

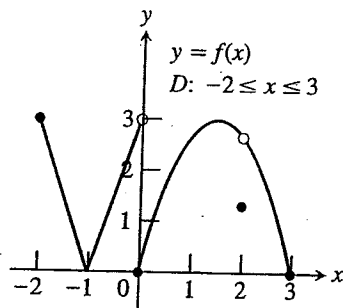
APPM 1350 – Forgiveness Exam 1  
Wednesday, 30 April 2008 A.D.

**INSTRUCTIONS:** Books, notes, flying monkeys and electronic devices are not permitted. Write your (1) name, (2) student number, (3) instructor's name, and (3) when your lecture meets on the front of your bluebook. Also make a scoring table, with places for 6 problems, plus a total score. This exam has 6 problems, on both sides of this sheet, plus the Particle problem that can replace any other 15-point problem. Work all 6 problems. Start each problem on a new page. Show your work. **BOX** in your answers. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit.

1. (15 points) Are the following functions odd, even or neither?

- (a)  $(-x)^{2/3}$   
(b)  $\frac{x}{x^2 - 1}$   
(c)  $\frac{\cos x}{x + 1}$

2. (15 points) Below is the graph of a function over a closed interval  $D$ .  
At what domain points does the function appear to be



- (a) differentiable?  
(b) continuous but not differentiable?  
(c) neither continuous nor differentiable?

3. (20 points) Calculate the following limits. If the limit does not exist, write DNE.

(a)  $\lim_{x \rightarrow -3} \frac{x + 3}{x^2 + 4x + 3}$

(b)  $\lim_{s \rightarrow 1} \frac{s - 1}{\sqrt{s + 3} - 2}$

(c)  $\lim_{\theta \rightarrow -\pi/2} \cos(\tan(\pi/2 + \theta))$

4. (15 points) Consider the function  $s = \frac{x^2 - 3x + 1}{x^2}$

- (a) On which intervals is  $f$  twice differentiable?  
(b) Calculate its first and second derivatives (wherever they exist).

5. (15 points)

- (a) What are the conditions for a function  $f$  to be continuous at a point  $x = c$ ?  
(b) Find the continuous extension of the function  $f(t) = t \sin(1/t)$ ,  $t \neq 0$ .

6. (20 points) An object is thrown from the ground straight up into the air with a velocity of 128 ft/sec. It reaches a height of  $s(t) = 128t - 16t^2$  feet after  $t$  seconds.

- (a) Calculate its velocity.  
(b) When does it reach its maximum height? When does it hit the ground?  
(c) What is the average velocity of the object while it is ascending?

**Extra credit:** (15 points) We suspect that three particles originated as by-products of the same molecular explosion, but we are not certain of what happened at the time of the explosion. The particles move along the same line. Particle  $X$  is oscillating, so that at time  $t$  from its birth it is  $f(t) = \frac{\sin(t)}{t}$  microns away from a reference point  $O$ . Particle  $Z$  is slowly moving away, so that at time  $t$  it is  $g(t) = t + 1$  from  $O$ . All we know about particle  $Y$  is that it is always trapped between  $X$  and  $Z$ . Is our suspicion on their common origin correct? (Hint: You want to check that the past trajectories of all particles approach the same point as  $t$  approaches zero.)