MULTIVARIABLE CALCULUS CONCEPTS (SEMESTER 1)

Chapter 9 – Techniques of Integration

Integration by Parts
Trig Integration
Integration using Trig Substitution
Integration using Partial Fractions
Integration using Miscellaneous Additional Strategies

Chapter 11 – Sequences and Series

Determining whether a sequence or series converges
Deriving a Taylor polynomial (of a finite number of terms) based on given information
Deriving a Taylor series for a transcendental function by comparing derivative values

Chapter 14 – Vectors in two and three space

Dot and Cross Products of vectors
Parametric and vector equations for lines and planes in two and three space
Rectangular equations for planes in three space
Volume of a parallelpiped $\left\|\vec{a}\times\vec{b}\cdot\vec{c}\right\|$
Distance from a point to a plane (three space) $d=\dfrac{\left|Ax_0+By_0+Cz_0+D\right|}{\sqrt{A^2+B^2+C^2}}$
Distance between skew lines in space $\dfrac{\left|\overrightarrow{P_1Q_1}\times\overrightarrow{P_2Q_2}\cdot\overrightarrow{P_1P_2}\right|}{\left\|\overrightarrow{P_1Q_1}\times\overrightarrow{P_2Q_2}\right\|}$
Distance from a point to a line (in space)
Vector (or parametric equations) for line perpendicular to a given line in space
Vector or parametric equations for the line that is the intersection of two planes

Chapter 15 – Vector-valued functions

Graphs of paths of vector-valued functions, curves in two and three space
Tangent lines and normal planes to curves
Limits, derivatives, and integrals of vector-valued functions—recalling that these "answers" are themselves VECTOR-VALUED FUNCTIONS!
Motion $\vec{r}(t) = \text{position}$, $\vec{r}\,'(t) = \text{velocity}$, $\vec{r}\,''(t) = \text{acceleration}$, $\left\|\vec{r}\,'(t)\right\| = \text{speed}$

Curvature $K = \dfrac{|y''|}{\left(1+(y')^2\right)^{3/2}} = \dfrac{|f'g''-g'f''|}{\left((f')^2+(g')^2\right)^{3/2}} = \dfrac{\left|\vec{r}\,'(t)\times\vec{r}\,''(t)\right|}{\left\|\vec{r}\,'(t)\right\|^3}$ (two and three space)

Radius of circle of curvature $r = \dfrac{1}{K}$
Finding center of circle of curvature (in two space)
Tangential and normal components of acceleration $a_T = \dfrac{\vec{r}\,'(t)\cdot\vec{r}\,''(t)}{\left\|\vec{r}\,'(t)\right\|}$ $\qquad a_N = \dfrac{\left\|\vec{r}\,'(t)\times\vec{r}\,''(t)\right\|}{\left\|\vec{r}\,'(t)\right\|}$

Chapter 16 – Partial Derivatives and their Uses

Multivariable functions $z = f(x,y)$, $w = f(x,y,z)$
Level curves to surfaces formed by multivariable functions
Limits of multivariable functions
Partial Derivatives
Increments and Differentials and Related Rates
Chain Rules
Tangent planes and normal lines to surfaces
Directional Derivatives $\qquad \nabla f = f_x\vec{i} + f_y\vec{j} + f_z\vec{k}$ and $\nabla f \perp$ the surface from which it was computed
Extrema on surfaces (maxima, minima, and saddle points)
Constrained Extrema – solving by setting partials to zero, solving using LaGrange Multipliers