

## ENGR 1990 Engineering Mathematics Homework #8 Answers

- $f'(3) = 16$  (lb/in)
  - $f(x) \approx 91 + 16x$  for  $x$  close to 3
  - approximation errors range from zero to  $-3.6\%$
  
- $a(2) = \frac{dv}{dt}(2) = -9$  (m/s<sup>2</sup>)
  - $v(t) \approx 36 - 9t$  (m/s)
  - approximation errors range from zero to  $-6.25\%$
  
- $\dot{x}(t) = 15$  (m/s) (constant), and  $\ddot{x}(t) = 0$
  - $\dot{y}(t) = 26 - 9.81t$  (m/s) and  $\ddot{y}(t) = -9.81$  (m/s<sup>2</sup>) (constant)
  - $\dot{y}(t = 4) = -13.2$  (m/s)
  - at  $t = 4$  (sec),  $\mathbf{V} = 15\mathbf{i} - 13.2\mathbf{j}$  (m/s) or  $|\mathbf{V}| = 20$  (m/s) at an angle of  $\theta = -41.4$  (deg)
  - Maximum vertical position occurs at  $t^* = 2.65$  (sec). Position is  $(39.8, 39.5)$  (m)
  
- $v(t) = \dot{x}(t) = 15\cos(10t) - 5\sin(10t)$  (ft/s)
  - $a(t) = \dot{v}(t) = -150\sin(10t) - 50\cos(10t)$  (ft/s<sup>2</sup>)
  - $a(t = 0) = -50$  (ft/s<sup>2</sup>)
  - $a(t) = 158.1 \sin(10t + 3.46)$   
 $v(t)$  is maximum or minimum when  $t = 0.282, 0.596, 0.910, \dots$  (sec)  
The times start at  $t = 0.282 + (nT/2)$  (sec) for  $(n = 1, 2, 3, \dots)$
  
- $x(t) = 1.3727e^{-4.202t} - 0.8727e^{-23.8t}$  (ft) and  $v(t) = \dot{x}(t) = -5.77e^{-4.20t} + 20.8e^{-23.8t}$  (ft/s)
  - $a(t) = \dot{v}(t) = 24.2e^{-4.20t} - 494e^{-23.8t}$  (ft/s<sup>2</sup>)
  - $a(0) = -470$  (ft/s<sup>2</sup>)
  - $t = 0.0654$  (sec)
  
- $i(t) = -37.7 \sin(240\pi t)$  (amps)
  - $p(t) = -1885 \sin(480\pi t)$  (watts),  $p_{\max} = 1885$  (watts)