VECTOR VALUED FUNCTIONS AND MOTION IN SPACE


- **READING:** Read the following parts from the Calculus Biographies that I have given (online supplement of our textbook):
  
  (a) History of Vectors
  (b) History of Multivariable Calculus
  (c) Biographies of the following mathematicians (and scientists):
     - Josiah Willard Gibbs (1839–1903)
     - Johannes Kepler (1571–1630)

- **SOLVE THE BELOW EXERCISES FROM YOUR TEXTBOOK.**
  Of course, solve as many exercises as you need to be sure that you have learned the concepts and can do computations without error but I require you to be prepared to solve some of the following exercises next week:

  **Section 10.1 Vector Functions and Their Derivatives (pages 552–554):**
  Exercises 4, 6, 7, 12, 18, 22–24, 26–28, 31–34.

  **Section 10.2 Integrals of Vector Functions (pages 558–560):**
  Exercises 4, 9, 12, 14, 18, 19, 22–28.

  **Section 10.3 Arc Length in Space (pages 563–564):**
  Exercises 8, 10, 12, 16–19.

  **Section 10.4 Curvature of a curve (pages 569–571):**
  Exercises 2, 5–8, 10, 16, 18, 19, 22, 24.

  **Section 10.5 Tangential and Normal Components of Acceleration (pages 574–575):**
  Exercises 2, 6, 8, 10, 16–21, 25–28.

  **Review.** Be sure that you can answer the Questions to Guide Your Review at the end of Chapter 10 at page 579.

  **Review.** For an overall review of Chapter 10, solve a few of the exercises in each group of exercises in the Practice and Additional Exercises at the end of Chapter 10 at pages 580–581.

  **Review.** In your course MAT 1029 ANALYTIC GEOMETRY in the previous term, you have seen vectors and the geometry of space, the conic sections (parabola, ellipse and hyperbola) and polar coordinates. See Chapters 8 and 9 from our textbook to review these topics from Analytic Geometry:

  - Vectors and the Geometry of Space, Conic Sections and Polar Coordinates: Three-dimensional Coordinate Systems; Vectors; The Dot Product; The Cross Product; The Distributive Law for Vector Cross Products; Lines and Planes in Space; Cylinders and Quadric Surfaces; Polar Coordinates; Graphing in Polar Coordinates; Conics and Parametric Equations; The Cycloid.

  → **All of chapter 9 and Appendix A.10, and sections 8.1, 8.2 and 8.5 of chapter 8.**

  • Solve the following question to review the concepts that we have seen for a space curve:

  → See the next page.
• For the space curve 
\[ r(t) = (3 \sin t) \mathbf{i} + (3 \cos t) \mathbf{j} + 4t \mathbf{k} \]
find the following:

(a) Find the velocity vector \( \mathbf{v} \).

(b) Find the speed \( |\mathbf{v}| \).

(c) Find the length of the curve from \( t = 0 \) to \( t = \pi/2 \).

(d) Find the arclength parameter \( s \) along the curve from the point where \( t = 0 \).

(e) Find the acceleration vector \( \mathbf{a} \).

(f) Find the unit tangent vector \( \mathbf{T} \).

(g) Find \( \frac{d\mathbf{T}}{dt} \).

(h) Find \( \left| \frac{d\mathbf{T}}{dt} \right| \).

(i) Find the principal unit normal vector \( \mathbf{N} \).

(j) Find the curvature \( \kappa \).

(k) Find the tangential and normal scalar components of acceleration vector \( \mathbf{a} \), that is, find the scalars \( a_T \) and \( a_N \) such that \( \mathbf{a} = a_T \mathbf{T} + a_N \mathbf{N} \).

(l) Find the binormal vector \( \mathbf{B} \).

(m) Find the torsion \( \tau \).