# **Practice problems for QUIZ IV**

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1. (a) Can you find a formula for d/dx (f (x) g(x) h(x))?

Can you extend this to a product rule for four or more factors?

(b) Using your result from (a), compute d/dx {5(x3) (cos x) (ln x) ex }

(c) Find any and all critical points of the function: y = (x2 + 3) (x – 5) ex

2. Let F(x) = x3(x – 1) (x – 2).

(a) Using precalculus techniques, sketch the curve y = F(x).

(b) Using calculus, determine regions of increase, regions of decrease, local max/min.

(c) Explain the geometric significance of each of the three *critical points.*

3. Let g(x) = x2 ex.

(a) Using precalculus techniques, sketch the curve y = g(x).

(b) Using calculus, determine regions of increase, regions of decrease, local max/min.

4. State carefully the *General Power Rule*. Review its proof, that depends only upon the product rule.

5. Using the General Power Rule, when appropriate, find dy/dx for each of the following functons:

1. y = (1 + x + x2)2015





 where *a, b, c* and *d* are non-zero constants. (Here you may assume that d/dx (xp) = px-1 for all real numbers p)

 





6. State the *Chain Rule*.

7. Explain why (d/dx) ln x = 1/x.

8. Using the Chain Rule, when appropriate, compute dy/dx for each of the following:

1. y = sec(ex + 4x + 1789)
2. 
3. y = ln(ax + b), where *a* and *b* are positive constants.
4. y = (ln x)4
5. y = ln(x4)
6. y = ln(ln(x)
7. y = ln(ln(lnx))
8. y = cosh(sinh(3x+1))
9. y = cos(sec(x))
10. y = tan(1/x)

9. Let y = u3 + 1 and u = 5 sin x. Using the chain rule, compute dy/dx

10. Let z = sin u and u = 5 + ex. Compute dz/dx.

11.  Compute f (2)(x), the second derivative of *f*.

12. Let g(x) = cos(5x). Compute g(2015)(x).

13. (a) Given , compute d2y/dx2.

(b) Given y = 5x , compute dy/dx.

(c) Given y = log13 x, find dy/dx.

14. Sketch the graph of each of the following functions, using the first two stages of our plan.

Be sure to identify the domain first.

(a) y = x + 1/x











15. Using *implicit differentiation*, find dy/dx for each of the following implicitly defined curves:

(a) xy + x + y = y sin x

(b) tan x + sec y = x + y + 2015

(c) xy4 – tan x = ey + 1234

16. Find an equation of the tangent line to the *bifolium*

4x4 + 8x2y2 – 25x2y+ 4y4 = 0

 at the point P = (2, 1).

*Who has not been amazed to learn that the function y = ex, like a phoenix rising again from its own ashes, is its own derivative?*

- Francois le Lionnais,***Great Currents of Mathematical Thought****, vol. 1*, Dover Publications

*I turn away with fright and horror from the lamentable evil of functions which do not have derivatives.*

* Charles Hermite (in a letter to Thomas Jan Stieltjes)