

## PRECALCULUS PROBLEM SESSION #8 SOLUTIONS

### Properties of Logarithms

1. Improper use of the multiplication/addition rule for logarithms. It should say:

$$\log_a ab^3 = \log_a a + \log_a b^3 = 1 + 3 \log_a b$$

2. a)  $\log x - 3$   
b)  $1/7 \ln x$   
c)  $4 \ln x + 1/2 \ln (x^2 + 3) - 5 \ln (x + 3)$   
d)  $1 + \log_9 x$   
e)  $1/3 \log_b x + 4 \log_b y - 5 \log_b z$

3. a)  $\ln \frac{(x+9)^8}{x^4}$

$$\log_4 \left[ (x+1)^2 \sqrt[3]{\frac{x}{y}} \right]$$

- b)   
4. (a) False (b) False (c) False

5. (a)  $7 \log_b (x+10) - 2 \log_b (1+10x)$   
(b)  $2 \log_b x + \log_b (x+5) + \log_b (x-4)$

### Exponential and Logarithmic Equations

1. a)  $x = -1/5$  (b)  $x = 5$

2. (a)  $x = 3 + \frac{\ln 137}{\ln 5} \approx 6.06$  (b)  $x = \frac{1 - \ln 7957}{8} \approx -1.00$

3. (a)  $x = 32$  (b)  $x = 1/5 = 0.2$  (c)  $x = 4$  (d)  $x = 5$

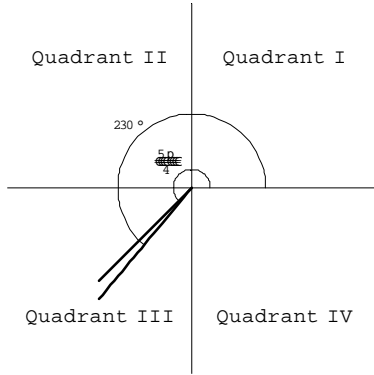
### Exponential Growth and Decay

1. a) In 2006, the population of Iraq was 26.8 million.  
b) The population of India will be 1416 million approximately 18 years after 2006, or 2024.
2. a)  $A = 3.2e^{0.026t}$   
b) The population of will be 9 million approximately 40 years after 2000, or 2040.
3. Approximately 4 grams of carbon-14 will be present in 11,430 years.
4. a) After 25,000 years, there will be 8 grams present.  
b) After 50,000 years, there will be 4 grams present.  
c) After 75,000 years, there will be 2 grams present.  
d) After 100,000 years, there will be 1 grams present.  
e) After 125,000 years, there will be  $1/2$  grams present.

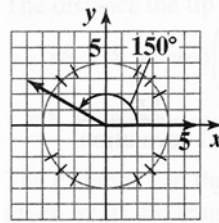
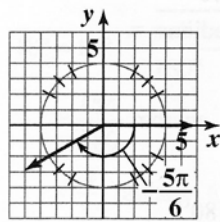
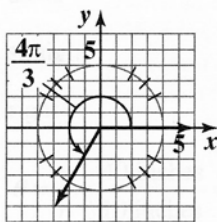
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5. In 1989, the skeletons were approximately 1056 years old.
6. It will take approximately 6.2 hours.
7. a)  $k = 0.012$ , so Mexico's growth rate is 1.2%.  
b) Mexico's population will double in approximately 58 years.

### Angles and Radian Measure



- 1.
2. (a)  $490^\circ, 850^\circ, -230^\circ, -590^\circ, -950^\circ$  ( $130^\circ \pm k \cdot 360^\circ$ ,  $k$  is a positive integer)  
(b)  $\pi, 5\pi, 7\pi, -\pi, -3\pi$  ( $3\pi \pm k \cdot 2\pi$ ,  $k$  is a positive integer)
3. a)  $-3\pi/2$  radians    b)  $5\pi/6$  radians
4. a)  $135^\circ$     b)  $-720^\circ$



5. a)    b)    c)
6. a)  $\pi/6$     b)  $16\pi/9$  radians
7. 6 radians
8.  $1/3$  revolution is equivalent to  $120^\circ$  or  $2\pi/3$  radians.
9. The distance the tip of the minute hand move is  $4\pi$  inches  $\approx 12.57$  inches.
10. The linear speed of the Ferris wheel is about 314 feet per minute. ( $100\pi$  feet per minute)