|n|$.

algebraic equation - A mathematical statement that is written using one or more variables and constants which contains an equal sign.

algebraic expression - A mathematical phrase that is written using one or more variables and constants, but which does not contain the symbols $=$, $<$, $>$, \leq , \geq , or \neq .

base of an exponential function - The number b in the exponential function $y = b^x$.

center-radius equation of a circle - The form of the equation of a circle with center (h, k) and radius r given by the formula $(x - h)^2 + (y - k)^2 = r^2$. Example: If the coordinates of the center of the circle are $(3, -8)$ and the length of the radius is 6, then the equation of the circle is $(x - 3)^2 + (y + 8)^2 = 36$.

circle - The set of all points (or locus of points) in a plane that are a fixed distance, (called the radius) from a fixed point, (called the center).

coefficient - The numerical factor of a term in a polynomial. Example: 9 is the coefficient of $9x^5$.

common factor - A number, polynomial, or quantity that divides two or more numbers or algebraic expressions evenly.

conjugate - Two binomials whose first terms are equal and last terms are opposites.

cosine - For a given acute angle in a right triangle, the ratio of the length of the side adjacent to an acute angle to the length of the hypotenuse.

degree of a monomial - The sum of the exponents of the variables in the monomial.

Example: The degree of the monomial $3x^5$ is five. The degree of the monomial x^3y^4 is seven.

degree of a polynomial - The highest degree of any monomial term in the polynomial.

difference of two perfect squares - A binomial form of $a^2 - b^2$ which can be factored into $(a - b)(a + b)$.

direct variation - A relationship in which the ratio of two variables is constant. A direct variation has an equation in the form $y = kx$ where x and y are variables and k is the constant of variation.

domain - The set of values of the independent variable, usually x in an equation, for which a given function is defined; the set of first coordinates in the ordered pairs of a relation.

equation - A mathematical sentence stating that two expressions are equal.

exact value - The value of an expression that has not been rounded.

exponential function - A function with a variable in the exponent; an equation in the form $y = ab^x$, where $a \neq 0$, $b > 0$ and $b \neq 1$.

extraneous root/value - A solution of a derived equation that is not a solution of the original equation.

factor - (noun) A whole number that is a divisor of another number; an algebraic expression that is a divisor of another algebraic expression. Example: 3 is a factor of 12.

factor - (verb) Find the number of algebraic expressions that give an indicated product.

Example: To factor $x^2 + x - 6$, write $(x + 3)(x - 2)$.

function - A rule that assigns to each number x a unique number y in the range.

Geometry - Branch of mathematics that deals with the properties, measurement, and relationships of points, lines, angles, surfaces, and solids.

greatest common factor (GCF) - The greatest number or expression that is a factor of two or more numbers or expressions.

index of a radical - The letter n in the expression $\sqrt[n]{x}$

irrational number - A number that cannot be expressed as the ratio of two integers.

linear equation - A first degree equation. Example: $y = 6x + 8$.

linear system - A set of two or more linear equations with common variables.

measure of central tendency - A summary statistic that indicates the typical value or center of an

ordinate - The horizontal or x -coordinate of a two-dimensional coordinate system.

parabola - The graph of a quadratic function. It is two-dimensional and u-shaped.

pi - The irrational number equal to the length of the circumference of a circle divided by the length of its diameter. The symbol for pi is π .

principal square root - The positive square root of a number.

quadratic equation - An equation that can be written in the form $ax^2 + bx + c = 0$, where a , b , and c are real constants and $a \neq 0$.

quadratic formula - The formula used to determine the roots of the quadratic equation. $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

radical - The root of a quantity as indicated by the radical sign.

radicand - The quantity under a radical sign; a number or expression from which a root is extracted.

rational number - Any number that can be expressed as a ratio in the form $\frac{a}{b}$ where a and b are integers and $b \neq 0$. A rational number is either a terminating or repeating decimal.

sine - For a given acute angle in a right triangle, \sin is the ratio of the length of the side opposite the acute angle to the length of the hypotenuse.

slope - The measure of the steepness of a line; the ratio of vertical change to horizontal change.

solution set - Any and all value(s) of the variable(s) that satisfy an equation, inequality, system of equations, or system of inequalities.

tangent (of an angle) - For a given acute angle in a right triangle, \tan is the ratio of the length of the side opposite the acute angle to the length of the side adjacent to the angle.

trigonometric functions - The functions, sine, cosine, tangent, cotangent, secant and cosecant.

undefined - An expression in mathematics which does not have meaning and therefore is not assigned a value. When the denominator of a fraction is equal to 0, the fraction is undefined.

univariate - A set of data involving one variable.

variable - A quantity whose value can change or vary; in algebra, letters often represent variables.

Properties of Mathematics

Commutative Property of Addition:	$a + b = b + a$
Commutative Property of Multiplication:	$ab = ba$
Associative Property of Addition:	$a + (b + c) = (a + b) + c$
Associative Property of Multiplication:	$a(bc) = (ab)c$
Identity Property of Addition:	$a + 0 = a$
Identity Property of Multiplication:	$a \cdot 1 = a$
Additive Inverse Property:	$a + (-a) = 0$
Multiplicative Inverse Property:	$a \cdot \frac{1}{a} = 1$
Distributive Property:	$a(b + c) = ab + ac$
Multiplication Property of Zero	$a \cdot 0 = 0$

Reciprocal Identities

$$\csc x = \frac{1}{\sin x}$$

$$\sec x = \frac{1}{\cos x}$$

$$\cot x = \frac{1}{\tan x}$$

Sum Formulas

$$\sin(x + y) = \sin x \cos y + \cos x \sin y$$

$$\cos(x + y) = \cos x \cos y - \sin x \sin y$$

$$\tan(x + y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}$$

Double Angle Formulas

$$\sin(2x) = 2 \sin x \cos x$$

$$\cos(2x) = \cos^2 x - \sin^2 x$$

$$\cos(2x) = 2 \cos^2 x - 1$$

$$\cos(2x) = 1 - 2 \sin^2 x$$

$$\tan(2x) = \frac{2 \tan x}{1 - \tan^2 x}$$

Pythagorean Identities

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

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

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

Difference Formulas

$$\sin(x - y) = \sin x \cos y - \cos x \sin y$$

$$\cos(x - y) = \cos x \cos y + \sin x \sin y$$

$$\tan(x - y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}$$

Half Angle Formulas

$$\sin \frac{1}{2}x = \pm \sqrt{\frac{1 - \cos x}{2}}$$

$$\cos \frac{1}{2}x = \pm \sqrt{\frac{1 + \cos x}{2}}$$

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

Special Angles

θ	0°	30°	45°	60°	90°
$\sin \theta$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
$\cos \theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0
$\tan \theta$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	undef.