

Answers

Autumn 2013 Math 125 Final Exam

1. (a)  $\frac{1}{3}x^3 \ln x - \frac{1}{9}x^3 + C$   
 (b)  $\frac{1}{3} \sec^3 x - \sec x + C$
2. (a)  $35 \ln 2 - 21 \ln 3$   
 (b)  $\frac{\pi}{6} - \frac{\sqrt{3}}{8}$
3. (a)  $\frac{16}{3}$   
 (b)  $\frac{17}{3}$
4. (a)  $\int_0^3 2\pi x \, dx + \int_3^4 2\pi x \left( (5x - 14) - (3 + 3(x - 4)^{1/3}) \right) \, dx$   
 $+ \int_4^5 2\pi x \left( 6 - (3 + 3(x - 4)^{1/3}) \right) \, dx$   
 (b)  $\int_0^1 \pi \left( 4 + \left( \frac{y - 3}{3} \right)^3 \right)^2 \, dy + \int_1^6 \pi \left( \left( 4 + \left( \frac{y - 3}{3} \right)^3 \right)^2 - \left( \frac{y + 14}{5} \right)^2 \right) \, dy$
5.  $\bar{x} = 0$ ;  $\bar{y} = \frac{4}{9\pi}$
6.  $y = \tan \left( \frac{1}{4}e^{2x^2} + \frac{\pi}{3} - \frac{1}{4} \right)$
7. (a)  $\frac{dy}{dt} = 0.13 - \frac{y}{5}$   
 (b)  $y = 0.65 + 5.6 e^{-t/5}$
8. (a)  $(0, 2)$ ; (b)  $[0, 1]$  and  $[5, 6]$ ; (c)  $[3, 6]$ ; (d)  $1$ ; (e)  $[0, 1]$  and  $[2, 5]$
9.  $2 - 4^{1/3}$
10. (a)  $\ln(b^2 + 1) - \frac{c}{5} \ln(5b + 1)$  (valid for  $b > -1/5$ )  
 (b)  $c = 10$ ;  $\int_0^\infty \left( \frac{2x}{x^2 + 1} - \frac{10}{5x + 1} \right) \, dx = -2 \ln 5.$