While all material covered in the syllabus is essential for success in the course, the following material will be stressed in the final exam for Math 126.
Chapter/Section taken from the class text: *Precalculus* (custom edition) by Stewart.

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<thead>
<tr>
<th>Section</th>
<th>Online Homework</th>
<th>Example Problem for Final Exam</th>
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</thead>
<tbody>
<tr>
<td>1.1</td>
<td>6, 12, 22, 26, 28, 30, 38, 44, 56, 64, 74, 75, 76</td>
<td>Write your answer as a ratio of two integers in lowest terms</td>
</tr>
</tbody>
</table>
|         |                | (a) \[
\frac{1}{360} - \frac{1}{36} \]
\[
= \frac{2}{3} - \frac{1}{6} = \frac{1}{3}
\]
|         |                | (b) \[
\frac{3}{7} - \frac{2}{1} = \frac{1}{3}
\]
|         |                | (c) \(x = 3.0012 \text{ and } 330x\) |
| 1.2     | 20, 32, 33, 40, 50, 58, 68, 76, 82, 98, 101 | Write your answer as a ratio of two integers in lowest terms |
|         |                | (a) \(\sqrt[3]{81} = 3\)
|         |                | (b) \(\sqrt[3]{729} = 9\)
|         |                | (c) Find \(x\) if \(6.8 \times 10^4 = 6,800,000,000,000\)
|         |                | (d) Find \(x\) if \(9.2 \times 10^4 = 0.0000000000000092\)
|         |                | (e) \[
\frac{(3.2 \times 10^9)(1.5 \times 10^{-6})}{(2.4 \times 10^4)} = \frac{1}{12}
\]
|         |                | (f) \(x = 7 \text{ if } 5^4 = \frac{5}{25}\)
|         |                | (g) \[
\frac{4^8}{5^9} \times \frac{5^7}{a^9} \times \frac{a^9}{2^4} = \frac{5}{4}
\]
| 1.3     | 16, 22, 24, 32, 48, 54, 70, 72, 74, 78, 86, 94, 114, 122, 128 | (a) Factor the following polynomial: \(2x^2 - 5x - 12\)
|         |                | (b) Factor the following polynomial: \(x^4 - 4b^4\) |
| 1.4     | 6, 8, 10, 14, 20, 30 36, 56, 60, 70, 80, 86, 88, 92 | \[
\frac{x}{x - 1} - \frac{x + 1}{x + 1} - \frac{x}{x + 2} - \frac{x - 1}{x - 1}
\]
|         |                | (a) \[
\frac{x}{x - 1} - \frac{x}{x + 1} - \frac{x}{x + 2} - \frac{x - 1}{x - 1}
\]
|         |                | (b) (also section 2.4) Let \(f(x) = \sqrt{2x}\). The difference quotient for the given function at \(x = 3\) is \(Q(h) = \frac{f(3 + h) - f(3)}{h} = \frac{\sqrt{6 + 2h} - \sqrt{6}}{h}\) for nonzero \(h\). Rationalize the numerator of \(Q(h)\) and simplify the resulting expression. Evaluate the simplified expression at \(h = 0\).
1.5  
<table>
<thead>
<tr>
<th></th>
<th>26, 36, 48, 60, 72, 86, 96, 110, 114, 116</th>
</tr>
</thead>
</table>
| 1.5 | (a) Solve the equation $6 - \sqrt{3} + 2x = 2x + 3$ for $x$.  
(b) Solve the following equation in the variable $x$ by factoring $4x^4 + 15x^2 - 4 = 0$.  
(c) (similar to problem #116) A large pond is stocked with fish. The fish population $P(t)$ is modeled by the parabolic equation $P(t) = 2t^2 - 32t + 258$, where $t$ is the number of days since the fish were first introduced into the pond. How many days will it take for the fish population to reach 162? Give reasoning for the two answers.  
How many days will it take for the fish population to reach the minimum population? What is the minimum population? Show, also all the above answers by graphing the associated parabola modeling the fish population. |

1.6  
<table>
<thead>
<tr>
<th></th>
<th>22, 26, 30, 34, 38, 44, 52, 58, 64, 68</th>
</tr>
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</table>
| 1.6 | (a) Find the value of $x$ from the following given proportional equations:  
\[
\frac{x}{y + 280} = \frac{30}{y + 35} = \frac{6}{y} \quad \text{(similar to problem #52)}
\]  
(b) (similar to problem #63) Betty and Karen have been hired to paint the houses in a new development. Working together the women can paint a house in two-thirds the time it takes Karen working alone. Betty takes 6 hours to paint a house alone. How long does it take Karen to paint a house working alone? |

1.7  
<table>
<thead>
<tr>
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<th>22, 34, 44, 50, 60, 62, 68, 88, 90, 101, 106, 111, 116</th>
</tr>
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</table>
| 1.7 | (a) (example #9 in text) The relationship between the two temperature scales Celsius($C$) and Fahrenheit($F$) is given by the equation $F = \frac{9}{5} C + 32$. Find the range of temperatures in Fahrenheit scale if the range of temperatures in the Celsius scale is given by $10 \leq C \leq 20$. (similar to example #9)  
(b) Solve the following inequality in the variable $x$ and write your answer for the solution set using the interval notation:  
\[
\frac{x^2 - 4}{x + 3} \geq 0 \quad \text{or} \quad \frac{x^2 - 8}{2x + 6} \geq 0.
\] |

1.8  
<table>
<thead>
<tr>
<th></th>
<th>8, 22, 28, 32, 34, 42, 46, 66, 94, 100, 106</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8</td>
<td>(a) Given that the tangent line to a circle is perpendicular to the adjoining radius at the point of contact, find the equation of the tangent line to the circle $(x - 1)^2 + (y - 2)^2 = 25$ at the point $(4, -2)$.</td>
</tr>
</tbody>
</table>

1.10  
|   | 10, 14, 16, 20, 24, 26, 28, 30, 32, 38, 56, 72, 76 |

2.1  
|   | 8, 12, 20, 22, 30, 34, 36, 40, 44, 46, 48, 58, 62, 71, 76 |
2.2 6, 10, 12, 22, 24, 28, 40, 46, 50, 52, 54, 56, 58, 60, 62, 66, 81, 83

2.3 6, 8, 20, 28, 34, 43

2.4 6, 10, 12, 18, 22, 26, 30

(a) (also section 1.4) Let \( f(x) = 2x^2 + 5 \). The difference quotient for the given function at \( x = 3 \) is \( Q(h) = \frac{f(3 + h) - f(3)}{h} \) for nonzero \( h \).

Rationalize the numerator of \( Q(h) \) and simplify the resulting expression. Evaluate the simplified expression at \( h = 0 \).

2.5 6, 8, 10, 26, 44, 54, 76, 78, 82, 86

(a) (also sections 2.7 and 3.7) Using the transformations coordinates (shifting, reflecting, and stretching) or otherwise solve the following problem: For the function \( f(x) \) as defined below, determine the following: (a) the domain and range of \( f(x) \), (b) the vertical and horizontal asymptotes, (c) \( x \) and \( y \) intercepts, (d) the inverse function \( f^{-1}(x) \), (e) the graph of \( f(x) \). Is \( f(x) \) its own inverse? Yes or No

\[
 f(x) = \begin{cases} 
 2x & \text{if } x \neq 2 \\
 2 & \text{if } x = 2 
\end{cases}
\]

(b) (also section 3.1) Graph the following: \( y = 2x^2 - 8x + 6 \)

(c) (also section 3.1) Graph the following: \( y = 8x - 6 - 2x^2 \)

(d) (also section 3.1) Graph the following: \( y = x^3 + 2x^2 - 8x \)

2.6 6, 8, 10, 12, 14, 22, 24, 36, 40, 44, 46, 52, 64

(a) Given \( f(x) = \sqrt[4]{4x} \) and \( g(x) = x^4 + 9 \), evaluate \( f \circ g(2) = f(g(2)) \) and \( g \circ f(2) = g(f(2)) \).

2.7 12, 14, 20, 22, 28, 34, 38, 44, 54, 82, 88

(a) (also sections 2.5 and 3.7) Using the transformations coordinates (shifting, reflecting, and stretching) or otherwise solve the following problem: For the function \( f(x) \) as defined below, determine the following: (a) the domain and range of \( f(x) \), (b) the vertical and horizontal asymptotes, (c) \( x \) and \( y \) intercepts, (d) the inverse function \( f^{-1}(x) \), (e) the graph of \( f(x) \). Is \( f(x) \) its own inverse? Yes or No

\[
 f(x) = \begin{cases} 
 2x & \text{if } x \neq 2 \\
 2 & \text{if } x = 2 
\end{cases}
\]

Modeling with Functions 8, 10, 18, 24, 30

3.1 10, 18, 20, 40, 42, 44, 46, 64, 66, 77

(a) (also section 2.5) Graph the following: \( y = x^3 + 2x^2 - 8x \)

(b) (also section 2.5) Graph the following: \( y = 8x - 6 - 2x^2 \)
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<tbody>
<tr>
<td>3.2</td>
<td>6, 18, 20, 22, 28, 32, 40, 48</td>
<td>(a) (also section 2.5) Graph the following: ( y = x^3 + 2x^2 - 8x )</td>
</tr>
<tr>
<td>3.3</td>
<td>4, 8, 10, 14, 16, 24, 26, 36, 44, 54, 64</td>
<td>(a) Solve the following equations in the variable ( x ) by using synthetic division and locating the rational roots first (or otherwise solve) ( 2x^4 - 5x^3 + 10x^2 - 20x + 8 = 0 )</td>
</tr>
<tr>
<td>3.4</td>
<td>8, 12, 16, 30, 34, 42, 48, 56, 68, 74, 88, 104</td>
<td>(a)</td>
</tr>
<tr>
<td>3.5</td>
<td>6, 8, 14, 18, 20, 28, 38, 54, 64, 68</td>
<td>(a) Find the real and imaginary parts of the complex number ( 2 + 3i ) and ( 5 - 2i )</td>
</tr>
</tbody>
</table>
| 3.6     | 8, 12, 14, 24, 32, 34, 44, 48, 56, 62, 64, 66                             | (a) (also sections 2.5 and 2.7) Using the transformations coordinates (shifting, reflecting, and stretching) or otherwise solve the following problem: For the function \( f(x) \) as defined below, determine the following: (a) the domain and range of \( f(x) \), (b) the vertical and horizontal asymptotes, (c) \( x \) and \( y \) intercepts, (d) the inverse function \( f^{-1}(x) \), (e) the graph of \( f(x) \). Is \( f(x) \) its own inverse? Yes or No 

\[
f(x) = \begin{cases} 
2x & x \neq 2 \\
2 & x = 2 
\end{cases}
\]

(b) Graph the following: \( y = \frac{x^3 + x^2}{x^2 - 9} \) |
<p>| 4.1     | 8, 10, 16, 18, 22, 34, 54                                                 |                                                                  |
| 4.2     | 12, 16, 20                                                                |                                                                  |
| 4.3     | 8, 10, 12, 14, 16, 18, 22, 24, 26, 30, 32, 36, 46, 58, 62, 64, 68, 86, 88, 90 | Write your answer as a ratio of two integers in lowest terms (a) ( \log_8 32 = ) |
| 4.4     | 8, 10, 16, 18, 20, 22, 26, 28, 30, 32, 36, 42, 46, 48, 52, 56, 58, 70, 71 | Write your answer as a ratio of two integers in lowest terms (a) ( \log_3 81 - \log_3 4^2 + \log_3 \frac{16}{3} = ) |</p>
<table>
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</table>
| 4.5     | 4, 6, 10, 12, 16, 26, 30, 32, 34, 38, 44, 46, 48, 54, 60, 66, 76, 80 | (a) Solve for $x$ in: $16^{(x^2+3x^3)} = 2^{(4-3x^2)}$ or in $16^{x^2} = 8^{(4+5x^3)}$ or in $\log_b(4x^2 + 3) - \log_b\left(\frac{1}{x^2 + 3}\right) = \log_b 13$.  
(b) Solve for $x$ in $\log_b(x^2 + 1) + \log_b 2 = \log_b x + \log_b 5$ |
| 4.6     | 6, 10, 14, 18, 24, 26, 32, 36, 42 | |
| 10.1    | 8, 12, 14, 38, 42, 44, 48, 58, 60, 66, 70, 74 | |
| 10.2    | 12, 20, 30, 32, 38, 46 | (a) (also section 10.3) One group of customers bought 8 deluxe hamburgers, 6 orders of large fries, and 6 large colas for $26.10$. A second group ordered 10 deluxe hamburgers, 6 large fries, and 8 large colas for $31.60$. Is there sufficient information to determine the price of each food item? If not, construct a table showing the various possibilities assuming that the hamburgers cost between $1.75$ and $2.25$, the fries between $0.75$ and $1.00$, and the colas between $0.60$ and $0.90$. |
10.3  
| 6, 10, 16, 20, 38, 40, 54, 56 |

(a) Use the reduced row echelon form of the augmented matrix to solve

\[
\begin{align*}
3x + 2y + 3z &= 10 \\
4x + 3y + 5z &= 15 \\
2x + 3y + 6z &= 14
\end{align*}
\]

and then check your answer for the variable \( x \) only by using the Cramer’s rule.

(b) Terry spent exactly $28 on exactly 10 Ties. Just 3 kinds are available, costing $2, $3, and $4 per Tie, respectively. Find a general solution for the number of Ties of each kind that can be bought by using elementary row operations, and list three possible (feasible) solutions from the general solution if Terry must buy at least one Tie of each kind.

\[ \text{Answer: A General Solution:} \]

\begin{center}
\begin{tabular}{|c|c|c|}
\hline
 & $2$ Ties & $3$ Ties & $4$ Ties \\
\hline
First feasible solution & & & \\
\hline
Second feasible solution & & & \\
\hline
Third feasible solution & & & \\
\hline
\end{tabular}
\end{center}

(c) (also section 10.2) One group of customers bought 8 deluxe hamburgers, 6 orders of large fries, and 6 large colas for $26.10. A second group ordered 10 deluxe hamburgers, 6 large fries, and 8 large colas for $31.60. Is there sufficient information to determine the price of each food item? If not, construct a table showing the various possibilities assuming that the hamburgers cost between $1.75 and $2.25, the fries between $0.75 and $1.00, and the colas between $0.60 and $0.90.

10.4  
| 6, 8, 10, 12, 14, 16, 20, 31, 32, 33, 38, 40, 46 |

(a) Evaluate the matrix product

\[
\begin{bmatrix}
5 & 2 \\
-1 & 3
\end{bmatrix}
\begin{bmatrix}
4 & 3 \\
2 & 6
\end{bmatrix}
\]

10.5  
| 4, 12, 14, 18, 26, 30, 40, 46 |

(a) Find the inverse matrix of \( A = \begin{bmatrix}
5 & 2 \\
4 & 2
\end{bmatrix} \) by elementary row operations

\[
\begin{bmatrix}
5 & 3 & 4 \\
3 & 2 & 3
\end{bmatrix}
\begin{bmatrix}
5 & -6 & -1 \\
-12 & 14 & 3
\end{bmatrix}
\]

(b) Given that \( \begin{bmatrix}
5 & -6 & -1 \\
3 & -3 & -1
\end{bmatrix} \) are inverses of each other, by using the inverse of the appropriate matrix, solve the system of equations:

\[
\begin{align*}
5x + 3y + 4z &= 15 \\
3x + 2y + 3z &= 10 \\
6x + 3y + 2z &= 14
\end{align*}
\]
Find the partial fraction decomposition of the following rational functions:

(a) \[ \frac{2x+3}{(x-1)(x+1)} \]

(b) \[ \frac{2x^3+7x+5}{(x^2+x+2)(x^2+1)} \]

(c) \[ \frac{2x^2-x+8}{(x^2+4)^2} \]

(d) \[ \frac{x^5-2x^4+x^3+5}{x^3-2x^2+x-2} \]

(a) Graph the following inequalities and shade the solution set:

\[ \begin{align*}
&x^2 + y^2 - 4x - 6y - 12 \leq 0, \\
&3x + y \geq 14
\end{align*} \]

Also find the common points of the two boundaries. Note that the first boundary equation is a circle of radius 5 centered at (2,3).

(a) Find the coefficient of \( x^4 y^3 \) in the binomial expansion of

\[ \left(3x - \frac{1}{3} y\right)^7 \]