MATH 192

CALCULUS I * FALL, 2025 *

Tue, Sep 9

HW

A.
1. **Linear Inequalities**
2. **Interval Notation**
3. **Quadratic Inequalities**
4. **Lines: Point-Slope**
5. **Domain**

B. ONLINE PRACTICE

Ch 1 – ALL

Ch 2 – #1, #2

Note: For many Online Practice problems, a number in brackets in the problem box indicates the number of variations in that problem. For example, in Ch 2, problem #2, the ***[4]*** means there are 4 different functions to be studied.

C. Know the **branch-function definition** of absolute value:

$$|x| = \begin{cases} _____ & if _____ \\ _____ & if _____ \end{cases}$$

D. Review the class discussion regarding square roots and absolute values.

Thu, Sep 11

Quiz #1 ✓

HW

A.

1. **Linear Inequalities**
2. **Interval Notation**
3. **Quadratic Inequalities**
4. **Lines: Point-Slope**
5. **Domain**

B. ONLINE PRACTICE

Ch 2 – #3, #4
Ch 3 – #2, #3, #4
Ch 4 – ALL
Ch 5 – #1, #2
Ch 6 – #1, #2
Ch 7 – ALL

Tue, Sep 16

Quiz #2 ✓

HW

A. ONLINE PRACTICE

Ch 8 – #2, #3, #4, #5

B. Use the **definition** of the derivative $\left(\lim_{h \to 0} \ldots\right)$ to calculate $f'(x)$ for the given function f. Assume that a, b, c, d, and m represent constants.

1. $f(x) = c$ Ans: 0

2. $f(x) = mx + b$ Ans: m

3. $f(x) = ax^2 + bx + c$ Ans: $2ax + b$

4. $f(x) = ax^3 + bx^2 + cx + d$ Ans: $3ax^2 + 2bx + c$

5. $f(x) = \sqrt{mx + b}$ Ans: $\dfrac{m}{2\sqrt{mx + b}}$

6. $f(x) = \dfrac{1}{mx + b}$ Ans: $\dfrac{-m}{(mx + b)^2}$

   OR, $-\dfrac{m}{(mx + b)^2}$

Thu, Sep 18

Quiz #3 ✓

A. ONLINE PRACTICE

Ch 2 – #4

Ch 3 – #5

Ch 6 – #1, #2

Ch 7 – #1

Ch 9 – ALL

Ch 10 – #1 - #8

B. Click: **Quadratic Inequalities**

Tue, Sep 23

A. ONLINE PRACTICE

Ch 12 – ALL

B. Find the **derivative** of each function. Each problem involves the Chain Rule:

		ANSWERS
1.	$\sin^3 x$	$3\sin^2 x\cos x$
2.	$\cos^9 x$	$-9\cos^8 x\sin x$
3.	$\tan^{12} x$	$12\tan^{11}\sec^2 x$
4.	$\cot^4 x$	$-4\cot^3 x\csc^2 x$
5.	$\sec^{13} x$	$13\sec^{13} x\tan x$
6.	$\csc^{10} x$	$-10\csc^{10} x\cot x$
7.	$\sin(7x+9)$	$7\cos(7x+9)$
8.	$\cos(x^2+x)$	$-\sin(x^2+x)(2x+1)$
9.	$\tan(x^3)$	$3x^2\sec^2(x^3)$
10.	$\cot(x^4+\pi)$	$-4x^3\csc^2(x^4+\pi)$
11.	$\sec(x^3+x^2+x+1)$	$(3x^2+2x+1)[\sec(x^3+x^2+x+1)][\tan(x^3+x^2+x+1)]$
12.	$\csc(\pi x)$	$-\pi\csc(\pi x)\cot(\pi x)$

Thu, Sep 25 CLASS CANCELLED NO NEW HOMEWORK!!
Tue, Sep 30 Same HW as Tue, Sep 23

Thu, Oct 2

A. ONLINE PRACTICE

Ch 13 – ALL

Ch 14 – #1, #2, #5, #6

Ch 15 – #1, #3, #6, #7

Ch 16 – #1, #2, #3, #4

B. Find the **derivative** of each function:

1. $y = \sin^4(3x+1)$ $\quad 12\sin^3(3x+1)\cos(3x+1)$

2. $y = \cos^5(x^2-x)$ $\quad -5(2x-1)\cos^4(x^2-x)\sin(x^2-x)$

3. $y = \sqrt{\tan x}$ $\quad \dfrac{\sec^2 x}{2\sqrt{\tan x}}$

4. $y = \sqrt{\sin(4x-2)}$ $\quad \dfrac{2\cos(4x-2)}{\sqrt{\sin(4x-2)}}$

5. $y = \sec^4(x^3)$ $\quad 12x^2\sec^4(x^3)\tan(x^3)$

6. $y = \csc^{10}(\pi x)$ $\quad -10\pi\csc^{10}(\pi x)\cot(\pi x)$

7. $y = \sin(\tan x)$ $\quad \cos(\tan x)\sec^2 x$

8. $y = \cot(\sin 2x)$ $\quad -2\csc^2(\sin 2x)\cos 2x$

9. $y = \cos^3\left(\sin(x^2)\right)$ $\quad -6x\cos^2(\sin x^2)\sin\left(\sin x^2\right)\cos x^2$

10. $y = \dfrac{\sin x}{\cos x}$ $\quad \sec^2 x$

Tue, Oct 7

A. Thursday's HW again

B. Find the derivative of each function:

1. $y = x^2 + e^2 + e^{\pi x} - \ln\left(5x^2 + x\right)$ $\quad 2x + \pi e^{\pi x} - \dfrac{10x+1}{5x^2+x}$

2. $y = \ln(e^{3x})$ $\quad 3$

3. $y = \ln\left(x \ln x\right)$ $\quad \dfrac{1+\ln x}{x \ln x}$

4. $y = \left(\ln x\right)^{4e}$ $\quad \dfrac{4e(\ln x)^{4e-1}}{x}$

5. $y = \sin(\ln x)$ $\quad \dfrac{\cos(\ln x)}{x}$

6. $y = \ln(\tan x)$ $\quad \dfrac{\sec^2 x}{\tan x}$

7. $y = \sqrt[3]{\dfrac{x}{\ln x}}$ $\quad \dfrac{\ln x - 1}{3\left(\sqrt[3]{\dfrac{x}{\ln x}}\right)^2 (\ln x)^2}$

C. Find the **equation** of the tangent line to the given curve at the given x–value:

1. $y = e^{3x} \quad x = 2$ $\quad y - e^6 = 3e^6(x-2)$

2. $y = \ln(2x+5) \quad x = 0$ $\quad y - \ln 5 = \dfrac{2}{5}x$

D. For each position function, calculate the **velocity** and **acceleration** at the given time value:

1. $s(t) = t + t^4 \quad t = 4$ $\quad 1 + e^4;\ \ e^4$

2. $s(t) = \ln(t^2) \quad t = 3$ $\quad \dfrac{2}{3};\ \ -\dfrac{2}{9}$

Thu, Oct 16

A. Use **L'Hôpital's Rule** to verify each limit:

1. $\lim_{x\to 0} \frac{\sin x}{x} = 1$
2. $\lim_{x\to 0} \frac{1-\cos x}{x^2} = \frac{1}{2}$
3. $\lim_{x\to 0} \frac{\tan x - x}{x^3} = \frac{1}{3}$
4. $\lim_{x\to 0} \frac{e^x - 1}{x} = 1$
5. $\lim_{x\to 0} \frac{\ln(1+x)}{x} = 1$
6. $\lim_{x\to 1} \frac{x^3-1}{x-1} = 3$

8. $\lim_{x\to 0} \frac{\sqrt{1+x}-1}{x} = \frac{1}{2}$
9. $\lim_{x\to 2} \frac{x^2-4}{x-2} = 4$

11. $\lim_{x\to\infty} \frac{x}{e^x} = 0$
12. $\lim_{x\to\infty} \frac{\ln x}{x} = 0$
13. $\lim_{x\to\infty} \frac{x^2+3x}{2x^2+5} = \frac{1}{2}$
14. $\lim_{x\to\infty} \frac{x^3}{e^x} = 0$
15. $\lim_{x\to\infty} \frac{\sqrt{x}}{\ln x} = \infty$
16. $\lim_{x\to\infty} \frac{\ln(x^2+1)}{x} = 0$
17. $\lim_{x\to\infty} \frac{e^x}{x^2} = \infty$
18. $\lim_{x\to\infty} \frac{x}{\ln x} = \infty$
19. $\lim_{x\to\infty} \frac{\ln(\ln x)}{\ln x} = 0$
20. $\lim_{x\to\infty} \frac{\ln x}{\sqrt{x}} = 0$

B. **Trigonometry** (to the left of the Calculus I button)

Online Practice **–Chapters 7, 23, 27, 28**

C. **ONLINE PRACTICE**

Ch 13 – ALL
Ch 17 – ALL

Tue, Oct 21

Quiz #8 ✓

A. Trigonometry

Online Practice **–Chapters 7, 23, 27, 28**

B. Intermediate Value Theorem

Let $f(x) = x^2 - 6x - 16$

A. Calculate: $f(6)$ _____

B. Calculate: $f(11)$ _____

C. Conclusion: There a number c such that c is _____ 6 and 11, and such that _____.

D. Find the value of c. [NO calculus needed.]

C.

Use **L'Hôpital's Rule** to calculate each limit. Try to check your answers using A.I.

1. $\lim_{x \to \infty} x \sin \frac{\pi}{x}$

2. $\lim_{x \to \infty} x^3 e^{-x^2}$

3. $\lim_{x \to 1^+} \ln x \tan \frac{\pi x}{2}$

D.

Perform a complete analysis for each function, culminating in your best effort in a graph. Consider domain, intercepts, asymptotes, inc/dec, extreme points, concavity and inflection points.

1. $y = x^{\frac{3}{2}}$

2. $y = x^{\frac{1}{3}}$

3. $y = x^4 - 2x^3$

4. $y = \frac{6x}{e^x}$

5. $y = e^{-x^2}$

Thu, Oct 23

Quiz #9 ✓

A. Trigonometry

Online Practice **–Chapters 28, 38**

B. Mean Value Theorem (MVT)

1. Let a and b be real numbers with a ___ b. Let f be a function which has a derivative everywhere on the interval _____. Then there exists a number $\boldsymbol{c}$ in $[a, b]$ such that

_____

2. For each function and interval, find the value of c guaranteed by the MVT:

a. $f(x) = \sqrt{x}$ on $[1, 9]$

b. $y = \ln x$ on $[1, e^3]$

c. $g(x) = \sin x$ on $[0, \pi]$ [Use a calculator in radian mode]

C. Use **L'Hôpital's Rule** (if appropriate) to calculate each limit. Try to check your answers using A.I.

1. $\lim_{x \to 0} \left(\frac{1}{x} - \frac{\cos 3x}{x} \right)$

2. $\lim_{x \to 0} \left(\csc x - \cot x \right)$

3. $\lim_{x \to 1^+} \left(\frac{1}{x^2 - 1} - \frac{1}{x - 1} \right)$ Why the limit from the right?

[CONTINUED]

D. Perform a complete analysis for each function, culminating in your best effort in a graph. Consider domain, intercepts, asymptotes, increasing/decreasing, extreme points, concavity and inflection points.

1. $y = x^{\frac{3}{2}}$

2. $y = x^{\frac{1}{3}}$

3. $y = x^4 - 2x^3$

4. $y = \dfrac{6x}{e^x}$

5. $y = e^{-x^2}$

6. $y = \dfrac{2x+6}{x-4}$

7. $y = 4xe^x$

8. $y = \dfrac{6}{1+x^2}$

E. Find the <u>equation of the tangent line</u> to the curve $y = x^2 + \sin x$ at the point where $x = 2$. NO Calculator.

Tue, Oct 28

Quiz #10 ✓

A. [SAME FUNCTIONS AS BEFORE] Perform a complete analysis for each function, culminating in your best effort in a graph. Consider domain, intercepts, asymptotes, increasing/decreasing, extreme points, concavity and inflection points.

1. $y = x^{\frac{3}{2}}$

2. $y = x^{\frac{1}{3}}$

3. $y = x^4 - 2x^3$

4. $y = \dfrac{6x}{e^x}$

5. $y = e^{-x^2}$

6. $y = \dfrac{2x+6}{x-4}$

7. $y = 4xe^x$

8. $y = \dfrac{6}{1+x^2}$

B. Use Tangent Lines to approximate each of the following – you can somewhat check your answer using your calculator:

1. $\sqrt{80}$
2. $\sqrt[3]{28}$
3. $\sqrt[5]{31.8}$
4. $\sin\frac{\pi}{7}$
5. $e^{0.1}$
6. $\ln 0.9$

Thu, Oct 30

A. Online Practice

Ch 18 – ALL
Ch 19 – ALL
Ch 20 – #1, #2

A 3 × 5 index card will be allowed for the next quiz.

B. Find y':

1. $y = \sin^{-1}(x^2)$
2. $\cos^{-1}(e^{3x})$
3. $\tan^{-1}(\ln x)$
4. $y = \dfrac{x^2}{\arcsin x}$
5. $y = x^3 \arccos x$
6. $y = \arctan(e^{x^2})$

C. Find $\dfrac{dy}{dx}$:

1. $y = \log x^2$
2. $y = 2^{x^3}$
3. $y = e^x \log_2 x^3$
4. $y = \sin 5^x$
5. $y = 3^{\sin x}$
6. $y = e^{\log x^2}$

Thu, Nov 6

A 3 × 5 index card will be allowed for the next quiz.

A. **Online Practice**

Chapter 20 – #3, #4, #5

B. Derive the **derivatives** of the three inverse trig functions.

C. **Newton's Method – Calculate x_2 for each problem:**

1. Find an x-intercept of $y = e^x - x - 4$ $\quad x_0 = 2$
2. Find an x-intercept of $y = \sin x + 2x - 3$ $\quad x_0 = 1$
3. Solve for x: $e^{2x} = 4$ $\quad x_0 = 1$
4. Solve for x: $\ln x + 3x = 0$ $\quad x_0 = 1$

D. **L'Hopital:**

1. $\lim\limits_{x \to 0^+} (1 + \sin x)^{\frac{1}{x}}$
2. $\lim\limits_{x \to 0^+} (1 + x^3)^{\frac{1}{x}}$
3. $\lim\limits_{x \to 0^+} x^{\sin x}$
4. $\lim\limits_{x \to 0^+} (x + x^2)^x$

Tue, Nov 18

A. **Online Practice** - Ch 21

B. Find each **antiderivative**. You know how to check your answers, and you might try A.I. to check. DON'T FORGET THE CONSTANT OF INTEGRATION!

1. $\int e^{5x}dx$
2. $\int \frac{3}{x}dx$
3. $\int \sqrt[4]{x^5}dx$
4. $\int \cos\theta\, d\theta$
5. $\int \pi \sin x\, dx$
6. $\int \sqrt{2}\sec^2 x\, dx$
7. $\int \csc^2\theta\, d\theta$
8. $\int \sec x \tan x\, dx$
9. $\int \csc\theta \cot\theta\, dx$
10. $\int (1+x+x^2+x^3+x^4)\, dx$
11. $\int (3x+4)^2\, dx$
12. $\int \frac{7}{1+x^2}dx$
13. $\int \frac{dx}{\sqrt{1-x^2}}$
14. $\int \left(\frac{2}{5x}-\frac{3}{x^2}\right)dx$
15. $\int (7e^t - e^3)\, dt$
16. $\int (\sin^2\theta + \cos^2\theta)\, d\theta$

Thu, Nov 20

1. $\int xe^{-2x^2}\,dx$

2. $\int (\cos^{12} x \sin x)\,dx$

3. $\int \sqrt{3r-5}\,dr$

4. $\int \csc 3\theta \cot 3\theta\, d\theta$

5. $\int \frac{x^5 - x^4 + x^3 - x^2 + x - 1}{2x}\,dx$

6. $\int \frac{x}{1+x^2}\,dx$

7. $\int \frac{dt}{1+t^2}$

8. $\int \frac{3x}{1+x^2}\,dx$

9. $\int \frac{dx}{1+49x^2}$

10. $\int \frac{dx}{\sqrt{1-x^2}}$

11. $\int \frac{dx}{\sqrt{1-9x^2}}$

12. $\int \frac{\cos\theta}{\sin\theta}\,d\theta$

Verify each definite integral:

13. $\int_0^1 (1-x)\,dx = \frac{1}{2}$

14. $\int_{-1}^1 e^x\,dx = \frac{e^2-1}{e}$

15. $\int_1^3 \frac{1}{x^2}\,dx = \frac{2}{3}$

16. $\int_0^3 (x+2x^2)\,dx = \frac{45}{2}$

17. $\int_{\pi/4}^{\pi/3} \sec x \tan x\,dx = 2-\sqrt{2}$

18. $\int_1^3 \frac{1}{x}\,dx = \ln 3$

19. $\int_0^{\pi} (\cos x - \sin x)\,dx = -2$

20. $\int_0^{\pi/4} \frac{\sin\theta}{\cos\theta}\,d\theta = -\ln\frac{\sqrt{2}}{2}$

21. Show that the answer to #20 can be simplified to $\frac{1}{2}\ln 2$.

Tue, Dec 2

1. Review and finish the lecture examples.

Find the area of the region bounded by the given curves:

2. $y = x^2$ $y = 4$ use a vertical element Ans. $\frac{32}{3}$

3. $x = y^2$ $x = 4$ use a horizontal element Ans. $\frac{32}{3}$

4. $y = x$ $y = x^2$ Ans. $\frac{1}{6}$

5. $y = e^x$ $y = 1$ $x = 0$ $x = 2$ Ans. $e^2 - 3$

6. $x = y^2$ $y = x - 2$ Ans. $\frac{9}{2}$

   Do this problem twice, once with a vertical element and then with a horizontal element.