

## CS 556 Assignment 6 - Derivatives

Solve the following questions. Type your solutions using L<sup>A</sup>T<sub>E</sub>X and submit your typed solutions as a PDF file.

**Question 1** (20 points) Use the limit definition of the derivative to exactly evaluate the derivative -

1.  $f(x) = \sqrt{x+4}$

2.  $f(x) = \frac{3}{x}$

**Question 2** (20 points) Find the derivatives of the following functions -

1.  $f(x) = 3x^3 - \frac{4}{x^2}$

2.  $f(x) = (4 - x^2)^3$

3.  $f(x) = e^{\sin(x)}$

4.  $f(x) = \ln(x+2)$

5.  $f(x) = x^2 \cos(x) + x \tan(x)$

6.  $f(x) = \sqrt{3x^2 + 2}$

7.  $f(x) = \frac{x}{4} \sin^{-1}(x)$

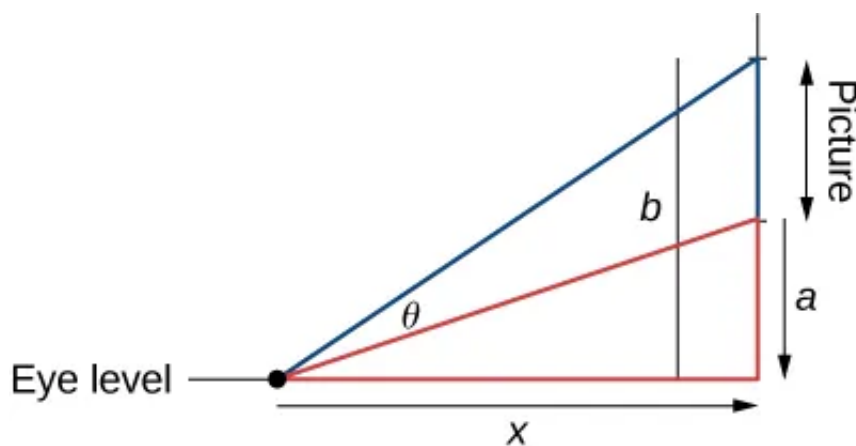
8.  $x^2y = (y+2) + xy \sin(x)$

**Question 3** (20 points) The following questions consider the wind speeds of Hurricane Katrina, which affected New Orleans, Louisiana, in August 2005. The data are displayed in a table.

Hours After Midnight, August 26	Wind Speed (mph)
1	45
5	75
11	100
29	115
49	145
58	175
73	155
81	125
85	95
107	35

- a) Using the table, estimate the derivative of the wind speed at hour 39. What is the physical meaning?
- b) Estimate the derivative of the wind speed at hour 83. What is the physical meaning?

**Question 4** (20 points) The famous Regiomontanus' problem for angle maximization was proposed during the 15th century. A painting hangs on a wall with the bottom of the painting a distance  $a$  feet above eye level, and the top  $b$  feet above eye level. What distance  $x$  (in feet) from the wall should the viewer stand to maximize the angle subtended by the painting,  $\theta$ ?



**Question 5** (20 points) An airline sells tickets from Tokyo to Detroit for \$1200. There are 500 seats available and a typical flight books 350 seats. For every \$10 decrease in price, the airline observes an additional five seats sold. What should the fare be to maximize profit? How many passengers would be onboard?