BRAC UNIVERSITY

Inspiring Excellence

Department of Mathematics and Natural Sciences

MAT 110

ASSIGNMENT 2

SUMMER (2021)

1. Find an expression for the derivative $\frac{dy}{dx}$ of the parametric function: $x = te^{2t} + \ln(t^2)$ and $y = t^2e^t$ and evaluate it at $t = 1$. Express your answer in terms of e.

2. Use logarithmic differentiation to find an expression for the derivative $\frac{dy}{dx}$ of

$$y = \frac{e^{-x}(\cos x)^2}{x^2 + x + 1}$$

3. Using Leibniz product rule, find an expression for the 5th derivative of the function

$$y = (x^2 + 3x)\cosh(x)$$

and evaluate it at $x = 0$.

4. Find an expression for the first derivative of the function

$$y = \sqrt{e^{\arcsin(x+1)}}$$

5. Let $f(x) = x^2 + 3$. Find an expression for the linear approximation for $f(x)$ at $x_0 = 2$ and use it to find an approximation when $x = 2.2$.

6. A cuboid with an open top was made using a metal sheet. The volume of the cuboid is $4000cm^3$. The base of the cuboid measures x cm by $2x$ cm and it has a height of h cm.
Using the expressions for the volume and surface area of the cuboid, find its minimum possible surface area. Show that the value you obtained is in fact a minimum value.

7. American Airlines requires that the total outside dimensions (length+width+height) of a checked bag not exceed 62 inches. Suppose you want to check a bag whose height is same as its width. What is the largest volume bag of this shape that you can check on an American Air Flight?

8. Find 2nd derivative$(\frac{d^2y}{dx^2})$ of $\tan y = \frac{x-1}{x+1}$ in terms of x.

9. Find the equation of the tangent line to the graph of $y = \ln(x^2+4) - x\arctan(\frac{x}{2})$ at $x = 2$.

10. If $y = (\sin x)^{\cos x} + (\cos x)^{\sin x} - 5x$, find $\frac{dy}{dx}$.

11. Let $f(x) = x + 2\sin x$ over the interval $[0, 2\pi]$. Use the first and second derivatives of f to determine where f is increasing, decreasing, concave up, and concave down. Locate all inflection points,if they exist.

12. Find the relative extrema of $f(x) = 3x^5 - 5x^3$.