# Pacing Guide - Pre-Calculus 12

Every September, teachers work hard to create a space that is safe and welcoming for all learners. The first weeks are a time to establish a sense of community, engage learners in rich interactive experiences to promote critical thinking and create opportunities for collaboration and discussion. This is an opportune time to develop a culture and a climate for mathematics learning, conducive to collaboration, risk taking and inquiry.

The following is a pacing guide for Pre-Calculus 12, which provides an overview of the units. It is a reference tool to support teachers with the timing of yearlong learning. Teachers are encouraged to use their professional judgement and consider the needs of their students when planning for instruction. **For the purposes of planning your mathematics lessons, refer to the Pre-Calculus 12 curriculum document and Pre-Calculus 12 Outcomes (2022) that provide essential background information and describe learning opportunities and assessment tasks for each of the outcomes in the unit.**

**Relations and Functions:** Develop algebraic and graphical reasoning through the study of relations. **(60 – 65 hours)**
**Trigonometry:** Develop trigonometric reasoning. **(30 – 35 hours)**

****NOTE:**
**The last unit: Permutations, Combinations and Binomial Theorem (approximately 10-15 hours) was removed. This time will allow teachers to be responsive to the needs of students and to spend more time on areas of concern.**

**PC01:** Apply the fundamental counting principle to solve problems.
**PC02:** Determine the number of permutations of *n* elements taken *r* at a time to solve problems.
**PC03:** Determine the number of combinations of *n* different elements taken *r* at a time to solve problems.
**PC04:** Expand powers of a binomial in a variety of ways, including using the binomial theorem (restricted to exponents that are natural numbers).

**Unit 1: Function Transformations and Radical Functions**

| Timeline | GCO/SCO | Topic | Resources |
|---|---|---|---|
| **September**<br><br>**or**<br><br>**February** | **Relations and Functions –**<br><br>**RF02** Demonstrate an understanding of the effects of horizontal and vertical translations on the graphs of functions and their related equations.<br><br>**RF03** Demonstrate an understanding of the effects of horizontal and vertical stretches on the graphs of functions and their related equations.<br><br>**RF04** Apply translations and stretches to the graphs and equations of functions.<br><br>**RF05** Demonstrate an understanding of the effects of reflections on the graphs of functions and their related equations, including reflections in the: *x*-axis, *y*-axis, and the line $y = x$.<br><br>**RF06** Demonstrate an understanding of inverses of relations.<br><br>**RF13** Graph and analyze radical functions (limited to functions involving one radical). | **Introduction** – Understanding graphs and how changes impact meaning | **Worksheets –** Swimming Pool **and** Comparing Cars |
| | | Horizontal and vertical translations | **Curriculum Document**: RF02<br>**Student Text:** Section 1.1 |
| | | Reflections and stretches | **Curriculum Document**: RF03<br>**Student Text:** Section 1.2 |
| | | Combining transformations | **Curriculum Document**: RF04<br>**Student Text:** Section 1.3 |
| | | Inverse of a relation | **Curriculum Document**: RF06<br>**Student Text:** Section 1.4 |
| | | Reinforcement, consolidation | **Student Text:** pp 56 - 59 |
| | | Radical functions and transformations | **Curriculum Document**: RF13<br>**Student Text:** Section 2.1 |
| | | Square root of a function | **Curriculum Document**: RF13<br>**Student Text:** Section 2.2 |
| | | Solving radical equations graphically | **Curriculum Document**: RF13<br>**Student Text:** Section 2.3 |
| | | Reinforcement, consolidation and assessment | **Student Text:** pp 56 – 59<br>**Student Text:** pp 99 – 101 |
| | **Approximately 19 hours** | | |

**Unit 2: Polynomial Functions**

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|---|---|---|---|
| **October**<br><br>**or**<br><br>**March** | **Relations and Functions –**<br><br>**RF11** Demonstrate an understanding of factoring polynomials of degree greater than 2 (limited to polynomials of degree ≤ 5 with integral coefficients).<br><br>**RF12** Graph and analyze polynomial functions (limited to polynomial functions of degree ≤ 5). | Characteristics of polynomial functions | **Curriculum Document**: RF11<br>**Student Text:** Section 3.1 |
| | | The remainder theorem | **Curriculum Document**: RF11<br>**Student Text:** Section 3.2 |
| | | The factor theorem | **Curriculum Document**: RF11<br>**Student Text:** Section 3.3 |
| | | Equations of graphs of polynomial functions | **Curriculum Document**: RF12<br>**Student Text:** Section 3.4 |
| | | Reinforcement, consolidation and assessment | **Student Text:** pp 153 - 156<br>**Student Text:** pp 158 - 161 |
| | **Approximately 11 hours** | | |

**Unit 3: Trigonometry & Trigonometric Functions and Graphs**

| Timeline | GCO/SCO | Topic | Resources |
|---|---|---|---|
| **October-November**<br><br>**or**<br><br>**March-April** | **Trigonometry –**<br><br>**T03** Solve problems, using the six trigonometric ratios for angles expressed in radians and degrees.<br><br>**T05:** Solve, algebraically and graphically, first and second degree trigonometric equations with the domain expressed in degrees and radians.<br><br>**T04:** Graph and analyze the trigonometric functions sine, cosine and tangent to solve problems. | Trigonometric ratios | **Curriculum Document**: T03<br>**Student Text:** Section 4.3 |
| | | Introduction to trigonometric equations | **Curriculum Document**: T05<br>**Student Text:** Section 4.4 |
| | | Graphing sine and cosine functions | **Curriculum Document**: T04<br>**Student Text:** Section 5.1 |
| | | Transformations of sinusoidal functions | **Curriculum Document**: T04<br>**Student Text:** Section 5.2 |
| | | The tangent function | **Curriculum Document**: T04<br>**Student Text:** Section 5.3 |
| | | Equations and graphs of trigonometric functions | **Curriculum Document**: T04, T05<br>**Student Text:** Section 5.4 |
| | | Reinforcement, consolidation and assessment | **Student Text:** pp215 - 219<br>**Student Text:** pp 282 - 287 |
| | **Approximately 17 hours** | | |

**Unit 4: Trigonometric Identities**

| Timeline | GCO/SCO | Topic | Resources |
|---|---|---|---|
| **November**<br><br>**or**<br><br>**April** | **Trigonometry –**<br><br>**T03** Solve problems, using the six trigonometric ratios for angles expressed in radians and degrees.<br><br>**T05:** Solve, algebraically and graphically, first and second degree trigonometric equations with the domain expressed in degrees and radians.<br><br>**T06** Prove trigonometric identities, using:<br>• reciprocal identities<br>• quotient identities<br>• Pythagorean identities<br>• sum or difference identities<br>• double-angle identities | Reciprocal, quotient, and Pythagorean theorem | **Curriculum Document**: T06<br>**Student Text:** Section 6.1 |
| | | Sum, difference, and double angle identities | **Curriculum Document**: T06<br>**Student Text:** Section 6.2 |
| | | Proving identities | **Curriculum Document**: T06<br>**Student Text:** Section 6.3 |
| | | Solving trigonometric equations using identities | **Curriculum Document**: T05, T06<br>**Student Text:** Section 6.4 |
| | | Reinforcement, consolidation and assessment | **Student Text:** pp 322 – 324 |
| | **Approximately 15 hours** | | |

## Unit 5: Exponential Functions

| Timeline | GCO/SCO | Topic | Resources |
|---|---|---|---|
| **November-December**<br><br>**or**<br><br>**April-May** | **Relations and Functions -**<br><br>**RF09** Graph and analyze exponential and logarithmic functions.<br><br>**RF10** Solve problems that involve exponential and logarithmic equations. | Characteristics of exponential functions | **Curriculum Document**: RF09<br>**Student Text:** Section 7.1 |
| | | Transformations of exponential functions | **Curriculum Document**: RF09<br>**Student Text:** Section 7.2 |
| | | Solving exponential equations | **Curriculum Document**: RF10<br>**Student Text:** Section 7.3 |
| | | Reinforcement, consolidation and assessment | **Curriculum Document:** RF09, RF10<br>**Student Text:** pp 366 - 369 |
| | **Approximately 9 hours** | | |

## Unit 6: Logarithmic Functions

| Timeline | GCO/SCO | Topic | Resources |
|---|---|---|---|
| **November-December**<br><br>**or**<br><br>**April-May** | **Relations and Functions -**<br><br>**RF07** Demonstrate an understanding of logarithms.<br><br>**RF08** Demonstrate an understanding of the product, quotient and power laws of logarithms.<br><br>**RF09** Graph and analyze exponential and logarithmic functions.<br><br>**RF10** Solve problems that involve exponential and logarithmic equations. | Understanding logarithms | **Curriculum Document**: RF07<br>**Student Text:** Section 8.1<br>**Please Note:** The textbook does not contain questions relating to e or Ln but this is an expectation. |
| | | Transformations of logarithmic functions | **Curriculum Document**: RF09<br>**Student Text:** Section 8.2 |
| | | Laws of logarithms | **Curriculum Document**: RF08<br>**Student Text:** Section 8.3 |
| | | Logarithmic and exponential equations | **Curriculum Document**: RF10<br>**Student Text:** Section 8.4 |
| | | Reinforcement, consolidation and assessment | **Student Text:** pp 366 – 367<br>**Student Text:** pp 368 – 369; pp 416 - 420 |
| | **Approximately 10 hours** | | |

## Unit 7: Rational Functions

| Timeline | GCO/SCO | Topic | Resources |
|---|---|---|---|
| **December**<br>**or**<br>**May** | **Relations and Functions -**<br><br>**RF14** Graph and analyze rational functions (limited to numerators and denominators that are monomials, binomials or trinomials). | Exploring rational functions using transformations | **Curriculum Document**: RF14<br>**Student Text:** Section 9.1 |
| | | Analyzing rational functions | **Curriculum Document**: RF14<br>**Student Text:** Section 9.2 |
| | | Connecting graphs and rational equations | **Curriculum Document**: RF14<br>**Student Text:** Section 9.3 |
| | | Reinforcement, consolidation and assessment | **Curriculum Document:** RF14<br>**Student Text:** pp 468 - 471 |
| | **Approximately 8 hours** | | |

## Unit 8: Function Operations

| Timeline | GCO/SCO | Topic | Resources |
|---|---|---|---|
| **January**<br>**or**<br>**June** | **Relations and Functions -**<br><br>**RF01** Demonstrate an understanding of operations on, and compositions of, functions.<br><br>(RF01.09 removed) | Sums and differences of functions | **Curriculum Document**: RF01<br>**Student Text:** Section 10.1 |
| | | Products and quotients of functions | **Curriculum Document**: RF01<br>**Student Text:** Section 10.2 |
| | | Composite functions | **Curriculum Document**: RF01<br>**Student Text:** Section 10.3 |
| | | Reinforcement, consolidation and assessment | **Student Text:** pp 468 – 471<br>**Student Text:** pp 510 – 513 |
| | **Approximately 8 hours** | | |