

**MAT 170 Section 005**  
Review for Final Exam

December 8, 2005

Chapter 3

1. Find  $\frac{d^2}{dx^2} [x^5]$ .
2. If  $f(x) = 3x^4 - 2x^3 + x^2 - 4x + 2$ , find  $f^{(5)}(x)$ .
3. Find the 42<sup>nd</sup> derivative of  $y = \sin(x)$ .
4. Find  $y'$  if  $y = \frac{(x-1)(x-4)}{(x-2)(x-3)}$ .
5. At what point on the curve  $y = 2 + e^x - x$  is the tangent line parallel to the line  $y = 2x - 3$ ?
6. Evaluate  $\lim_{x \rightarrow \infty} \tanh(x)$ .
7. Use implicit differentiation to derive the formula for the derivative of  $y = \tan^{-1}(x)$ . State the answer in terms of  $x$ .
8. A mass attached to a vertical spring has position function  $y(t) = A \sin \omega t$  where  $A$  is amplitude and  $\omega$  a constant.
  - (a) Find the velocity and acceleration.
  - (b) Show acceleration is proportional to the displacement  $y$ .
  - (c) Show the speed is maximum when acceleration is zero.
9. The cost, in dollars, of producing  $x$  units of a certain commodity is
$$C(x) = 920 + 2x - 0.02x^2 + 0.00007x^3$$
  - (a) Find the marginal cost function.
  - (b) Find  $C'(100)$  and explain its meaning.
  - (c) Compare  $C'(100)$  with the cost of producing the 101st item.
10. The angle of elevation of the sun is decreasing at a rate of 0.25 radians per hour. How fast is the shadow cast by a 400 ft tall building increasing when the angle of elevation of the sun is  $\pi/6$ ?
11. The volume of a cube is increasing at a rate of 10 cm<sup>3</sup>/min. How fast is the surface area increasing when the length of an edge is 30 cm?
12. Find the linearization of  $f(x) = \sqrt[3]{1+3x}$  at  $a = 0$ . State the corresponding linear approximation and use it to give an approximate value for  $\sqrt[3]{1.03}$ .