

**Elementary Engineering Mathematics**  
**Exercises #7 Answers**

1. a)  $\omega \approx 28.6$  (rad/s)  
b) decay rate,  $\alpha \approx -1.82$
2. a)  $x(t) \approx 0.633 \sin(15.8t) + 0.5 \cos(15.8t)$  (ft)  
b)  $x(t) \approx 0.806 \sin(15.8t + 0.669)$  (ft)  
c)  $t \approx 0.0570$  (sec)  
d)  $T \approx 0.4$  (sec)
3. a)  $c_c \approx 12.7$  (system is under-damped)  
b)  $x(t) \approx e^{-3.75t} (0.773 \sin(15.4t) + 0.5 \cos(15.4t))$  (ft)  
 $\approx 0.921 e^{-3.75t} \sin(15.4t + 0.574)$
4. a)  $c_c \approx 12.7$  (system is over-damped)  
b)  $x(t) \approx 0.831 e^{-5.64t} - 0.331 e^{-44.4t}$  (ft)
5. a)  $T \approx 0.02$  (sec)  
b)  $f \approx 50$  (Hz)  
c)  $\omega = 100\pi \approx 314$  (rad/s)  
d)  $A \approx 6$  (volts)
6.  $i(t) \approx 5 \cos(120\pi t - 0.927)$  (amps)
7.  $v(t) \approx 110 \cos(120\pi t + \frac{\pi}{6})$  (volts)