MTH 151
Exam 2, Form A
Fall 2022

Show all work in a neat and organized fashion. Clearly indicate your answers.
100 points possible.

Formulas and unit circle are on the last page, which you may pull off.

Graphing calculator OK but not one with CAS (e.g., no TI-89, no TInspire).

1. (20 pts.) Differentiate the function. (You don't have to simplify your answers.)

(a) $f(x) = \dfrac{1}{x^3} + \dfrac{1}{x^6}$

(b) $y = 8x + \sqrt{x}$

(c) $g(x) = \sec x \tan x$

2. (20 pts.) Find the derivative of the function. (You don't have to simplify your answers.)

(a) $h(x) = \dfrac{\sin x}{1 + \cos x}$

(b) $g(x) = \left(\dfrac{x^4 - 1}{x^4 + 1}\right)^5$

(c) $y = \tan^4(\sin x)$

3. (10 pts.) Find the derivative of the function f "the long way," using the definition of derivative.

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

Neatly show all important algebraic steps to justify your answer.

$$f(x) = \frac{1}{x-5}$$

4. (10 pts.) Find an equation of the tangent line to the curve at the given point.

$$y = \frac{3x}{x+1}, \qquad (1, \tfrac{3}{2})$$

5. (10 pts.) Find the amplitude, period, and horizontal shift of the function, and graph one complete period.

$$y = 4\sin\pi(x + \tfrac{1}{2})$$

6. (10 pts.) A table of values for f, g, f', and g' is given.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
1	4	1	4	11
2	2	3	5	7
3	3	2	13	9
4	1	4	10	20

(a) If $h(x) = f(g(x))$, find $h'(3)$.

(b) If $H(x) = g(f(x))$, find $H'(4)$.

7. (10 pts.) Find dy/dx by implicit differentiation. (You have to solve for dy/dx but you don't have to simplify your answer.)

$$6x^3 + x^2y - y^3 = 8$$

8. (10 pts.) A particle moves according to a law of motion $s = f(t)$, $t \geq 0$, where t is measured in seconds and s in feet.

$$f(t) = t^3 - 12t^2 + 21t$$

(a) Find the velocity at time t.

(b) What is the velocity after 3 seconds?

(c) When is the particle at rest?

(d) When is the particle moving in the positive direction.

(e) Find the acceleration at time t and after 3 seconds.

MTH 151
Exam 2, Form B
Fall 2022

Show all work in a neat and organized fashion. Clearly indicate your answers.
100 points possible.

Formulas and unit circle are on the last page, which you may pull off.

Graphing calculator OK but not one with CAS (e.g., no TI-89, no TInspire).

1. (20 pts.) Differentiate the function. (You don't have to simplify your answers.)

(a) $f(x) = \dfrac{1}{x^4} + \dfrac{1}{x^5}$

(b) $y = 9x + \sqrt{x}$

(c) $g(x) = \sec x \tan x$

2. (20 pts.) Find the derivative of the function. (You don't have to simplify your answers.)

(a) $h(x) = \dfrac{\sin x}{1 + \cos x}$

(b) $g(x) = \left(\dfrac{x^6 - 1}{x^6 + 1}\right)^3$

(c) $y = \tan^4(\sin x)$

3. (10 pts.) Find the derivative of the function f "the long way," using the definition of derivative.

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

Neatly show all important algebraic steps to justify your answer.

$$f(x) = \frac{1}{x-3}$$

4. (10 pts.) Find an equation of the tangent line to the curve at the given point.

$$y = \frac{5x}{x+1}, \qquad (1, \tfrac{5}{2})$$

5. (10 pts.) Find the amplitude, period, and horizontal shift of the function, and graph one complete period.

$$y = 6 \sin \pi(x + \tfrac{1}{2})$$

6. (10 pts.) A table of values for f, g, f', and g' is given.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
1	4	1	4	11
2	2	3	5	7
3	3	2	13	9
4	1	4	10	20

(a) If $h(x) = f(g(x))$, find $h'(2)$.

(b) If $H(x) = g(f(x))$, find $H'(1)$.

7. (10 pts.) Find dy/dx by implicit differentiation. (You have to solve for dy/dx but you don't have to simplify your answer.)

$$4x^3 + x^2y - y^3 = 8$$

8. (10 pts.) A particle moves according to a law of motion $s = f(t)$, $t \geq 0$, where t is measured in seconds and s in feet.

$$f(t) = t^3 - 18t^2 + 33t$$

(a) Find the velocity at time t.

(b) What is the velocity after 3 seconds?

(c) When is the particle at rest?

(d) When is the particle moving in the positive direction.

(e) Find the acceleration at time t and after 3 seconds.