MATH 2413 LEARNING GOALS

1. Larson's Chapter 1 - Sections 1.1, 1.2, 1.3, 1.4, 1.5

1.1. **A Preview of Calculus.**

(1) Find the secant line passing through 2 given points on the graph of a function. Use the slopes of secant lines to approximate the slope of the tangent line at a point.
Ex: 7.
(2) Approximate the area of the region under the graph of a function by using rectangles.
Ex: 9.

1.2. **Finding limits graphically and numerically.**

(1) Estimate a limit numerically.
Ex: 2, 3, 5.
(2) Find a limit graphically.
Ex: 17, 19, 20, 22, 24, 67, 69, 70.
(3) Use the $\epsilon - \delta$ definition of a limit.
Ex: 29.

1.3. **Evaluating limits analytically.**

(1) Find limits of polynomial and rational functions and limits of composite functions.
Ex: 11, 13, 21, 25, 39.
(2) Find limits of basic trigonometric functions.
Ex: 29, 31, 35.
(3) Find limits using the dividing out technique and the rationalizing technique.
Ex: 49, 52, 53, 57, 83, 87.
(4) Find limits of trigonometric functions using two special trigonometric limits.
Ex: 63, 64, 74.
(5) Find limits using the Squeeze Theorem.
Ex: 89.

1.4. **Continuity and one-sided limits.**

(1) Understand the definition of continuity and discuss the continuity of a function given its graph.
Ex: 2, 3, 5, 27, 29.
(2) Understand removable and nonremovable discontinuities.
Ex: 35, 43, 45, 48, 49, 51, 53.
(3) Apply the properties of continuity to solve problems.
Ex: 61, 65, 69, 77, 79.
(4) Understand and be able to find one-sided limits.
Ex: 9, 13, 18, 19, 20.
(5) Use the intermediate value theorem to solve problems.
Ex: 95, 98.

1.5. **Infinite limits.**

(1) Determine infinite limits from a graph.
Ex: 1, 2, 3, 4.
(2) Find infinite limits of functions.
Ex: 5, 7, 33, 39, 43.

(3) Find vertical asymptotes.
Ex: 13, 15, 17, 22, 65, 66, 67.

2. Chapter 2 - Sections 2.1, 2.2, 2.3, 2.4, 2.5, 2.6

2.1. **The derivative and the tangent line problem.**

(1) Find the slope of a tangent line using the definition.
Ex: 5, 10, 47, 55, 93.
(2) Find the derivative by the limit process.
Ex: 11, 14, 17, 21, 23, 67.
(3) Determine differentiability from graphs.
Ex: 75, 76, 77, 79.
(4) Understand the relationship between differentiability and continuity.
Ex: 94, 95, 96.

2.2. **Basic differentiation rules and rates of change.**

(1) Find derivatives using basic differentiation rules.
Ex: 3, 5, 7, 9, 17, 19, 24, 41, 45, 47, 49, 52.
(2) Apply the derivative to solve applications that involve tangent lines, rates of change, motion, etc.
Ex: 79, 81, 93, 97.

2.3. **Product and quotient rules and higher-order derivatives.**

(1) Find derivatives using the product rule and quotient rule.
Ex: 5, 9, 11, 17, 31, 69, 73, 81, 105, 131.
(2) Find derivatives of trigonometric functions using the derivative of tan, sec, cot, and csc.
Ex: 43, 44, 46, 49, 53, 59.
(3) Find higher-order derivatives. Use the second derivative to find acceleration.
Ex: 93, 98, 101, 115, 120, 132.

2.4. **The chain rule.**

(1) Find derivatives using the chain rule.
Ex: 7, 13, 19, 21, 31, 41, 43, 49, 55, 59, 63, 64, 65, 89, 101, 103.

2.5. **Implicit differentiation.**

(1) Find derivatives using implicit differentiation.
Ex: 3, 5, 15, 25, 27, 37, 38, 41.
(2) Find second derivatives using implicit differentiation.
Ex: 45, 49.

2.6. **Related rates.**

(1) Find a related rate.
Ex: 1, 4, 7.
(2) Use related rates to solve real-life problems.
Ex: 11, 13, 19, 25, 31, 37.

3. Chapter 3 - Sections 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.9

3.1. **Extrema on an interval.**

(1) Find the critical numbers of a function.
Ex: 3, 5, 11, 13, 15.
(2) Find the absolute extrema of a function on a closed interval.
Ex: 21, 25, 35.
(3) Apply the technique for finding extrema on a closed interval to solve real-life problems.
Ex: 59.

3.2. **Rolle's theorem and the mean value theorem.**

(1) Use Rolle's theorem to solve problems.
Ex: 9, 11, 13, 17, 27, 74, 75.
(2) Use the Mean Value Theorem to solve problems.
Ex: 29, 31, 32, 33, 35a, 35b, 35c, 39, 58, 73.

3.3. **Increasing and decreasing functions and the first derivative test.**

(1) Determine the intervals of increasing or decreasing.
Ex: 5, 7, 11, 15.
(2) Apply the first derivative test to solve problems.
Ex: 21, 29, 35, 41, 47.

3.4. **Concavity and the second derivative test.**

(1) Determine the intervals of concavity and find points of inflection.
Ex: 5, 9, 13, 17, 21, 28.
(2) Use the second derivative test to solve problems.
Ex: 33, 35, 39, 51, 53, 55.

3.5. **Limits at infinity.**

(1) Find limits at infinity.
Ex: 15, 19, 29, 31, 37, 43, 45, 58a, 58b.
(2) Sketch the graph of an equation using extrema, intercepts, symmetry and asymptotes.
Ex: 61, 63.

3.6. **A summary of curve sketching.**

(1) Determine the graph of f' from the graph of f.
Ex: 1, 2, 3, 4, 49, 51.
(2) Analyze the graph of a function using the curve sketching technique in the section.
Ex: 9, 13, 21, 23, 55, 57, 59.

3.7. **Optimization problems.**

(1) Solve minimum and maximum problems.
Ex: 9, 11, 15, 19, 21, 25, 41.

3.8. **Differentials.**

(1) Find the tangent line approximation to the graph of a function.
Ex: 1, 5.
(2) Find differentials and using differentials to solve problems.
Ex: 7, 13, 17, 19, 37, 39.
(3) Use differentials to approximate propagated errors.
Ex: 27, 29.

4. Chapter 4 - Sections 4.1, 4.2, 4.3, 4.4, 4.5

4.1. **Antiderivatives and indefinite integration.**

(1) Find indefinite integrals using basic integration rules.
Ex: 15, 16, 19, 21, 23, 25, 27, 29, 31.
(2) Use the antiderivative to solve problems.
Ex: 1, 33, 37, 41, 51, 55, 60, 69, 72, 73, 74.

4.2. **Area.**

(1) Understand the sigma notation.
Ex: 1, 5, 7, 11.
(2) Evaluate sums using summation formulas.
Ex: 13, 15, 17.
(3) Approximate the area of a plane region by using rectangles.
Ex: 25, 29.
(4) Find upper and lower sums for a region.
Ex: 31, 33, 35, 72.
(5) Find are by the limit definition.
Ex: 41, 45, 49.
(6) Approximate area with the midpoint rule.
Ex: 61.

4.3. **Riemann sums and definite integrals.**

(1) Find a definite integral as a limit of a Riemann sum.
Ex: 1, 7, 11, 12, 77.
(2) Understand a definite integral as the area of a region.
Ex: 13, 15, 17, 19, 21.
(3) Find a definite integral using a geometric formula.
Ex: 23, 25, 31, 47.
(4) Find a definite integral using properties of definite integrals.
Ex: 39, 41, 43, 64, 67, 68.

4.4. **The fundamental theorem of calculus.**

(1) Find a definite integral using the first fundamental theorem of calculus.
Ex: 9, 13, 15, 21, 25, 29, 31, 32, 33, 34, 105, 107.
(2) Find the area of a region using by evaluating a definite integral using the fundamental theorem of calculus.
Ex: 35, 37, 41.
(3) Understand the mean value theorem for integrals.
Ex: 45.
(4) Find the average value of a function.
Ex: 55.
(5) Use the second fundamental theorem of calculus to solve problems.
Ex: 69, 73, 79, 83, 86, 88, 89, 91.

4.5. **Integration by substitution.**

(1) Find an indefinite integral using the change of variables method.
Ex: 15, 19, 21, 33, 35, 39, 41, 42, 47.
(2) Find a definite integral using the change of variables method.
Ex: 59, 61, 65.
(3) Find definite integrals using the properties of even and odd functions.
Ex: 69, 70, 71.

5. Chapter 5 - Sections 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7

5.1. **The natural logarithmic function: differentiation.**

(1) Find the derivative of a logarithmic function.
Ex: 43, 45, 49, 51, 55, 57, 61, 75, 83, 99, 100, 101.
(2) Find derivatives using the method of logarithmic differentiation.
Ex: 91, 92.

5.2. **The natural logarithmic function: integration.**

(1) Use the log rule for integration to integrate functions.
Ex: 5, 9, 11, 15, 21, 22, 23, 25, 27, 29, 51, 67, 99.
(2) Integrate trigonometric functions using the integrals of basic trigonometric functions.
Ex: 31, 33, 37, 39, 55, 69.

5.3. **Inverse functions.**

(1) Determine whether a function has an inverse function by using the derivative.
Ex: 23, 27, 31, 33.
(2) Find the derivative of the inverse function at a given point.
Ex: 63, 64, 69.

5.4. **Exponential functions: differentiation and integration.**

(1) Find the derivative of an exponential function.
Ex: 35, 39, 43, 45, 49, 51, 53, 63, 67.
(2) Find an equation of a tangent line to the graph of an exponential function.
Ex: 55, 65.
(3) Find integrals of exponential functions.
Ex: 93, 95, 97, 99, 101, 105, 107, 113, 117.

5.5. **Bases other than e and applications.**

(1) Find the derivative of an exponential function or a logarithmic function with base other than e.
Ex: 37, 39, 47, 51, 59, 61.
(2) Use the method of logarithmic differentiation to solve problems.
Ex: 63, 66, 69.
(3) Find integrals of exponential functions with base other than e.
Ex: 71, 77, 78, 81.
(4) Solve problems that involve applications of exponential functions.
Ex: 87, 91, 95, 97.

5.6. **Inverse trigonometric functions: differentiation.**

(1) Understand the basic properties of inverse trigonometric functions and solve related problems.
Ex: 3, 5, 7, 9, 15, 17, 21, 23, 25, 29, 85, 90.
(2) Find the derivative of an inverse trigonometric function.
Ex: 39, 42, 43, 47, 50, 53, 89.
(3) Find an equation of a tangent line to an inverse trigonometric function.
Ex: 61, 79.
(4) Use inverse trigonometric functions to solve real-life problems.
Ex: 91, 95.

5.7. **Inverse trigonometric functions: integration.**

(1) Find integrals that involve inverse trigonometric functions.
Ex: 1, 3, 9, 11, 17, 23, 29, 33, 37, 45.

6. Chapter 7 - Sections 7.1

6.1. **Area of a region between two curves.**

(1) Find the area of a region between two curves.
Ex: 1, 2, 3, 4, 5, 6, 15, 17, 25, 27, 37.