

**Math 2250 Extra Credit Problems**  
**Chapter 2**  
**February 2007**

**Due date:** See the internet due date for 3.1, which is the due date for these problems. Records are locked on that date and only corrected, never appended.

**Submitted work.** Please submit one stapled package per problem. Kindly label problems Extra Credit. Label each problem with its corresponding problem number. You may attach this printed sheet to simplify your work.

**Problem ExL1.1. (maple lab 1)**

Solve the following quadratic equations using maple, as in Example 1 of maple lab 1, then use maple to reconstruct the quadratic equation from the roots. You may submit this problem only for score increases on maple lab 1.

- (a)  $x^2 + x + 1 = 0$
- (b)  $8x^2 + 2x + 15 = 0$
- (c)  $5x^2 - 250x + 3125$

**Problem ExL1.2. (maple lab 1)**

Plot the following functions in maple. Print the plots in size  $2 \times 2$  inches, approximately. You may submit this problem only for score increases on maple lab 1.

- (a)  $f(x) = x^2 - 7x + 5$  on  $-1 \leq x \leq 3$
- (b)  $f(x) = |x - 1| + |2x + 3|$  on  $-5 \leq x \leq -1$
- (c)  $f(x) = e^x \sinh(x - 1) + e^{-x} \sinh(2x - 3)$  on  $-2 \leq x \leq 1$
- (d)  $f(x) = \ln |\sin(2x) + \cos(3x) + 3|$  on  $-2\pi \leq x \leq 3\pi$

**Problem Ex2.1-8. (Verhulst equation)**

Solve  $x'(t) = 4x(t)(7 - x(t))$ ,  $x(0) = 11$  by separation of variables and partial fractions. Sketch the solutions, including equilibria. Check your answer from the textbook answer for 2.1-7.

**Problem Ex2.1-16. (population dynamics)**

Assume a population  $P(t)$  of alligators with  $P(0) = P_0$  satisfies the Verhulst equation  $P' = (aP - b)P$  with birth rate  $aP_0^2 = 11$  and death rate  $bP_0 = 12$  [see 2.1-18 in the textbook]. Find the equilibrium solutions, sketch them and a suitable sampling of other possible solutions. Determine the time  $t$  at which  $P(t) = M/10$ , where  $M = b/a$  is the threshold population. This problem corrected 7 Feb. Yes,  $aP_0^2 = 11$  is correct.

**Problem Ex2.2-10. (Separation of variables, Verhulst DE)**

Solve  $x'(t) = x(t)(3 - x(t))$  by separation of variables and partial fractions. Sketch the solutions, including equilibria. Check your answer from the textbook answer for 2.2-4.

**Problem Ex2.3-10. (Parachute)**

Assume model (1)  $v' = -32 - 0.15v$  before the chute opens and model (2)  $v' = -32 - 1.5v$  after. Suppose the fall from 10000 feet uses (1) for 15 seconds. Find the trip time from 10000 feet to the ground (0 feet).

**Problem Ex2.3-20. (Terminal speed)**

Assume model  $v' = -32 + 0.075v^2$  for a parachutist who pulls the ripcord at 10000 feet at speed 10 feet per second. Find his terminal speed and the trip time to the ground from 10000 feet.

**End of extra credit problems chapter 2.**