

MATH 112 - Winter 2005  
Exam 1, Version 1 - Hints and Answers

1. (a) (3 points) HINT:  $f'(x)$  crosses the  $x$ -axis when  $f(x)$  has a horizontal tangent line.  
ANSWER:  $x = 2, 5,$  and  $8$
  - (b) (3 points) HINT:  $g(x)$  has a horizontal tangent line when  $g'(x)$  crosses the  $x$ -axis  
ANSWER:  $x = 3, 6,$  and  $10$
  - (c) (2 points) HINT:  $f'(x)$  is above the  $x$ -axis when  $f(x)$  is increasing  
ANSWER: from  $0$  to  $2$  and from  $5$  to  $8$
  - (d) (2 points) HINT:  $g(x)$  decreases when  $g'(x)$  is below the  $x$ -axis  
ANSWER: from  $0$  to  $3$  and from  $6$  to  $10$
  - (e) (1 point) ANSWER: iv
2. (4 points each)
    - (a) HINT:  $y = x^{1/3} - 4x^{-2/3}$   
ANSWER:  $\frac{dy}{dx} = \frac{1}{3}x^{-2/3} - 4\left(-\frac{2}{3}x^{-5/3}\right)$
    - (b) HINT:  $R(q) = q^5 + 2q^2$   
ANSWER:  $R'(q) = 5q^4 + 4q$
    - (c) HINT:  $s = 5t^5 - 4t + 1$   
ANSWER:  $\frac{ds}{dt} = 25t^4 - 4$
3. (a) (3 points) HINT: You're looking for  $\frac{A(4 + 0.5) - A(4)}{0.5}$ . So, take  $t = 4$  and  $m = 0.5$  in the given formula.  
ANSWER: 11.5 thousand gallons per hour
  - (b) (4 points) HINT: Take  $t = 6$  and  $m = h$  and use the given formula to compute  $\frac{A(6 + h) - A(6)}{h}$ . Multiply both sides by  $h$  to get  $A(6 + h) - A(6) = 8h - h^2$ . Set this equal to 16 and solve for  $q$ .  
ANSWER:  $h = 4$
  - (c) (4 points) HINT: You want to compute  $A'(8.73)$ . You have a formula for the slope of the secant line through  $A(t)$  at  $t$  and  $t + m$ . To get  $A'(t)$ , let  $m$  go to zero:  $A'(t) = 20 - 2t$ .  
ANSWER:  $A'(8.73) = 2.54$  thousand gallons per hour

- (d) (4 points) HINT: You know that  $A(2) = 6$  and you want  $A(5)$ . Take  $t = 2$  and  $m = 3$  and use the given formula to compute  $\frac{A(5) - A(2)}{3}$ . Multiply by 3 to get  $A(5) - A(2) = 39$ . Now use the fact that  $A(2) = 6$  and solve for  $A(5)$ .

ANSWER:  $A(5) = 45$  thousand gallons

4. (4 points each)

- (a) HINT: Speed is the derivative of distance. So, Bert's speed is  $B'(t) = -2t + 16$  and Ernie's is  $E'(t) = 2t$ . You need to solve the equation  $E'(t) = B'(t) + 13.44$  for  $t$ .

ANSWER:  $t = 7.36$  minutes

- (b) HINT:  $B(1 + h) = -(1 + h)^2 + 16(1 + h) = -h^2 + 14h + 15$  and  $B(1) = 15$ .

ANSWER:  $B(1 + h) - B(1) = (-1)h^2 + (14)h + (0)$

- (c) HINT: Solve  $B'(t) = 8.86$  for  $t$ :  $t = 3.57$ . Compute  $E(3.57)$ .

ANSWER: 12.7449 feet (rounding to 12.74 feet is OK)