

**Answers for Even-Numbered Problems**  
**Unit 4**

**3.7**

6a. Speeding Up:  $(1, 2) \cup (3, 4)$ ; Slowing Down:  $(0, 1) \cup (2, 3)$  \*

6b. Speeding Up:  $(1, 2) \cup (3, 4)$ ; Slowing Down:  $(0, 1) \cup (2, 3)$  \*

\* Explanations not provided – ask in class

20a.  $\frac{dF}{dr} = -\frac{2GmM}{r^3}$ , which is the instantaneous rate of change of the force with respect to the distance between the bodies. The negative sign indicates that as the distance between the bodies increases, the magnitude of  $F$  decreases.

20b.  $\left. \frac{dF}{dr} \right|_{r=10,000} = -16 \text{ N/km}$

**3.9**

12.  $-\frac{1}{20\pi} \text{ cm/min}$

16.  $0.6 \text{ m/s}$

18a.  $-\frac{24}{\sqrt{5}} \text{ ft/s}$

18b.  $\frac{24}{\sqrt{5}} \text{ ft/s}$

28.  $-\frac{1}{50} \text{ rad/s}$

38.  $-\frac{10}{\sqrt{133}} \text{ ft/s}$

**3.10**

4.  $f(x) \approx 8 + \frac{3}{8}(x-16)$

24. Using the linear approximation of  $f(x) = e^x$  at  $x=0$ :  $e^{-0.015} \approx 0.985$

28. Using the linear approximation of  $f(x) = \sqrt{x}$  at  $x=100$ :  $\sqrt{99.8} \approx 9.99$

34a. Max. Error  $\approx dA = 30.159 \text{ cm}^2$

34b. Rel. Error  $\approx \frac{dA}{A} = \frac{1}{60}$ ; Percent Error  $\approx 1.667\%$

**4.1**

50. Abs. Max:  $(0, 5)$ ; Abs. Min:  $(-3, -76)$     54. Abs. Max:  $(1, 1)$ ; Abs. Min:  $(0, 0)$

56. Abs. Max:  $(2, 6\sqrt[3]{2})$ ; Abs. Min:  $(0, 0)$  and  $(8, 0)$

**4.7**

14.  $40 \text{ cm} \times 40 \text{ cm} \times 20 \text{ cm}$

16. \$163.54

20.  $\left(\frac{5}{2}, \sqrt{\frac{5}{2}}\right)$

24.  $A = 2ab$