Notre Dame High School

220 Jefferson Street
Fairfield, CT 06825
June, 2022

Dear Parent(s)/Guardian(s) and Incoming Calculus Students,

Many students find first-year calculus difficult. The main reason is that in mathematics, as in music or athletics, the development of knowledge and skill is cumulative: what you learn next depends heavily on retention of what you learned before. Facility with basic algebra is very important, as is ability to combine techniques from several areas. It is easy to fall behind and difficult to catch up, especially if your skills have diminished over the summer.

In an effort to get you ready for the upcoming year in AP, we suggest you keep up your mathematical knowledge and skills during the summer. The problems cover the parts of the high school curriculum most essential as background for calculus. Many problems are challenging: it will take some time to work through the complete set, but do not become discouraged if you have difficulty with some of them.   You should consider working with friends in small groups.   Calculus students you are being asked to complete this math packet and have it ready to hand in on Friday, September 2, 2022. Many of the concepts that we will encounter this year requires students to have a good understanding of Algebra. We will be building on prior concepts this year. All Calculus students are required to complete the enclosed Summer 2022 Math packet.

All students in Calculus are required to have a TI-84, TI-84 CX or TI-nspire CX calculator. A graphing calculator is a necessary tool for many high school and college math classes. If a student has another brand of graphing calculator that will also be acceptable but the teachers of the Mathematics Department are most familiar with the Texas Instrument calculators and we have the emulators for the Smart Board for these calculators. In the month of August Target runs a sale on TI-84 calculators and they are even cheaper than getting them on Amazon. The TI-84 CX is the most recent TI-84 calculator.
<u>Summer Packet Guidelines:</u>

Calculators may be used to solve problems.
- All work must be done in pencil and shown under each problem.
- Summer packets for Calculus are due Friday, September 2nd, 2022
- After reviewing packets, the teachers of the class will know which preliminary skills need to be reviewed with the students.

The teachers of the Mathematics Department are available after school for extra help. I encourage all students to take advantage of working with their own teacher so the teacher can fully assess their knowledge of mathematics.

Please feel free to email me with any concerns or questions over the summer. I will be doing day trips during the summer but will get back to you within a few days of your email. You may reach me at: szembrzuski@notredame.org   In the subject area indicate if it is a Calculus question.

Sherrie Zembrzuski
Math Department Chairperson

SUMMER MATH PACKET
NOTRE DAME HIGH SCHOOL
CALCULUS

The examples on the following pages are to be completed and handed into your teacher on Friday, September 2nd, 2022. This will aid the teachers of these classes to give focus to mathematical concepts that will be necessary for this class.

Name_____

1. Determine the equation of the line passing through each pair of points in Slope-Intercept Form. Show all work.

    a.) $(3, 9)$ and $(1, 15)$ b.) $(2, -8)$ and $(7, 2)$

2. Write the equation of the perpendicular line to each line from the previous problem in Slope-Intercept Form.

    a.) $(3, 9)$ and $(1, 15)$ b.) $(2, -8)$ and $(7, 2)$

3. Factor each expression completely. Show all work.

    a.) $x^3 + 12x^2 + 32x$ b.) $x^6 - 16x^4$

    c.) $8x^3 + 27$ d.) $4x^3 - 8x^2 - 25x + 50$

4. Determine the roots of each polynomial expression. Show all work.

a.) $4x^3 - 20x^2 - 144x = 0$ b.) $x^3 - 9x^2 - 4x + 36 = 0$

5. Simplify each of the following expressions. Show all work.

a.) $\dfrac{x^3-9x}{x^2-7x+12}$

b.) $\dfrac{x^2-2x-8}{x^3+x^2-2x}$

c.) $\dfrac{\frac{1}{x}-\frac{1}{5}}{\frac{1}{x^2}-\frac{1}{25}}$

d.) $\dfrac{9-\frac{1}{x^2}}{3-\frac{1}{x}}$

6. Rationalize the denominator in each expression below. Show all work.

a.) $\dfrac{4}{1-\sqrt{5}}$

b.) $\dfrac{2}{\sqrt{3}+\sqrt{2}}$

7. Simplify each expression into the form $ax^b y^c$ where $a, b,$ and c are real numbers. Show all work.

a.) $\dfrac{\left(4x^3y^5\right)^2}{2x^3y^2}$

b.) $(-5x^7y^8)^3$

c.) $(64x^{18}y^{12})^{-1/2}$

d.) $\sqrt[3]{(2x^9y^6)^4}$

8. Solve for x in each equation below. Express your answers in exact form (no decimals) and show all work.

a.) $5^{x-3} + 2 = 127$

b.) $3(9)^{4x} = 243$

c.) $e^{-5x} = 10$

d.) $9e^{x+5} = 72$

e.) $\log_2(x - 4) = 3$

f.) $\log_3(-6x) = \frac{1}{81}$

g.) $\ln(x) + 8 = 23$

h.) $2\ln(x - 3) = 40$

9. Simplify each expression using properties of logarithms. Show all work.

a.) $\log(5) + \log(x^2 + 1) - \log(x - 1)$

b.) $2\log_5(x - 3) - \log_5(x + 3)$

10. Determine the domain of each function shown below. Show all work.

a.) $f(x) = \frac{x-5}{\sqrt{x^2-x-2}}$

b.) $g(x) = \frac{5x+3}{2x-1}$

11. Evaluate each trigonometric expression without a calculator. Rewrite each expression in terms of sine or cosine then express your final answers in exact form (no decimals).

a.) $\sin(\frac{\pi}{4})$

b.) $\cos(\frac{2\pi}{3})$

c.) $\tan(\frac{\pi}{2})$

d.) $\csc(\frac{5\pi}{6})$

e.) $\sec(\pi)$

f.) $\cot(\frac{3\pi}{2})$

12. Solve each equation below. Express your answers in simplest radical form and show all work.

a.) $4x^2 + 12x + 3 = 0$

b.) $2x + 1 = \frac{5}{x+2}$

c.) $5x^{-2} - 45 = 0$

d.) $-4x^{\frac{3}{2}} + 36 = 4$

13. Identify each conic below and rewrite the expressions in Standard Form. Show all work.

a.) $x^2 + 4x + y^2 + 4y = 28$

b.) $-x^2 + 8y^2 + 16y + 8x - 80 = 0$

14. Simplify the difference quotient $\frac{f(x+h)-f(x)}{h}$ for each function below. Show all work.

a.) $f(x) = \frac{1}{x+2}$

b.) $g(x) = x^2 + 5x$

15. Determine the inverse of each function below then sketch the original function and its inverse on the provided planes. Show all work.

a.) $f(x) = \frac{3}{4}x - 6$

b.) $g(x) = 2x^3 + 8$