Math 141 Exam 1 Review Problems
Spring 2019-UOWD

Problem 1 Find the following limits

1. $\lim\limits_{x\to 4} \dfrac{x^2-16}{x^2+x-20}$ 2. $\lim\limits_{x\to 9} \dfrac{9-x}{3-\sqrt{x}}$ 3. $\lim\limits_{x\to 0^+} \left[\dfrac{1}{x} - \dfrac{1}{|x|}\right]$ 4. $\lim\limits_{x\to -\infty} \dfrac{x}{\sqrt{x^2+1}}$

Problem 2
Find the value (s) of a that makes the function

$$f(x) = \begin{cases} a-x, & \text{if } x \le -1 \\ x+1 & \text{if } x > -1 \end{cases}$$

continuous at $x=-1$.

Problem 3
Sketch the graph of a function f that satisfies the following conditions
1. $f(0)=0$
2. $\lim\limits_{x\to -\infty} f(x) = 1$
3. f has a jump discontinuity at $x=-1$
4. $\lim\limits_{x\to 0^-} f(x) = -\infty$
5. $\lim\limits_{x\to 0^+} f(x) = \infty$
6. f has a removable discontinuity at $x=2$
7. $\lim\limits_{x\to \infty} f(x) = 0$

Problem 4
A) Find an equation for the tangent line to the graph of $f(x)=\ln(x+2)$ at $x=0$.
B) Find the slope of the normal line to the graph of

$$x^2y + y^2 = 6$$

at the point $(\sqrt{5},1)$.

Problem 5

Find $\dfrac{dy}{dx}$ if

1. $y=e^{x\ln x}$ 2. $y=\log_2 \sqrt[3]{x+1}$ 3. $y=\cos^2(2x)$ 4. $y=\dfrac{x-2}{x+2}$

Problem 6

Sand is falling into a conical pile so that the radius of the base of the pile is always equal to one-half of its altitude. If the sand is falling at a rate of 10 cubic feet per minute, how fast is the altitude of the pile increasing when the pile is 4 feet deep? $V = \frac{1}{3}\pi r^2 h$.

Problem 7

Find the intervals on which

$$f(x) = 4x^3 - 15x^2 - 18x + 10$$

increases and the intervals on which f decreases.

Problem 8

Find the critical numbers and the local extreme values of

$$f(x) = x^{2/3}(5 - x).$$

Problem 9

If 1200 m^2 of material is used to construct a rectangular box with a square base and an open top. Find the largest possible volume of the box.