MATH 1041 RECOMMENDED HOMEWORK PROBLEMS Fall 2024

Text: **James Stewart**, *Calculus, Early Transcendentals*, **9th** Edition, Cengage

Chapter 2: Limits and Derivatives

2.1: 3, 8

2.2: 4, 5, 7, 8, 9, 15, 17, 29, 30, 31, 32, 34, 35, 42a

2.3: 2, 15, 16, 17, 18, 23, 25, 26, 27, 28, 39, 41, 42

2.5: 3, 5, 7, 9, 20, 22, 25, 26, 35, 37, 43, 45, 47, 49, 52, 55, 57, 59a

2.6: 3, 4, 7, 10, 15, 18, 21, 23, 25, 26, 35, 37, 40, 42, 43a, 49, 51, 52, 67

2.7: 1, 3ab, 5, 8, 10ab, 12ab, 13, 19, 28, 35, 43, 44, 45, 48

2.8: 21, 23, 31, 41, 42, 43, 44

Chapter 3: Differentiation Rules

3.1: 3, 5, 8, 11, 13, 19, 23, 24, 30, 32, 37, 38, 53, 59, 60, 63, 64 (no graphing)

3.2: 3, 7, 10, 11, 15, 17, 31, 35, 43, 46, 47, 49, 53, 56

3.3: 1, 3, 4, 6, 7, 12, 13, 15, 28, 29, 30, 38, 39, 41

3.4: 2, 3, 4, 6, 7, 15, 21, 25, 27, 33, 38, 42, 58, 59, 60, 65, 68, 69, 71, 75

3.5: 1, 5, 7, 10, 11, 13, 16, 17, 19, 27, 28, 30, 31

3.6: 3, 5, 8, 9, 10, 15, 18, 21, 29, 37, 39, 45, 46, 48, 49, 51, 53, 55, 63, 65, 66, 67, 69, 74, 75

3.7: 1, 3, 4 (in Problems 1, 3 and 4 skip Part (f); in Part (i) determine if the particle is speeding up or slowing down at $t = 1$ second), 5, 9, 10, 15ab, 16abc, 17ab

3.9: 1, 2, 3, 5, 6, 9, 10, 12, 13, 15, 16, 17, 19, 32

3.10: 1, 3, 4, 5 (no graphing), 31, 33, 34, 35

Chapter 4: Applications of Differentiation

4.1: 3, 5, 7, 9, 11, 13, 31, 32, 35, 44, 45, 47, 48, 51, 53, 57, 60, 63, 64, 66

4.2: 1, 3, 5, 6, 10, 11, 13, 15, 16, 17, 21, 22, 29, 30, 31

4.3: 1, 2, 4, 5, 6, 8, 9, 11, 14, 15, 16, 17, 20, 23, 27, 34, 37, 39, 41, 43

4.4: 1, 5, 7, 8, 11, 13, 14, 16, 18, 19, 21, 23, 25, 27, 32, 35, 37, 43, 44, 45, 47, 49

4.7: 2, 3, 4, 5, 7, 8, 11, 12, 15, 18, 19, 21, 25, 26, 27

4.9: 5, 8, 9, 11, 13, 15, 17, 18, 19, 21, 22, 24, 37, 38, 39, 42, 43

Chapter 5: Integrals

5.2: 35, 36, 41, 43, 45, 58, 59, 63

5.3: 25, 29, 32, 37, 41, 43, 47, 55, 56, 57

5.4: 5, 7, 8, 10, 11, 13, 15, 16, 32, 33, 39, 45, 51

Additional Book Problems as Needed

The problems in this list use the same techniques and types of functions as those on the previous page. Some sections of the course may pull some of these as assigned HW problems. Your class meetings/ Canvas page are the definitive source for which problems are assigned.

2.1: 5, 7a

2.2: 6, 18, 33, 36, 37, 41

2.3: 13, 14, 21, 24, 29, 32, 34, 40, 43, 44, 51, 61

2.5: 8, 10, 23, 24, 36, 41, 42, 48, 51ab, 58

2.6: 6, 17, 19, 27, 28, 38, 42, 47

2.7: 7, 14ab, 21, 23, 26, 28, 34, 36, 46, 47

2.8: 22, 29, 32

3.1: 4, 6, 7, 9, 12, 15, 17, 21, 25, 26, 27, 28, 33, 39, 40, 44 (no graph), 49, 50, 52, 54ab, 62

3.2: 5, 8, 9, 12, 16, 25, 32, 36, 45, 48, 54

3.3: 2, 5, 20, 27, 35, 40

3.4: 1, 5, 8, 9, 10, 11, 13, 14, 17, 18, 19, 22, 23, 24, 30, 40, 44, 52, 56, 67, 70, 73, 78

3.5: 6, 12, 14, 21, 23

3.6: 4, 6, 7, 12, 19, 30, 31, 32, 40, 47, 50, 54, 56, 64, 65, 68, 69, 72, 73, 78

3.7: 7, 18ab

3.9: 4, 7, 14, 29

3.10: 2, 6, 32

4.1: 6, 8, 10, 12, 30, 37, 39, 46, 51, 56, 58, 65

4.2: 2, 4, 7, 8, 9, 12, 18

4.3: 10, 25, 26, 35, 38, 42, 44, 47, 53, 58

4.4: 6, 9, 15, 17, 22, 30, 31, 34, 41, 48, 50

4.7: Any

4.9: 7, 23, 40

5.2: 42, 62

5.3: 26, 27, 30, 31, 42, 58

5.4: 28, 31, 35

SE 2.3

1. Suppose $x\sin x \le f(x) \le \tan^2 x$ for all x in $(-\pi/2,\, \pi/2)$.

1. Find $\lim\limits_{x\to 0} x\sin x$ and $\lim\limits_{x\to 0} \tan^2 x$.
2. State whether the Squeeze Theorem can or cannot be applied to find $\lim\limits_{x\to 0} f(x)$. Justify your answer. Apply the theorem if it can be applied and find $\lim\limits_{x\to 0} f(x)$.
3. Find $\lim\limits_{x\to \pi/4} x\sin x$ and $\lim\limits_{x\to \pi/4} \tan^2 x$.
4. State whether the Squeeze Theorem can or cannot be applied to find $\lim\limits_{x\to \pi/4} f(x)$. Justify your answer. Apply the theorem if it can be applied and find $\lim\limits_{x\to \pi/4} f(x)$.

2. Suppose $\dfrac{3x^2-10x+8}{x^2-2x} \le f(x) \le e^{x-2}$ for all x in $(0,\, 2) \cup (2,\, \infty)$.

1. Find $\lim\limits_{x\to 1} \dfrac{3x^2-10x+8}{x^2-2x}$ and $\lim\limits_{x\to 1} e^{x-2}$.
2. State whether the Squeeze Theorem can or cannot be applied to find $\lim\limits_{x\to 1} f(x)$. Justify your answer. Apply the theorem if it can be applied and find $\lim\limits_{x\to 1} f(x)$.
3. Find $\lim\limits_{x\to 2} \dfrac{3x^2-10x+8}{x^2-2x}$ and $\lim\limits_{x\to 2} e^{x-2}$.
4. State whether the Squeeze Theorem can or cannot be applied to find $\lim\limits_{x\to 2} f(x)$. Justify your answer. Apply the theorem if it can be applied and find $\lim\limits_{x\to 2} f(x)$.

SE 2.6

1. Suppose $2\arctan x \le f(x) \le \dfrac{\pi x^2+4}{x^2+1}$ for all x.

1. Find $\lim\limits_{x\to \infty} 2\arctan x$ and $\lim\limits_{x\to \infty} \dfrac{\pi x^2+4}{x^2+1}$.
2. State whether the Squeeze Theorem can or cannot be applied to find $\lim\limits_{x\to \infty} f(x)$. Justify your answer. Apply the theorem if it can be applied and find $\lim\limits_{x\to \infty} f(x)$.
3. Find $\lim\limits_{x\to 1} 2\arctan x$ and $\lim\limits_{x\to 1} \dfrac{\pi x^2+4}{x^2+1}$.
4. State whether the Squeeze Theorem can or cannot be applied to find $\lim\limits_{x\to 1} f(x)$. Justify your answer. Apply the theorem if it can be applied and find $\lim\limits_{x\to 1} f(x)$.

SE 2.5

In Problems 1, 2, and 3, find the values of a and b (or just a) that make the function $f(x)$ continuous everywhere in its domain.

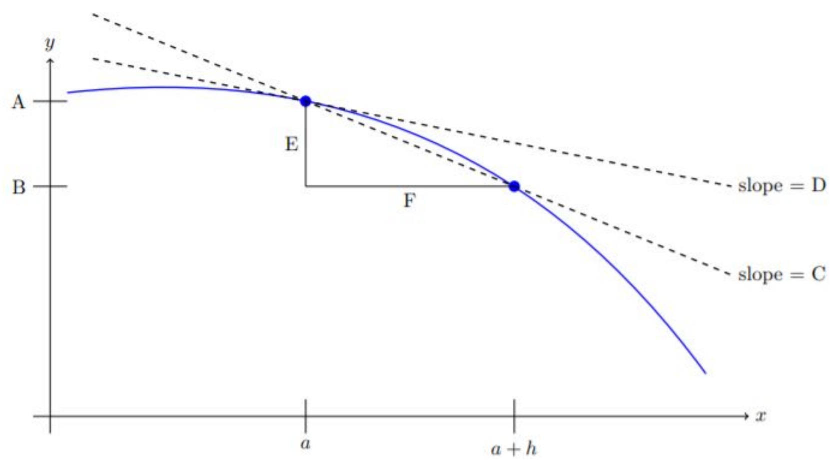
1. $f(x) = \begin{cases} \frac{x^2-4}{x-2} & \text{if} \quad x < 2 \\ a & \text{if} \quad x = 2 \\ 5x - a + b & \text{if} \quad x > 2 \end{cases}$

2. $f(x) = \begin{cases} \frac{\sqrt{x}-\sqrt{3}}{x-3} & \text{if} \quad x \neq 3,\ x > 0 \\ a & \text{if} \quad x = 3 \end{cases}$

3. $f(x) = \begin{cases} e^{x-a} & \text{if} \quad x \neq 1 \\ 3 & \text{if} \quad x = 1 \end{cases}$

SE 2.7

Consider the graph $y = f(x)$ shown below. Match each label A through F with the corresponding expression.



$f(a) - f(a+h) =$

$f(a+h) =$

$\dfrac{f(a+h) - f(a)}{h} =$

$\lim\limits_{h \to 0} \dfrac{f(a+h) - f(a)}{h} =$

$f(a) =$

$h =$

SE 3.10

In Problems 1 and 2,

(a) find the linearization $L(x)$ of the function $f(x)$ at the given value of a (please note that the linearization should be written in the form $L(x) = f(a) + f'(a)(x - a)$ and **should NOT be rewritten in the form** $L(x) = Ax + B$);

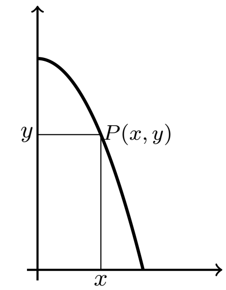
(b) use $L(x)$ to approximate $f(x)$ at the given value of x.

1. $f(x) = 4 \arctan x$, $a = 1$. Approximate $f(1.01)$. Round your answer to two decimal places.

2. $f(x) = x\, e^{x-2}$, $a = 2$. Approximate $f(1.9)$.

3. Suppose $f(-1) = 4$ and $f'(-1) = -2$. Find the linearization of $f(x)$ at $a = -1$ and use it to estimate $f(-1.01)$.

SE 4.1



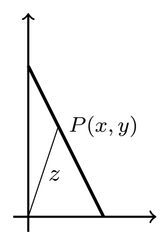
1. Let $f(x) = 4 - x^2$. Consider a rectangle with vertices $(0, 0)$, $(x, 0)$, (x, y), and $(0, y)$, where the vertex (x, y) lies on the curve $y = f(x)$, $0 \leq x \leq 2$ (see the picture at right).

Part I.

1. Express the perimeter P of the rectangle as a function of x, $P(x)$.
2. Find the absolute maximum and absolute minimum of $P(x)$ on the interval $0 \leq x \leq 2$.
3. Find the dimensions of the rectangle with the **largest** perimeter.

Part II.

1. Express the area A of the rectangle as a function of x, $A(x)$.
2. Find the absolute maximum and absolute minimum of $A(x)$ on the interval $0 \leq x \leq 2$.
3. Find the dimensions of the rectangle with the **largest** area.



2. Let z denote the distance from the origin to the point (x, y) on the line $y = 2 - 2x$, $0 \leq x \leq 1$ (see the picture at right).

1. Express z as a function of x, $z(x)$.
2. Find the absolute maximum and absolute minimum of $z(x)$, $0 \leq x \leq 1$.
3. Find the coordinates of the point on the segment $y = 2 - 2x$, $0 \leq x \leq 1$, that is **closest** to the origin.