Functions and Applications, Grade 11 (MCF3M)
Course Description

Course Title: Functions and Applications
Course Code: MCF3M
Grade: 11

Course Type: University/College
Credit Value: 1.0
Prerequisite: MPM2D or MFM2P

- This course builds on your knowledge from grade 10 Applied or Academic mathematics
- It leads you to MDM4U, MCT4C
- You will also have the option to take MAP4C
- This can lead you to many careers such as: Architectural Technician, Biomedical Engineer, Satellite Image Analyst, Urban Planner, Web Developer

Official Ontario Ministry of Education secondary curriculum available here:
http://www.edu.gov.on.ca/eng/curriculum/secondary/math.html

This course focuses on three main strands:

- Quadratic Functions
- Exponential Functions
- Trigonometric Functions
Functions and Applications, Grade 11 (MCF3M)
Course Description

Quadratics Functions

Students will manipulate and gather information from quadratic functions to solve a variety of real-world problems, such as how to determine the initial speed a rocket will need at take-off in order to achieve a certain height, and the total distance it will travel at that speed or designing and building products such as:

Problem: You have decided to make a picture frame out of a sheet of aluminum. The frame will be cut out of a singular sheet and the final area of the frame is to be 28 cm². The inside of the frame has to be 12 cm by 6 cm. What should the width, \( x \), of the frame be?

Solution:

Area = \((12 + 2x) \times (6 + 2x)\)

\[
= 72 + 24x + 12x + 4x^2
\]

\[
= 4x^2 + 36x + 72
\]

Subtract the cut-out part of 12 \times 6

Area = \(4x^2 + 36x + 72 - 72\)

\[
= 4x^2 + 36x
\]

Desired area is 28

\[
28 = 4x^2 + 36x
\]

\[
0 = 4x^2 + 36x - 28
\]

\[
\therefore \text{the width of } x \text{ is approximately 0.72 cm}
\]
Functions and Applications, Grade 11 (MCF3M)
Course Description

Exponential functions:

Students will solve problems using their knowledge of exponent laws and explore the graphical representation of exponential functions, such as modelling the growth of an investment or debt.

\[ A = P(1 + i)^n \]

Where:
- \( A \) = final amount
- \( P \) = starting amount or principal
- \( i \) = the interest rate as a decimal
- \( n \) = the number of compounding periods

**Problem:** One day you made an impulse buy on a $1500 new computer and put it on your credit card. The credit card has an interest rate of 20% per annum compounded monthly. How much money will the computer end up costing if you don’t pay off your credit card until 2 years from now?

**Solution:**

\[ A = P(1 + i)^n \]

\[ A = ? \]

\[ P = 1500 \]

\[ i = \frac{0.20}{12} \]

\[ n = 2 \times 12 \]

\[ A = 1500 \left(1 + \frac{0.20}{12}\right)^{24} \]

\[ = \$2,230.37 \]

\[ \therefore \text{the computer will end up costing $2,230.37} \]
Functions and Applications, Grade 11 (MCF3M)  
Course Description

Trigonometric Functions:

Students will solve problems using triangles and trigonometry laws such as understanding changes to a staircase's angle of incline. They will also learn the graphical and algebraic representations of periodic and trigonometric functions used in investigating the periodic nature of the tides or other applications such as how a landscaper might use trigonometry to build a fence around a property.

Uses of Trigonometry

<table>
<thead>
<tr>
<th>Music Theory</th>
<th>Audio Synthesis</th>
<th>Acoustics</th>
<th>Optics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Markets</td>
<td>Electronics</td>
<td>Probability</td>
<td>Statistics</td>
</tr>
<tr>
<td>Biology</td>
<td>Medical Imaging</td>
<td>Pharmacy</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Seismology</td>
<td>Meteorology</td>
<td>Oceanography</td>
<td>and Many More</td>
</tr>
</tbody>
</table>

Problem: A landscaper is building a garden for a customer. The customer has asked for a fence to be built connecting two existing walls so that animals will be not be able to enter the garden. The following diagram shows the scenario and the data collected by the landscaper. How long is the fence going to have to be if built in the indicated location, $x$?

Solution: The landscaper recognizes that they have a non-right angle triangle with a corresponding side and angle and that sine law can be used to solve for the unknown side. Use the Trigonometric Table provided.

\[
\frac{x}{\sin 112} = \frac{15}{\sin 36}
\]

\[
x = \frac{\sin(112)15}{\sin 36}
\]

\[
x = 23.7
\]

$\therefore$ the fence needs to be 23.7 m long
## Functions and Applications, Grade 11 (MCF3M)

### Course Description

#### Trigonometric Table

<table>
<thead>
<tr>
<th>Angle in degrees</th>
<th>Angle in Radians</th>
<th>Sine</th>
<th>Cosine</th>
<th>Tangent</th>
</tr>
</thead>
<tbody>
<tr>
<td>36°</td>
<td>0.628</td>
<td>0.588</td>
<td>0.809</td>
<td>0.727</td>
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<tr>
<td>37°</td>
<td>0.646</td>
<td>0.602</td>
<td>0.799</td>
<td>0.754</td>
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<tr>
<td>38°</td>
<td>0.663</td>
<td>0.616</td>
<td>0.788</td>
<td>0.781</td>
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<tr>
<td>39°</td>
<td>0.681</td>
<td>0.629</td>
<td>0.777</td>
<td>0.810</td>
</tr>
<tr>
<td>40°</td>
<td>0.698</td>
<td>0.643</td>
<td>0.766</td>
<td>0.839</td>
</tr>
<tr>
<td>41°</td>
<td>0.716</td>
<td>0.656</td>
<td>0.755</td>
<td>0.869</td>
</tr>
<tr>
<td>42°</td>
<td>0.733</td>
<td>0.669</td>
<td>0.743</td>
<td>0.900</td>
</tr>
<tr>
<td>43°</td>
<td>0.750</td>
<td>0.682</td>
<td>0.731</td>
<td>0.933</td>
</tr>
<tr>
<td>44°</td>
<td>0.768</td>
<td>0.695</td>
<td>0.719</td>
<td>0.966</td>
</tr>
<tr>
<td>45°</td>
<td>0.785</td>
<td>0.707</td>
<td>0.707</td>
<td>1.000</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
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<th>Sine</th>
<th>Cosine</th>
<th>Tangent</th>
</tr>
</thead>
<tbody>
<tr>
<td>81°</td>
<td>1.414</td>
<td>0.988</td>
<td>0.156</td>
<td>6.314</td>
</tr>
<tr>
<td>82°</td>
<td>1.431</td>
<td>0.990</td>
<td>0.139</td>
<td>7.115</td>
</tr>
<tr>
<td>83°</td>
<td>1.449</td>
<td>0.993</td>
<td>0.122</td>
<td>8.144</td>
</tr>
<tr>
<td>84°</td>
<td>1.466</td>
<td>0.995</td>
<td>0.105</td>
<td>9.514</td>
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<tr>
<td>85°</td>
<td>1.484</td>
<td>0.996</td>
<td>0.087</td>
<td>11.43</td>
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<tr>
<td>86°</td>
<td>1.501</td>
<td>0.998</td>
<td>0.070</td>
<td>14.301</td>
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<tr>
<td>87°</td>
<td>1.518</td>
<td>0.999</td>
<td>0.052</td>
<td>19.081</td>
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<tr>
<td>88°</td>
<td>1.536</td>
<td>0.999</td>
<td>0.035</td>
<td>28.636</td>
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<tr>
<td>89°</td>
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<td>1.000</td>
<td>0.017</td>
<td>57.290</td>
</tr>
<tr>
<td>90°</td>
<td>1.571</td>
<td>1.000</td>
<td>0.000</td>
<td>∞</td>
</tr>
</tbody>
</table>