The Derivative Game

Work in groups of 2-3 to solve the limits below. **You must answer the limits in the order given in order to get credit.** For instance: if you solve Problem 2 before Problem 1, you will receive NO points. However, you may distribute the limits in anyway you like; one person works on the first problem while a second person works on the next problem. **When you have an answer, come to the front and show me.** A checkmark means you received one point.

Goal: The group with the most points at the end of class wins.
(The prizes are cupcakes)
Good luck! And remember, the steps to solving ~~limits~~ derivatives!

1. $y = \sqrt{\pi \cos^2(x^2)}$

$\frac{1}{2}(\pi\cos^2(x^2))^{-1/2} \cdot 2\pi\cos(x^2)(-\sin x^2) \cdot 2x$

2. $\pi^x + \arctan\left(\frac{\pi}{x^2}\right)$

$e^{x\ln(\pi)} \cdot \ln(\pi) + \frac{1}{1+(\pi/x^2)} \cdot [-2\pi/x^3]$

3. $y = (\sqrt{x})^{3x}$

$e^{\ln(\sqrt{x}) \cdot 3x} \cdot [\frac{1}{\sqrt{x}} \cdot \frac{1}{2}(x)^{-1/2} \cdot 3x + 3\ln(\sqrt{x})]$

4. $(t^2 + 5)\arctan(3t)$

$(t^2+5)\left(\frac{1}{1+(3t)^2}\right) \cdot 3 + [2t]\tan^{-1}(3t)$

5. $\ln(x - \sqrt{1 + x^2})$

$\frac{1}{x-\sqrt{1+x^2}} \cdot [1 - \frac{1}{2}(1+x^2)^{-1/2} \cdot 2x]$

6. $\left(\frac{1}{x}\right)^{\sec x}$

$e^{\ln(\frac{1}{x}) \cdot \sec x} \cdot [\cancel{-x \cdot} x^{-2} \cdot \sec x + \ln(1/x) \cdot \sec x \tan x]$

7. $(x^2 + 5)(\sqrt{x} + 8)$

$2x(\sqrt{x}+8) + (x^2+5)\frac{1}{2}(x)^{-1/2}$

8. $\frac{e^x}{\cos(x)+3}$

$\frac{e^x[\cos x+3] + e^x \sin x}{(\cos x+3)^2}$

9. $\tan^3(t) + \ln(5t + 1) + 10\arcsin(t)$

$3\tan^2(t)\sec^2 t + \frac{5}{5t+1} + \frac{10}{\sqrt{1-t^2}}$

10. $\tan\left(\frac{x^4}{\sqrt[4]{17x^3+1}}\right)$

$\sec^2(x^4/(17x^3+1)^{1/4}) \cdot \frac{[4x^3(17x^3+1)^{1/4} - \frac{1}{4}(17x^3+1)^{-3/4} \cdot 51x^2 \cdot x^4]}{\sqrt{17x^3+1}}$

11. $x^{\cos x}$

$e^{\ln(x)\cos x}[\frac{1}{x}\cos x - \ln(x)\sin x]$

12. $\arccos(t)$

$\frac{-1}{\sqrt{1-x^2}}$

13. $e^e e^x + x^e x^x$

$e^e e^x + [ex^{e-1}x^x + x^e \cdot e^{\ln x \cdot x} \cdot [1/x \cdot x + \ln(x)]$

14. $\frac{x\sin(x)}{1+x^2}$ $\frac{(1+x^2)[\sin x + x\cos x] - x\sin x(2x)}{(1+x^2)^2}$

x6 C

15. Find $f^{(10)}$ of $\sin(2x + 7) + (x^3 + 2x^2 + 1)^2$

$-2^{10}\sin(2x+7) = -1024\sin(2x+7)$

16. $\sqrt{3 + x}\sqrt[3]{5x^2 - 6}$

$[\frac{1}{2}(3+x)^{-1/2}][(5x^2-6)^{1/3}] + (3+x)^{1/2} \cdot \frac{1}{3}(5x^2-6)^{-2/3} \cdot$ 10x

17. $\left(e^x - \frac{2}{4x^3}\right)^3$

$3(e^x - 1/2x^{-3}) \cdot [e^x + 3/2x^{-4}]$

18. $(\tan x)^{\ln x}$

$e^{\ln(\tan x) \cdot \ln x} \cdot [\frac{1}{\tan^2 x} \cdot \sec^2 x \ln x + \frac{1}{x}\ln(\tan x)]$

19. $(1 + \cos^3 x)^{2/3}$

$2/3(1+\cos^3 x)^{-1/3} \cdot 3\cos^2 x \cdot (-\sin x)$

20. $\arctan(e^{\arctan x})$

$1/(e^{\tan^{-1}x})^2+1 \cdot e^{\tan^{-1}x} \cdot \frac{1}{1+x^2}$

21. $(\cos x)^{sin(x)}$

$e^{\ln(\cos x)\sin x} \cdot [\frac{-\sin^2 x}{\cos x} + \ln(\cos x) \cdot \cos x]$

22. $\frac{t}{(1+\sqrt{t})^{100}}$

$\frac{(1+\sqrt{t})^{100} - 100(1+\sqrt{t})^{99} \cdot (\frac{1}{2}t^{-1/2}) \cdot t}{(1+\sqrt{t})^{200}}$

23. $\sin(\sqrt{x\cos x})$

$\cos(\sqrt{x\cos x}) \cdot \frac{1}{2}(x\cos x)^{-1/2} \cdot [\cos x - \sin x \cdot x]$

24. x^{2^x}

$e^{\ln x e^{\ln(2)x}} \cdot [\frac{1}{x}2^x + \ln x[e^{\ln(2)x} \cdot \ln(2)]]$

25. $\sqrt{arctan(2x)}$

$1/2(\tan^{-1}(2x))^{-1/2} \cdot \frac{1}{1+(2x)^2} \cdot 2$

$(e^{x+\sin x}))^{1/3}$

$1/3(e^{x+\sin x})^{-2/3} \cdot e^{x+\sin x} \cdot [1+\cos x]$