

**Quiz 7 Solutions**

MAC 1147.3881, Fall 2015

Thursday, October 29, 2015

Show all relevant work to support your answer. A correct answer without supporting work will not earn the points. **Problems 3 and 4 are on the back.**

- (1 point) What is your most memorable moment of the course so far? (Hint: There is no wrong answer)

1. [responses for questions](#)

- (4 points) Solve the following equations for  $x$ :

(a)  $e^{2x} - 4e^x - 5 = 0$

**Solution:** We want the given equation to be a polynomial so it is easy to solve for  $x$ . Thus, we make the substitutions  $u = e^x$  and  $u^2 = e^{2x}$  into the given equation. Then we get  $u^2 - 4u - 5 = 0$  as our new equation. Now factor to get  $(u - 5)(u + 1) = 0$ , and so  $u = 5, -1$ . Since we started with the variable  $x$ , our solution must contain  $x$ . So now substitute each  $u$  into  $u = e^x$ , so that  $5 = e^x$  and  $-1 = e^x$ . Solving each equation using the natural log, we get  $x = \ln 5, \ln -1$ . Finally since  $\ln x$  isn't defined for  $x \leq 0$ , our only solution is  $x = \ln 5$ .

(b)  $\ln \sqrt{x - 8} = 5$

**Solution:** First, note that  $\sqrt{x - 8} = (x - 8)^{\frac{1}{2}}$ . Hence by properties of logs, we have  $\frac{1}{2} \ln(x - 8) = 5$ . Multiply both sides by 2 to get  $\ln(x - 8) = 10$ . Now exponentiate both sides to get  $x - 8 = e^{10}$ . After adding 8 to both sides, our solution is  $x = e^{10} + 8$ .

3. (2 points) Find the supplement of  $\frac{\pi}{4}$ .

**Solution:** By definition, supplementary angles must add up to  $\pi$ , or  $180^\circ$ . Then, the supplement of  $\frac{\pi}{4}$  is  $\pi - \frac{\pi}{4} = \frac{4\pi}{4} - \frac{\pi}{4} = \frac{3\pi}{4}$ .

4. (3 points) Complete the table assuming interest is compounded continuously:

Initial Investment	Annual Percent Rate	Time to Double	Amount After 10 years
\$500	11.0%	6.30	\$1505.00

**Solution:** First, we compute the Annual Percent Rate. Since interest is compounded continuously, we must use the formula  $A = Pe^{rt}$ , where  $A$  is the balance in the account after some time  $t$  (in years),  $P$  is the initial investment (principle), and  $r$  is the annual percent rate. Plugging in what we are given in the chart and letting  $t = 10$ , we see  $1505 = 500e^{10r}$ . Dividing both sides by 500, we get  $\frac{1505}{500} = e^{10r}$ . Taking the natural log of both sides, we get  $10r = \ln\left(\frac{1505}{500}\right)$  or simplified as  $r = \frac{\ln\left(\frac{1505}{500}\right)}{10} \approx 11.0$  percent.

Finally we solve for the time to double. Plugging in the values given in the chart and letting  $A = 2P = 1000$ , we see  $1000 = 500e^{0.110t}$ . Dividing both sides by 500, we get  $2 = e^{0.110t}$ . Taking the natural log of both sides, we get  $0.110t = \ln 2$  or simplified as  $t = \frac{\ln 2}{0.110} \approx 6.30$  years