MAP 2302 – INTROD TO  DIFF EQUATIONS                    FLORIDA INT'L UNIV.

Review for Test #1

REMEMBER TO BRING AN 8’’x11”  BLUE EXAM BOOKLET FOR THE TEST

             MAIN PROBLEM SOLVING TECHNIQUES:

1.      How to test if an ODE is exact and how to solve exact ODEs.

2.     How to find integrating factors of first-order ODEs and how to use them to solve ODEs.

3.   How to solve separable first-order ODEs by separating and integrating both sides.    
4.      How to solve homogeneous first-order ODEs by using the substitution y(x) = x.v(x).  
5.      How to solve linear first-order ODEs by using the integrating factor ep(x).dx.

6.      How to solve Bernoulli ODEs by using the substitution v = y1-n.

7.     How to solve vertically *downward* & *upward* motion problems under constant gravity when  
 the air resistance is:  (a) proportional to v,  and (b) proportional to v2.

8.   How to solve horizontal motion problems on a flat surface when friction is involved and the   
       air resistance is:   (a) proportional to v (b) proportional to v2.

9.    How to solve problems involving  (a) radioactive decay,   (b)  Newton's law of cooling.   
10.  How to solve problems involving (a) simple population growth, (b) realistic growth.

11. How to find the orthogonal trajectories of a given family of curves in the plane.

              MAIN DEFINITIONS:

The total derivative of a function,  Exact first-order ODEs,  Integrating factor of a non-exact first order ODE,  Integrating factor for linear first order ODEs,  Homogeneous functions of deg. k,  Orthogonal trajectories, Newton's second law of motion, The coefficient of friction, Law of radioactive decay, Newton's law of cooling,  Simple population logistic law,  Realistic population logistic law.

             MAIN THEOREMS & RESULTS:  
1.     Basic Existence & Uniqueness theorem for first-order ODEs  (Theorem 1.1)

2.     Test for exactness of a first-order ODE (Theorem 2.1).   My(x,y) = Nx(x,y)

3    Transforming a homogeneous first-order ODE into a separable one (Theorem 2.3)  
       Put  y(x)  =  x . v(x)  and solve the resulting separable equation for v(x).    
4.      Solution of  linear first-order ODEs by using integrating factors  (Theorem 2.4)  
       The integrating factor  =  ep(x).dx   (ignore constant of  integration). 5.      Transforming  Bernoulli ODEs into linear first-order ODE  (Theorem 2.5)  
 dy/dx + p(x).y = q(x). yα.  Use the substitution v(x) = y(x)1-α solve for v(x), then get y(x).

6.      Two cases where you can find integration factors of non-exact ODEs (Theorem 2.6)  
  (a)  If  [My(x,y)-Nx(x,y)] / N(x,y) =  p(x), then integrating factor is e p(x).dx .  
  (b)  If  [My(x,y)-Nx(x,y)] / M(x,y) = q(y), then integrating factor is e - q(y) dy.

7.   Solving the following ODEs and finding and plugging in appropriate initial conditions:

(a) mdv/dt = mg – k|v|  (b) mdv/dt = mg - kv2.

[vertically downward motion under gravity & air resistance of two kinds]

(c) mdv/dt = - mg – k|v|  (d) mdv/dt = - mg - kv2.

[vertically upward motion under gravity & air resistance of two kinds]

8.   (a) mdv/dt = - N- k|v|)  (b) mdv/dt = - N- kv2 , where Friction = N.

[horizontal motion under gravity & air resistance of two kinds]

( = coefficient of friction,  N = normal force exerted by surface).

9.    (a) dQ/dt  = - Q    (b)  dT/dt =  -.(T-T0)  [Radioactive decay & Cooling problems]

10.  (a) dP/dt  = P  (b)  dP/dt =  P(1 – P/K)[Simple & Realistic Population growth problems]