

# Spring 2008 Math 151

## Week in Review # 5

sections: 3.6-3.9

courtesy: Joe Kahlig

### Section 3.6

1. Find  $\frac{dy}{dx}$  if  $x^4 - 4x^2y^2 + y^3 = 0$
2. Find  $\frac{dy}{dx}$  if  $\sqrt{x^2 + y^2} = 3$
3. Find  $\frac{dx}{dy}$  if  $4x = \frac{3 + y^3}{y^2 + x}$
4. Find the equation of the line tangent to  $x^{\frac{1}{3}} + y^{\frac{1}{3}} = 3$  at  $(1, 8)$ .
5. Show that the curves  $x^2 - y^2 = 5$  and  $4x^2 + 9y^2 = 72$  are orthogonal

### Section 3.7

6. Find the unit tangent vector to the curve  $\mathbf{r} = (t^2)\mathbf{i} + (3t^3)\mathbf{j}$  at the point where  $t = 1$
7. Find the vector and parametric equations of the line tangent to  $\mathbf{r} = (t^3 + 2t)\mathbf{i} + (4t - 5)\mathbf{j}$  at the point where  $t = 2$
8. The curve  $\mathbf{r} = (\sin 2t)\mathbf{i} + (\cos t)\mathbf{j}$ ,  $0 \leq t \leq 2\pi$  crosses itself at the origin. Find the angle between the tangent lines at this point.
9. A cannonball fired from a cannon has a position function given by  $\mathbf{r} = (5t)\mathbf{i} + (36t - 2t^2)\mathbf{j}$ , where distance is measured in feet and time is measured in seconds.
  - (a) Compute the velocity and speed of the cannon ball at  $t = 3$ .
  - (b) With what speed does the cannon ball hit the ground?

### Section 3.8

10. Find  $y''$  for  $y = \sqrt{x^2 + 1}$
11. Find  $y'$ ,  $y''$ , and  $y'''$  for  $y = \frac{x^2}{x + 1}$
12. Find  $D^{25} \cos(4x)$

13. Suppose the position of a particle at time  $t$  is given by  $\mathbf{r} = (4t^2)\mathbf{i} + (\cos 2t)\mathbf{j}$ . Find the acceleration of the particle when  $t = \frac{\pi}{4}$

14. Find a second degree polynomial,  $p(x)$ , such that  $p(2) = 4$ ,  $p'(2) = 3$  and  $p''(2) = 4$

### Section 3.9

15.  $x(t) = t^3 - 3t^2 + 5$  and  $y(t) = 2t - 7$ 
  - (a) compute  $\frac{dy}{dx}$
  - (b) compute  $\frac{dx}{dy} \Big|_{t=3}$
  - (c) compute  $\frac{dy}{dx} \Big|_{(3,-5)}$
16. A curve is given parametrically by  $x = t^4 - 4t^3$ ,  $y = 3t^2 - 6t$ .
  - (a) Find the equation of the line tangent to the curve at the point  $(-16, 0)$
  - (b) Find all the points on the curve where the tangent line is horizontal or vertical