ACMAT161 Summer 2024
Professor Manguba-Glover
Classwork 9 & 10 Name: _____

Complete as many of the following problems as you can with your table in the allotted time. You do not have to go in order.

Classwork 9

1. Find the first and second derivative of the following functions:
   (a) $f(x) = -x^2 + 3$
   (b) $f(x) = \frac{x^3}{3} + \frac{x^2}{2} + \frac{x}{4}$
   (c) $r(\theta) = \frac{2}{\theta} - \frac{3}{\theta^3} + \frac{1}{\theta^4}$

2. Find the derivatives of the following:
   (a) $f(x) = \frac{4x-2}{2x^2}$
   (b) $f(x) = (x^2+1)\left(x + 5 + \frac{1}{x}\right)$
   (c) $y = \frac{2x+5}{2x-2}$
   (d) $y = \frac{5x+1}{2\sqrt{x}}$
   (e) $y = (x-1)(x^2+x+1)$

3. Let $f(x) = 2x^3 - 15x^2 + 24x$. For what values of x does the line tangent to the graph of f have a slope of 6?

Key:

1. (a) $-2x$, -2
   (b) $x^2 + x + \frac{1}{4}$, $2x + 1$
   (c) $-2\theta^{-2} + 9\theta^{-4} - 4\theta^{-5}$, $4\theta^{-3} - 36\theta^{-5} + 20\theta^{-6}$
2. (a) $\frac{2-2x}{x^3}$
   (b) $3x^2 + 10x - \frac{1}{x^2} + 2$
   (c) $-\frac{19}{(3x-2)^2}$
   (d) $\frac{5x-1}{4x^{3/2}}$
   (e) $3x^2$
3. $x = \frac{5 \pm \sqrt{13}}{2}$

Classwork 10

1. Find the derivative of the following:

   (a) $y = e^{-x}$

   (b) $f(x) = \sqrt[3]{x}e^x$

   (c) $y = e^x \cos x$

   (d) $y = \sin x - x\cos x$

   (e) $y = \sec x \csc x$

   (f) $y = \frac{1+\sin x}{1-\sin x}$

   (g) $\frac{4xe^x}{x^2+1}$

   (h) $3e^x + 10x^3 \ln x$

2. Write an equation of the line tangent to the graph of $f(x) = 2x - \frac{e^x}{2}$ at $\left(0, -\frac{1}{2}\right)$

3. Find the second derivative of $y = \csc x$

4. Find the second derivative of $y = 3^x$

Key:

1. (a) $-e^{-x}$
   (b) $\frac{e^x(1+3x)}{3x^{2/3}}$
   (c) $e^x(\cos x - \sin x)$
   (d) $x\sin x$
   (e) $\sec^2 x - \csc^2 x$
   (f) $\frac{2\cos x}{(1-\sin x)^2}$
   (g) $\frac{4e^x(x^3-x^2+x+1)}{(x^2+1)^2}$
   (h) $3e^x + 30x^2 \ln x + 10x^2$
2. $y + \frac{1}{2} = \frac{3}{2}x$ or $y = \frac{3}{2}x - \frac{1}{2}$
3. $\csc x(\cot^2 x + \csc^2 x)$
4. $(\ln 3)^2 3^x$