

## Jeopardy Questions

Chain Rule: find the derivative:

- 1.  $\sqrt{3x^2+1}$
2.  $(x-1/x)^4$
- ~ 3.  $1/\sqrt{1-\cos x}$
4.  $\exp(-x^2+4)/3 + 4$
5.  $[\ln(1+\cos 3x)]^2$

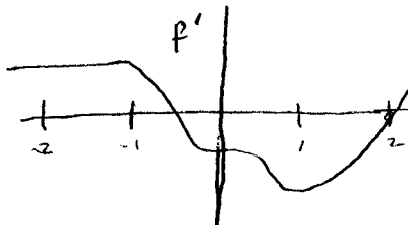
Product and Quotient Rules: find the derivative:

1.  $x \ln x$
- ~ 2.  $(2x+1)/(x^2-1)$
- ~ 3.  $\exp(x^2)/\sqrt{x}$
4.  $(\sin 3x)/\ln(x^2+1)$
- ~ 5.  $\sin^2(2x+1)$

Interpretations:

1. A bird flying at a velocity  $v$  expends energy at a rate of  $j(v)$  joules per second. The rate at which  $j(v)$  is changing increases as the velocity of the bird increases. Draw a potential graph of  $j$  and explain.
2. For problem 1,  $j(1) = 2$ , and  $j'(1) = .5$ . Interpret this.
3. The thickness,  $T(c)$ , in mm, of wildlife eggshells decreases as the concentration, in ppm, of PCB's in the eggshells increases. Interpret  $T(147) = .39$ , and  $T'(147) = .0014$ . find the equation of the tangent line to  $T$  at  $c = 147$ .
- 4. Find the equation of the tangent line to the graph of  $(\ln x)/x$  at  $x=1$ .
5.  $f(x) = x^3 - (3a/2)x^2$ , where  $a$  is a parameter. Discuss how the value of  $a$  affects the location of the local maximum. Local minimum too.

Graphing:

1. Find the sign diagram for  $f'(x)$  if  $f(x) = x^3 - 3x^2 + 3x - 1$ .
- 2. Suppose  $f'(x)$  looks like this:  -> Construct a sign diagram for  $f'$  and draw the shape of  $f$ .
3. With the picture of  $f'$  in 2., discuss the concavity of  $f$ .
4. Locate all critical pts and relative extremes of the function  $f$  drawn below:
- 5. Where is  $\exp(x)\sin x$  increasing on  $0 < x < 2\pi$ .

Theory:

1. What do you conclude about the graph of  $f$  if the derivative is increasing?
2. Discuss the difference between local extremes and critical points.
- \* 3. Using the limit definition of the derivative, show that the derivative of  $f(x) = 1 - x^2$  is  $-2x$ .
4. Find the limit of  $\ln(1+x)/x$  as  $x \rightarrow 0$ . Explain how you got your answer.
5. The five points indicated below are the only critical points of a function  $f(x)$ . The limit of  $f(x)$  as  $x \rightarrow -\infty$  is  $+\infty$ , and the limit of  $f(x)$  as  $x \rightarrow +\infty$  is  $-\infty$ . Draw a possible graph of  $f$ .

