MAT 141 REVIEW SHEET FOR THE FINAL EXAMINATION

SECTION ONE: APPLICATIONS OF FUNCTIONS.
   (i) A couple who wishes to have $18,500 in three years, is depositing $16,445 into a savings account where the bank will pay a rate that is continuously compounded. At what rate will the bank pay in order for the couple to have $18,500 in three years?

SECTION TWO: SOLVING EXPONENTIAL AND LOGARITHMIC EQUATIONS.
Solve for x.
   (i) \( \log_2(3x + 2) - \log_2(x - 5) = 3 \).
   (ii) \( 6e^{(x^2) - 9} = 18 \).

SECTION THREE: SKETCHING FUNCTIONS.
   (i) Sketch the function, \( f(x) = \sin(2x) \).

SECTION FOUR: SOLVING TRIGONOMETRIC EQUATIONS.
Find all x, such that \( 0 \leq x \leq 2\pi \).
   (i) \( \cos(2x) + \cos(x) = 0 \).

SECTION FIVE: FINDING TRIGONOMETRIC VALUES BASED ON GIVEN INFORMATION.
   (i) Suppose that \( \cos(t) = 3/5 \) and \( \tan(t) = -4/3 \). Find \( \cot(t) \), \( \csc(t) \), and \( \sec(t) \).

SECTION SIX: DETERMINING THE POLAR AND RECTANGULAR COORDINATES.
Convert each of the following points in polar coordinate form into rectangular coordinates.
   (i) \((6\sqrt{2}, \frac{11\pi}{6})\)
   (ii) \((7\sqrt{3}, \frac{5\pi}{3})\)
   Convert each of the following points in rectangular coordinates into polar coordinates, where \( r > 0 \) and \( 0 \leq \theta \leq 2\pi \).
   (iii) \((6\sqrt{3}, -6)\)
   (iv) \((-\sqrt{6}, -\sqrt{2})\)

SECTION SEVEN: TWO AND THREE DIMENSIONAL VECTORS
   (i) Express the vector \( \mathbf{v} \) with initial point \( P \) and terminal point \( Q \) in component form.
      (a) \( P(4, 6) \) \( Q(9, 11) \) \( (b) P(-5, -7) \) \( Q(1, -8) \)
   (ii) Suppose \( \mathbf{u} = -5\mathbf{j} \) and \( \mathbf{v} = -\mathbf{i} - \sqrt{3}\mathbf{j} \). Find the dot product of \( \mathbf{u} \) and \( \mathbf{v} \) and find the angle between \( \mathbf{u} \) and \( \mathbf{v} \) to the nearest angle.
   (iii) Suppose that \( \mathbf{u} = \mathbf{i} + 5\mathbf{j} \) and \( \mathbf{v} = 6\mathbf{i} - \mathbf{j} \). Find the dot product of \( \mathbf{u} \) and \( \mathbf{v} \) and find the angle between \( \mathbf{u} \) and \( \mathbf{v} \) rounded off to the nearest degree.

SECTION EIGHT: FINDING THE EQUATION OF A LINE AND/OR A PLANE USING 3-D VECTORS.
   (i) Find parametric equations for the line that passes through the point \( (4, -3, 1) \) and is parallel to the vector \( \mathbf{v} = <3, -4, 2> \).
   (ii) A plane has normal vector \( n=\langle 4, -6, 3 \rangle \) and passes through the point \( P(3, -1, -2) \). Find the equation of the plane.
MAT 141 Review for Series and Sequences

1. Find the common difference, the 8th term, and the nth term of the sequence?
   \[ 2, 5, 8, 11, 14, \ldots \]

2. \( a_5 = 28, a_{16} = 61 \); find the common difference and the nth term?

3. Find the partial sum of the arithmetic series?
   (a) \( 1 + 5 + 9 + \ldots + 401 \)
   (b) \(-3 + \left(\frac{-3}{2}\right) + 0 + \frac{3}{2} + 3 + \ldots + 30 \)

4. \( \sum_{k=1}^{8} (k^3 + k^2 - 4k - 3) \); find the sum.

5. \( 1 + \frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \ldots \); find the sum of the infinite series if it exist. State whether or not if the series converges or diverges.

6. Find the common ratio, the 5th term, and the nth term of the geometric sequence \( 2, 6, 18, 54, \ldots \).
7. Find the partial sum of the geometric series
\[ 1 + 3 + 9 + 27 + \ldots + 2187 \]
1) Solve the following equations:
   a) $8^{3x+4} = 45$
   b) $x^2 e^x + xe^x - 6e^x = 0$
   c) $\log_x (2-x) = 3$

2) Use properties of logarithms to:
   a) Expand
   \[ \log \left( \frac{x^5 y^2}{a^3 b^4} \right) \]
   b) Condense
   \[ 5 \log_4 x + \frac{1}{2} \log_4 x - 6 \log_4 (x-1) - 2 \log_4 (x^2 - 5) \]

3) Let $u = \ln x$ & $v = \ln y$, write the following in terms of $u$ & $v$:
   a) $\ln(\sqrt{x} y^2)$
   b) $\ln \left( \frac{3 \sqrt{x^5} y^4}{\sqrt{y}} \right)$

4) Find the missing part of the circle

   a) Find arc length
   b) Find the radius $R$

5) Evaluate $\cos(45^\circ) \cos(60) - \sin(45^\circ) \sin(60)$. 

6) Simplify
   \[ \frac{\sin x}{\csc x} + \frac{\cos x}{\sec x} \]
7. Find all exact solutions of the trigonometric equations. Use radian measures for angles.
   a) \(2\cos x + 1 = 0\)  
   b) \(\tan^2 x = 1\)  
   c) \(4\sin^2 x - 4\sin x + 1 = 0\)

8. Find all solutions to \(2\cos x + \sqrt{2} = 0\)

9. Convert \(x^2 + y^2 = 16\) to polar form

10. Convert \(r = -2\csc \theta\) to rectangular coordinate

11. Let \(\vec{v} = <5\sqrt{3}, -5>\)

12. Given vectors \(\vec{u} = <-4, 5>\) and \(\vec{v} = 3\vec{i} - 2\vec{j}\). Find:
   a) \(2\vec{u}\)  
   b) \(\vec{u} + \vec{v}\)  
   c) \(|\vec{u} + \vec{v}|\)  
   d) \(3\vec{u} - 5\vec{v}\)  
   e) \(\vec{u} \cdot \vec{v}\)  
   f) are \(\vec{u}\) & \(\vec{v}\) perpendicular? why/why not?

13. Find work done by \(\vec{F} = 3\vec{i} - 5\vec{j}\) in moving an object from point \((2, 2)\) to the point \((7, -13)\).

14. Are vectors \(\vec{u} = <-2, 6>\) and \(\vec{v} = <4, 2>\) orthogonal?

15. Find an equation of the plane with normal vector \(\vec{n} = <4, -6, 3>\) and passes through the point \((3, -1, -2)\).

16. Label all missing parts of the unit circle below.
13) Label all missing parts of the unit circle below.