

**Math1220 Midterm 1 Review Problems**  
(6.1-6.5, 6.8, 6.9, 7.1)

1. Find the equation of the tangent line to the graph of  $y = \cos^{-1}(\ln(x^4))$  when  $x = 1$ .

2. Find  $f^{-1}(x)$  for  $f(x) = \left(\frac{2x-1}{2x+5}\right)^3$ .

3. Find  $\frac{dy}{dx}$  for each function. **(Don't simplify.)**

(a)  $y = \ln(\cos^2(3x)) + \sin^{-1}(3x-2)$

(b)  $y = (5x+3)^{2x^2}$

(c)  $y = (1+x^4)^\pi + \pi^{1+x^4}$

(d)  $y = \operatorname{sech}(\cos(2x))$

(e)  $y = \ln(3x-2) + 2x^{-6} + 4x^3 - \sin(5x) + 9$

(f)  $y = e^{\frac{1}{3x}} + \frac{1}{e^{3x}}$

(g)  $y = (x^3 - 1)^{\ln x}$

(h)  $y = \cosh^{-1}(\cos x + 3)$

4. A certain radioactive substance has half-life of 10 years. How long will it take for 50 grams to decay to 4 grams? (Simplify answer as much as possible without calculator.)

5. Evaluate each integral.

(a)  $\int \frac{20x+5}{2x^2+x-7} dx$

(b)  $\int \frac{-5}{x+x(\ln x)^2} dx$

(c)  $\int_1^3 4^{2x-7} dx$

(d)  $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} 2^{\cos x} \sin x dx$

(e)  $\int_0^1 \frac{2t^2+1}{2t^3+3t-4} dt$

(f)  $\int_{-2}^0 6^{2x+4} dx$

(g)  $\int \frac{e^{2x}}{e^{2x}+5} dx$

(h)  $\int \frac{5x^2}{\sqrt{1-x^6}} dx$

(i)  $\int \frac{x}{x^4+4} dx$

(j)  $\int \frac{x^3}{x^4+4} dx$

6. Find  $(f^{-1})'(5)$  given  $f(x) = 2x^5 + 4x - 1$  .

7. Show that  $f(x) = \frac{\sin x + 1}{\cos x}$  is monotonic, i.e. that its inverse exists, on a restricted domain (and give such a restricted domain that will work).

8. Find the area of the region bounded by  $y = \sinh x$  ,  $y = 0$  and  $x = \ln 2$  .

9. Show that  $f(x) = 6 - \tan^{-1}(2x) - 5(x-1)^3$  has an inverse. (Explain your reasoning.)  
Then, find  $(f^{-1})'(11)$

10. Find the limits.

(a)  $\lim_{x \rightarrow \infty} \left(1 + \frac{3}{x}\right)^{5x}$

(b)  $\lim_{x \rightarrow \infty} (1)^{5x}$