A.P. Calculus BC
Summer Assignment 2025

The following packet contains topics that you will be required to know in order to succeed in A.P. Calculus BC this year. You are advised to be familiar with each of the concepts and to turn in the included problems on the first day of school. All of these topics were discussed in either Honors Algebra II or Honors Pre-Calculus and will be used frequently throughout the year.

Due on first day of school, 2025. **ALL problems must be done in this paper!**
Show your procedure algorithmically, not just your answer.
All graphs must be shown in this paper! All answers must be placed in the space provided!
There will be a test covering this material.
Good luck!

1. Expand the following binomials

a. $Expand \quad (x-2h)^5$ b. $Expand \quad \left(2x^2-3\right)^4$

2. Evaluate:

a. $\left(e^3\right)^{\ln 2}\cdot \ln\left(\frac{\sqrt{e}}{e^2}\right)$ b. $\sum_{k=3}^{31}\left(\frac{1}{k}-\frac{1}{k+1}\right)$ c. $\sum_{k=3}^{\infty}\left(\frac{1}{k}-\frac{1}{k+1}\right)$

a. _____ b. _____ c. _____

3. Write each of the following expressions in the form ca^pb^q where *c*, *p* and *q* are numbers:

Find **<u>all</u>** solutions to the following <u>without</u> using a calculator.

a.	$x^{12}-64x^6=0$	b.	$4x^6-16x^4-25x^2+100=0$	c.	$8x^3+27=0$	d.	$x^8-1=0$

a. _____ b. _____ c. _____ d. _____

4. Expand the summation notation and evaluate

a. $\sum_{n=0}^{4} \frac{n^2}{2}$ b. $\sum_{n=1}^{3} \frac{1}{n^3}$

a. _____ b. _____

5. Solve the following equations for the indicated variables:

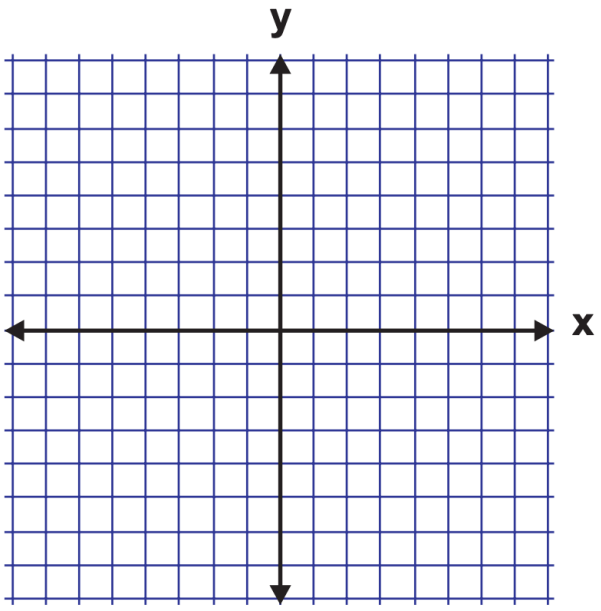
a. $A = 2\pi r^2 + 2\pi rh$, for positive r.

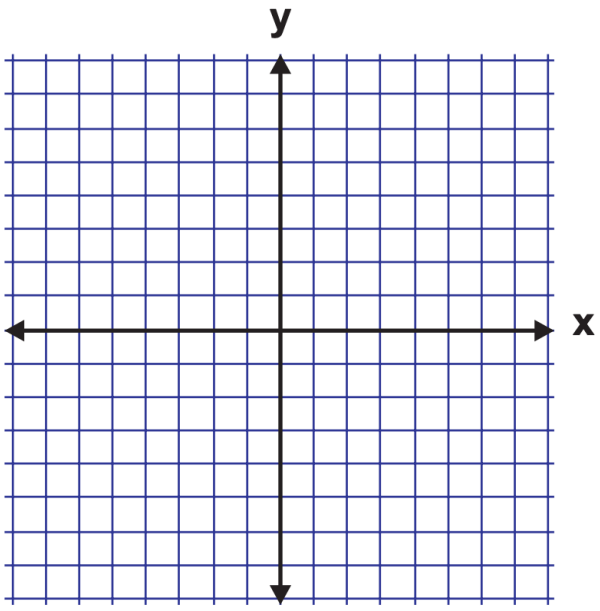
b. $\frac{2x}{4\pi} + \frac{1-x}{2} = 0$, *for* x

Answer a. _____ Answer b. _____

6. For the following equations, complete the square and reduce to one of the standard forms $y - b = A(x - a)^2$ *or* $(x - a) = A(y - b)^2$. Then sketch the graph.

a.	$y = x^2 + 4x + 3$	b.	$9y^2 - 6y - 9 - x = 0$

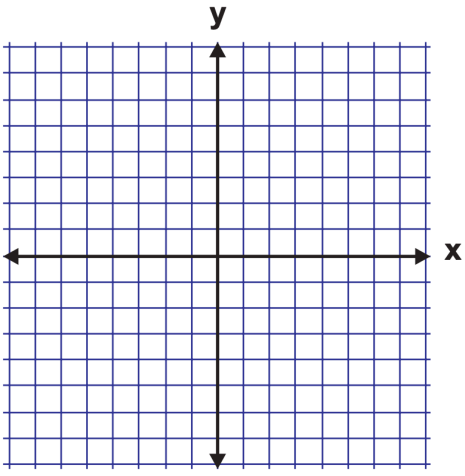




7. Consider a function $y = \dfrac{x^3}{x^2 - 1}$. Please, answer the following questions and **graph**:

a. Is this function odd/even/neither? Prove your answer algebraically.

b. Write the equations of the asymptotes: _____



8. Solve the following equations or inequalities:

a. $\ln(x-1) < 0$

b. $\frac{x^2-3x+2}{\log(x+2)} \geq 0$

a. _____

b. _____

c. $2sin^5x=3sin^3x-sinx$

d. $2cos^2x=2\sin(2x)$

c. _____

d. _____

e. $e^{\left(\frac{sinx}{1-cosx}\right)} > e$ on $[0, 2\pi]$

f. $\frac{sinx-2}{4\sin^2 x-1} = 2$

e. _____

f. _____

8. continues

g. $1-\frac{2}{x-1}\le\frac{1}{x}$

h. $\left|3x-\left|2x+1\right|\right|=4$

g. _____

h. _____

i. $\left(e^4\right)^x\cdot e^{x2}=e^{12}$

j. $z^6=1$ (all 6 answers)

i. _____

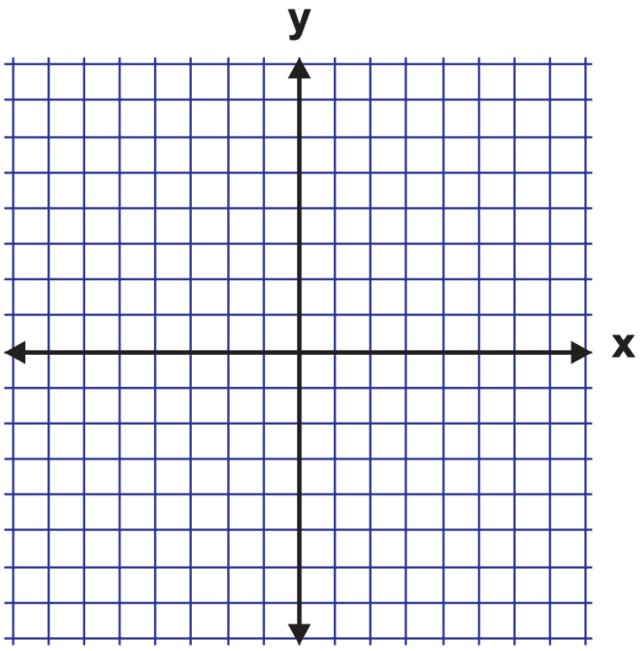
j. _____

9. What is the area of the region enclosed by $3x^2+y^2+12x+6y=15$?

Answer _____

10. Graph the following function. Note: [x] is a Greatest Integer Function

$$f(x)=\begin{cases}-2x^2+3, & if \quad -2<x\le 1\\ 2x-1, & if \quad 1<x\le 3\\ [x]+2, & if \quad 3<x\le 6\end{cases}$$



For the function above, please find the domain, range, and the points of discontinuity:

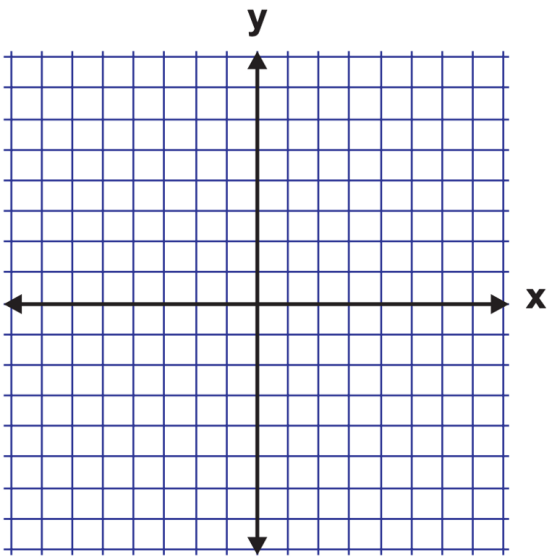
Domain _____ Range _____Points of Discontinuity _____

11. The equation $12x^3-23x^2-3x+2=0$ has a solution $x=2$.
Find all other solutions without using a calculator.

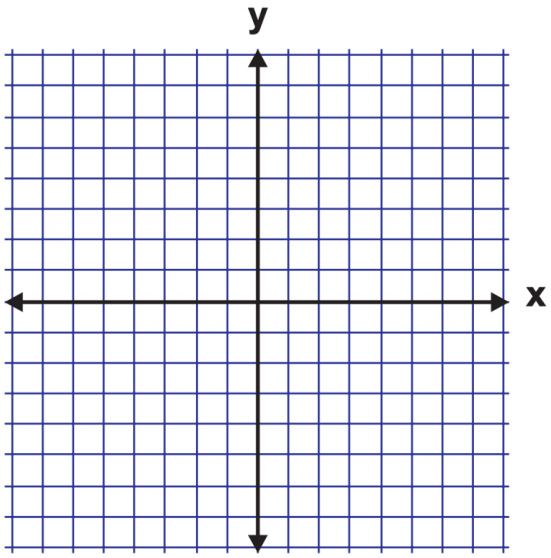
Answer _____

12. Graph the following relations or functions (only on this paper):

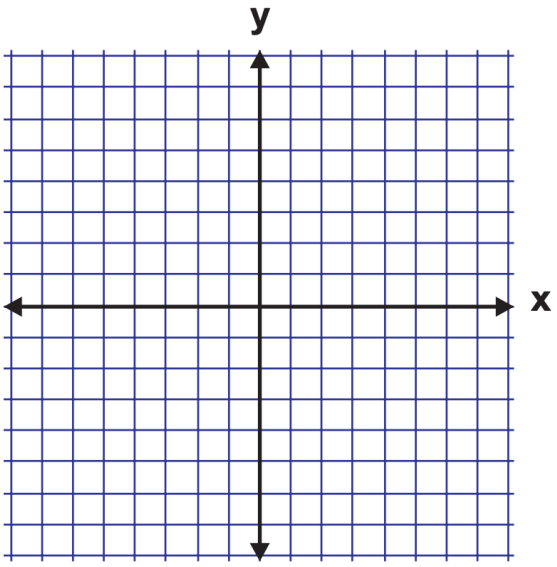
a. $\frac{(x-2)^2}{4} - \frac{(y-1)^2}{9} = 1$



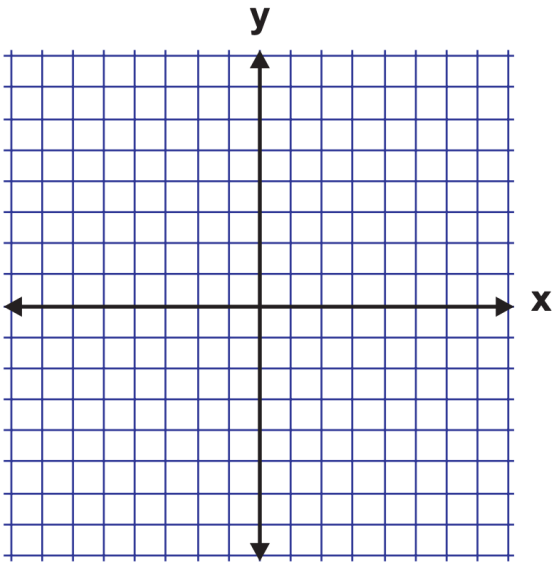
b. $\frac{(x+4)^2}{64} + \frac{(y-2)^2}{9} = 1$



c. $f(x) = \begin{cases} |x+1|, & \text{if } x \le 0 \\ \frac{x-1}{x-2}, & \text{if } 0 < x \le 3 \\ \log_2(x+1), & \text{if } x > 3 \end{cases}$



d. f(x) = |x – 2| - | x + 1|



13. If two points on a circle are (3,2) and (6,-1), and an equation of a line that goes through the center of this circle is y = 2x – 7, find an equation for the circle.

Answer _____

14. A hyperbola which is centered at the origin intersects the y axis at (0,2) and (0,-2). A point on the hyperbola has coordinates $(\frac{\sqrt{5}}{2},3)$. Find an equation for the hyperbola.

Answer _____

15. Find the *domain* of each of the following functions. Find the range only for (c) and (d).

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

Only Domains for (a) and (b)

(a) _____ (b) _____

(c) $g(x)=\dfrac{5x^2-5}{4x^2-1}$ (d) $f(x)=\dfrac{|x|}{x}$

Domain and Range for (c) and (d):

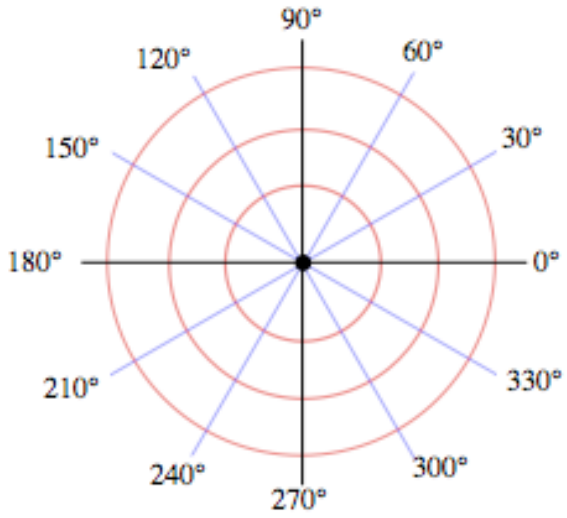
(c) _____ (d) _____

(e) $f(x)=\dfrac{\sqrt{x^2-5x+4}}{x^2-4x}$ (f) $g(x)=\log\left(\dfrac{2x-3}{x^2-3x+2}\right)$ Only domain for (e) and (f)

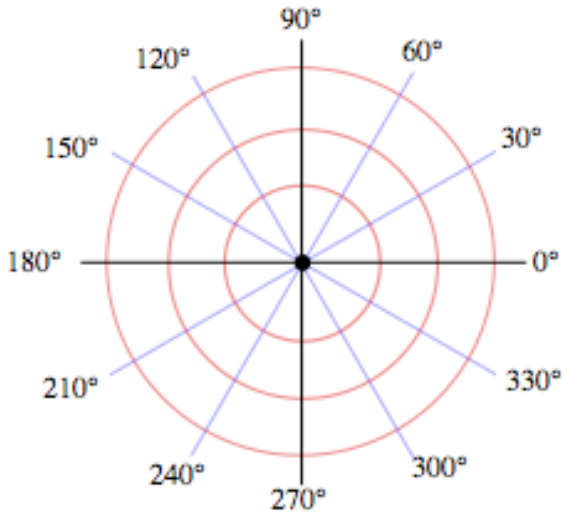
(e) _____ (f) _____

16. Graph the following functions given in polar coordinate system (use the symmetry):

(a) r = -2 + 3cos θ



(b) r = 3 + 2sin(2 θ)



17. Find inverses for the following functions:

$(a)\ f(x) = x^2 + 2x - 1, x > 0$

(b) $g(x) = \frac{x+2}{5x-1}$

(a) _____

(b) _____

18. Write the partial fraction decomposition:

(a) $\dfrac{x+3}{(x-2)(x-1)(x+1)}$

(b) $\dfrac{x}{(x^2+9)(x+1)}$

(a) _____

(b) _____

(c) $\dfrac{x^3+2x^2-x+1}{x^2+3x-4}$

(d) $\dfrac{2x^4+8x^3+7x^2-7x-12}{x^3+4x^2+4x}$

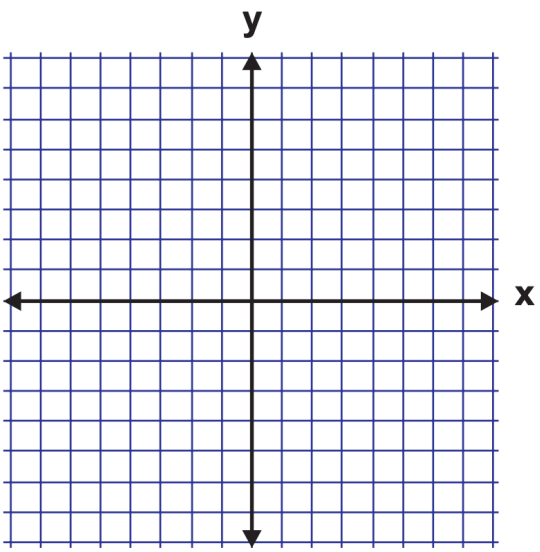
(c) _____

(d) _____

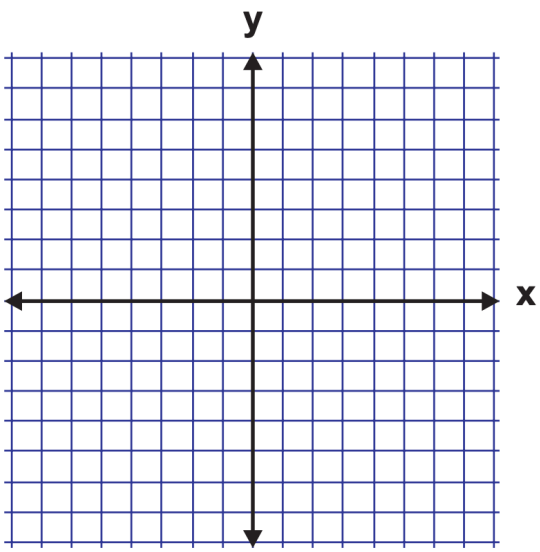
The functions in #19 and #20, are given parametrically.

(a) Eliminate the parameter and represent the functions in terms of x and y only. (Answers must be given below).
(b) Graph the functions in this paper only!

19. $x = 3 + 2\cos(t)$, $y = 1 - 3\sin(2)$; $0 \le t \le \pi$



20. $x = 2t$; $y = t^2 - t - 1$; $-2 < t < 3$



Answers for the functions with the eliminated parameters

19. _____

20. _____

21. Evaluate the following expressions, describing the series and showing your work when evaluating: $(a)\ \sum_{n=1}^{23}(4n-1)$ (b) $\sum_{n=3}^{8} 2(-4)^{n-2}$

(a) _____ (b) _____

(c) $\sum_{n=3}^{\infty} 2(-4)^{n-2}$ (d) $\sum_{n=2}^{\infty} 2(-0.4)^{n-2}$

(c) _____ (d) _____

Have a great and meaningful summer!!!