

# Final Exam Review Session - Answer Key

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- 1)  $-\frac{2}{3}$
- 2)  $\int_0^1 x^4 dx = \frac{1}{5}$
- 3)
  - (a)  $-\frac{11}{10}$
  - (b)  $\frac{25\pi}{2}$  (semicircle)
  - (c) 1 (the graph is a triangle)
  - (d)  $\frac{(1+\tan(\theta))^6}{6} + C$  ( $u = 1 + \tan(\theta)$ )
  - (e)  $2(e^2 - e)$  ( $u = \sqrt{x}$ )
  - (f)  $g'(x) = \frac{1}{\ln(\ln(x))} \left(\frac{1}{x}\right) - \frac{1}{\ln(\tan(x))} \sec^2(x)$
  - (g) 0 (odd function)
  - (h)  $F(x) = \tan^{-1}(x) + \sin^{-1}(x) + 1$
  - (i)  $\frac{2}{5\pi}$  ( $u = \cos(x)$ )
- 4)  $\int_{-1}^4 (x+4) - (x^2 - 2x) dx = \frac{125}{6}$
- 5)
  - (a)  $\frac{1}{2}$  (l'Hopital's rule twice)
  - (b)  $e^{-2}$  (take ln, find the limit, and exponentiate)
  - (c) 0 (squeeze theorem)
  - (d) 1 (factor out  $x^4$  out of the square root)
- 6)
  - (a)  $\left(\frac{1}{\ln(\ln(\ln(x)))}\right) \left(\frac{1}{\ln(\ln(x))}\right) \left(\frac{1}{\ln(x)}\right) \left(\frac{1}{x}\right)$
  - (b)  $x^{\sin(x)} \left(\cos(x) \ln(x) + \frac{\sin(x)}{x}\right)$  (logarithmic differentiation)
  - (c)  $y' = -\frac{2x+y}{x+2y-\cos(y)}$

(d)  $y' = 1$  (plug in  $x = 0$ ,  $y = \frac{1}{2}$  after you differentiated)

7) Absolute max:  $f(3) = 19$ , Absolute min:  $f(1) = -1$  (remember that  $-1$  is not in  $[0, 3]$ )

8) 1 (use MVT)

9) IVT and Rolle's theorem

10)  $-\frac{1}{3}$

11) Width =  $w = 20$ , Length =  $2l = 30$