2.1 Key Terms/Concepts:

Tangent
Secant Line
Average Rate of Change
Instantaneous Velocity

2.1 Formulas

Average Rate of Change/Average Velocity

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{y(t_2) - y(t_1)}{t_2 - t_1} = \frac{\Delta position}{\Delta time}$$

Section 2.1 p. 87 #3 (modified)

The point $P = (1, \frac{1}{2})$ lies on the curve $y = x/(1+x)$

(a) If Q is the point $(x, x/(1+x))$, find the slope of the secant line PQ when x is:

(i) 0.9

(ii) 0.99

(iii) 1.1

(iv) 1.001

(b) From (a), guess the value of the slope of the tangent line.

(c) From (b), find the equation of the tangent line at the point P.

Section 2.1 p. 87 #6 (modified)

A rock is thrown upward on the planet Mars with a velocity of 10 m/s and its height (position) at t seconds later is described by $y = 10t - 1.86t^2$.

(a) Find the average velocity over the given time intervals:

(i) $[1, 1.5]$

(ii) $[1, 1.1]$

(iii) $[1, 1.01]$

(iv) $[1, 1.001]$

(b) Estimate the instantaneous velocity when t=1.

2.2 Key Terms/Concepts:

Limit of a Function at a Point
Left-Hand (LH) Limits
Right-Hand (RH) Limits
Limit exists if and only if RH & LH limits are equal in value
Vertical Asymptote at point *a*

2.2 Formulas –what does each mean?

$\lim_{x\to a^-} f(x) = L$

$\lim_{x\to a^{(\pm)}} f(x) = \pm\infty$

$\lim_{x\to a^+} f(x) = L$

$\lim_{x\to a} f(x) = L$

$\lim_{x\to a} f(x) = L$ iff $\lim_{x\to a^+} f(x) = L$ and $\lim_{x\to a^-} f(x) = L$

Section 2.2 p. 97 #5

Use the graph of *f* in the book to state the value of each if it exists. If it does not, explain why:

(a) $\lim_{x\to 1^-} f(x)$ (b) $\lim_{x\to 1^+} f(x)$ (c) $\lim_{x\to 1} f(x)$

(d) $\lim_{x\to 5} f(x)$ (e) $f(5)$

Section 2.2 p. 98 #14

Sketch the graph of what the function *f* may look like under the given conditions:

$\lim_{x\to 0^-} f(x) = 1$

$\lim_{x\to 0^+} f(x) = -1$

$\lim_{x\to 2^-} f(x) = 0$

$\lim_{x\to 2^+} f(x) = 1$

$f(2) = 1$

$f(0)$ is undefined

Section 2.2 p. 98 #26

Determine the infinite limit. *Hint: There are two ways of doing this: try a table and do the limiting process as in Section 2.1 OR you can try graphing it*

$$\lim_{x\to -3^-} \frac{x+2}{x+3}$$

2.3 Key Terms/Concepts:
Limit Laws
Direct Substitution Law
Squeeze Theorem

2.3 Formulas—what does each mean?

$$\lim_{x\to a}\left[f(x)\pm g(x)\right]=\lim_{x\to a}f(x)\pm\lim_{x\to a}g(x)$$

$$\lim_{x\to a}cf(x)=c\lim_{x\to a}f(x)$$

$$\lim_{x\to a}\left[f(x)g(x)\right]=\lim_{x\to a}f(x)\cdot\lim_{x\to a}g(x)$$

$$\lim_{x\to a}\frac{f(x)}{g(x)}=\frac{\lim_{x\to a}f(x)}{\lim_{x\to a}g(x)}$$

$\lim_{x\to a}\left[f(x)\right]^n=\left[\lim_{x\to a}f(x)\right]^n$ for n any rational number

$$\lim_{x\to a}c=c$$

$\lim_{x\to a}f(x)=f(a)$ if a is in the domain of x

If $f(x)\le g(x)\le h(x)$ and $\lim_{x\to a}f(x)=L=\lim_{x\to a}h(x)$,
then $\lim_{x\to a}g(x)=L$

Section 2.3 p.107 #12
Evaluate the limit if it exists.

$$\lim_{x\to -4}\frac{x^2+5x+4}{x^2+3x-4}$$

Section 2.3 p. 107 #20
Evaluate the limit if it exists.

$$\lim_{h\to 0}\frac{(2+h)^3-8}{h}$$

Section 2.3 p. 107 #36
If $2x\le g(x)\le x^4-x^2+2$ for all x, evaluate $\lim_{x\to 1}g(x)$.

2.5 Key Terms/Concepts: *Give a pictorial example of each term*

1. Continuous
2. Discontinuous
3. Removable discontinuity
4. Infinite discontinuity
5. Jump discontinuity
6. Continuous from right/left at *a*
7. Continuous on an interval
8. Intermediate Value Theorem

Section 2.5 p. 128 #6 (modified)

Sketch the graph of a function that has a jump discontinuity at $x = 2$, and a removable discontinuity at $x = 4$, and an infinite discontinuity at $x = -1$.

Section 2.5 p. 129 #39

Find the numbers at which *f* is discontinuous. At which of these numbers is *f* continuous from the right, from the left, or neither. Sketch the graph of *f*.

$$f(x) = \begin{cases} x+2 \text{ if } x<0 \\ e^x \text{ if } 0 \le x \le 1 \\ 2-x \text{ if } x>1 \end{cases}$$

Section 2.5 p. 129 #46

Suppose *f* is continuous on [1,5] and the only solutions of the equation $f(x) = 6$ are $x = 1$ and $x = 4$. If $f(2) = 8$, explain why $f(3) > 6$.

2.6 Key Terms/Concepts:
Horizontal Asymptote

2.6 Formulas –what does each mean?

$\lim_{x \to \pm\infty} f(x) = L$

$\lim_{x \to \infty} f(x) = \infty$

Section 2.6 p. 141 #20
Find the limit.

$$\lim_{t \to -\infty} \frac{t^2 + 2}{t^3 + t^2 - 1}$$

Section 2.6 p. 141 #32
Find the limit.

$$\lim_{x \to \infty} \frac{x^3 - 2x + 3}{5 - 2x^2}$$

Section 2.6
Find the limit.

$$\lim_{x \to -\infty} \frac{\sin^2(x)\cos(x)}{1 - \cos^2(x)}$$

Section 2.6
Find the limit.

$$\lim_{x \to \infty} \frac{x^3 - 1}{x^3 + 2x - 185}$$

2.7 Key Terms/Concepts:
Tangent line slope
Difference Quotient
Instantaneous velocity
Derivative of a function at *a*

2.7 Formulas –What does each mean?

$$\frac{f(x+h)-f(x)}{h}$$

$$\lim_{x\to 0}\frac{\Delta y}{\Delta x}=\lim_{x_2\to x_1}\frac{f(x_2)-f(x_1)}{x_2-x_1}$$

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

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

Section 2.7 p. 150 #7 modified
Find the equation of a tangent line to the curve at the given point.
$y=\sqrt{x}$ at $(4,2)$

Section 2.7 p 151 #28
Find *f'(x)*.

$$f(x)=\frac{x^2+1}{x-2}$$

Section 2.7 p. 151 #32, 33
The following limits represent the derivative of some function *f* at some number *a*. State such *f* and *a*.

$$\lim_{h\to 0}\frac{\sqrt[4]{16+h}-2}{h}$$

$$\lim_{x\to 5}\frac{2^x-32}{x-5}$$

2.8 Key Terms/Concepts:

Differentiable at *a*
Differentiable on an interval
Differentiation operators
Implications differentiation on continuity
Not Differentiable (3 cases)
Higher Derivatives(acceleration, jerk)

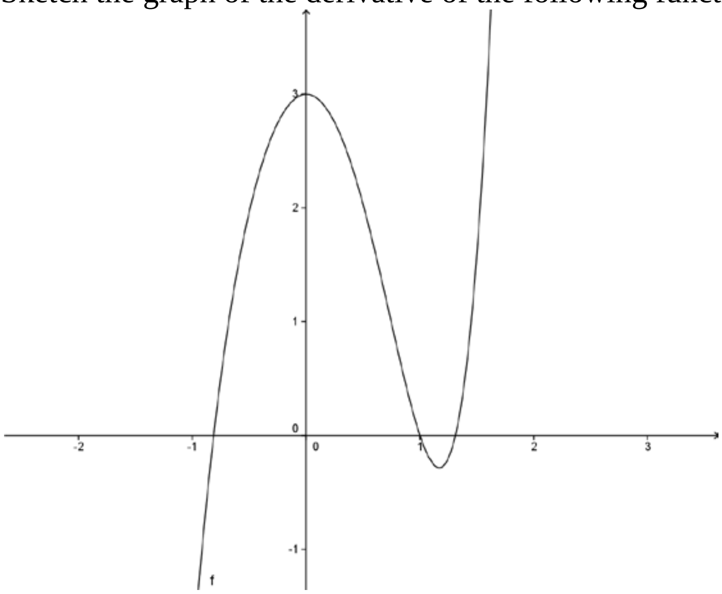
2.8 Formulas –what does each mean?

$\frac{d}{dx}$

$\frac{d^2s}{dt^2} = a, \frac{d^3}{dx^3}, \frac{d^{(n)}}{dx^{(n)}}$

Section 2.8 p. 162 #4-11 (modified)

Sketch the graph of the derivative of the following function:



Section 2.8 p. 163 #23

Find the derivative of the function using the definition of derivative. State the domain of the function and the domain of its derivative:

$f(x) = x^3 - 3x + 5$