Answers to Selected Even-Numbered Problems

Please note that answers are not provided for the following type of even-numbered problems:

- Concept Problems.
- Computer Problems.
- Design Problems.

For Concept and Computer problems, please consult the solutions manual.

Chapter 1

1.2 $(r_{B/A})_\ell = 3.883\,\text{ft}$

1.4 $\vec{r}_{B/A}\big|_{xy\text{ system}} = (4.000\,\hat{\imath} - 1.000\,\hat{\jmath})\,\text{ft}$

$\vec{r}_{B/A}\big|_{pq\text{ system}} = (3.313\,\hat{u}_p - 2.455\,\hat{u}_q)\,\text{ft}$

$\big|\vec{r}_{B/A}\big|_{xy\text{ system}} = \big|\vec{r}_{B/A}\big|_{pq\text{ system}} = 4.123\,\text{ft}$

1.6 $\vec{v} = (79.68\,\hat{\imath} + 7.190\,\hat{\jmath})\,\text{ft/s}$

1.8 $\theta = 3.229\,\text{rad}$

$\phi = 0.087\,31\,\text{rad}$

1.10 $v_r = 504.6\,\text{ft/s}$ and $v_\theta = -353.3\,\text{ft/s}$

1.12 $\phi = 101.1^\circ$

1.14 $x_{P2} = -0.7679\,\text{ft}$ and $y_{P2} = 5.330\,\text{ft}$

1.16 $\vec{v}_A = -(20.02\,\hat{\imath} + 12.81\,\hat{\jmath})\,\text{ft/s}$ and $\vec{a}_A = (-1.414\,\hat{\imath} + 4.243\,\hat{\jmath})\,\text{ft/s}^2$

1.18 $r = 26.36\,\text{mm}$

1.20 $[I_{xx}] = [I_{yy}] = [I_{zz}] = ML^2$

Units of I_{xx}, I_{yy}, and I_{zz} in the SI system: $\text{kg}\cdot\text{m}^2$,

Units of I_{xx}, I_{yy}, and I_{zz} in the U.S. Customary system: $\text{slug}\cdot\text{ft}^2 = \text{lb}\cdot\text{s}^2\cdot\text{ft}$.

1.22 Concept problem.

1.24 the units of E are $\text{kg}/(\text{m}\cdot\text{s}^2)$.

Chapter 2

2.2 Concept Problem

2.4 Concept Problem

2.6 $\Delta\vec{r}_1 = 8.747\,\hat{u}_r$ m and $\Delta\vec{r}_2 = 13.73\,\hat{u}_r$ m

$\left(\vec{v}_{\text{avg}}\right)_1 = 5.467\,\hat{u}_r$ m/s and $\left(\vec{v}_{\text{avg}}\right)_2 = 8.579\,\hat{u}_r$ m/s

2.8 $\vec{v} = (-154.0\,\hat{\imath} + 266.7\,\hat{\jmath})$ ft/s

2.10 $\vec{v} = (145.4\,\hat{\imath} + 69.81\,\hat{\jmath})$ ft/s

2.12 $\Delta\vec{v}_1 = -(0.4623\,\hat{\imath} + 0.08155\,\hat{\jmath})$ m/s

$\Delta\vec{v}_2 = -(0.002550\,\hat{\imath} + 0.0004499\,\hat{\jmath})$ m/s

2.14 $\theta_1 = 12.21^\circ$ and $\theta_2 = -17.30^\circ$

$\phi_1 = 102.2^\circ$ and $\phi_2 = 72.70^\circ$

2.16 $\phi(x) = \cos^{-1}\left(\dfrac{3 + 4x}{\sqrt{10 + 24x + 16x^2}}\right)$

2.18 $\vec{a}_{\text{avg}} = (-0.04588\,\hat{\imath} + 3.886\,\hat{\jmath})$ ft/s^2

$\vec{a}_{\text{avg}} - \vec{a}(5\,\text{s}) = (-0.001154\,\hat{\imath} - 0.003175\,\hat{\jmath})$ ft/s^2

2.20 $\Delta\vec{r} = \vec{0}$

$\vec{v}_{\text{avg}} = \vec{0}$

$d = 1.394$ ft

$v_{\text{avg}} = 0.3485$ ft/s

2.22 Computer Problem

2.24 $v_{\max} = 2v_0 = 58.67$ ft/s and $v_{\min} = 0$ ft/s

$y_{v_{\min}} = 0$ ft and $y_{v_{\max}} = 2R = 2.300$ ft

$\vec{a}_{v_{\min}} = \dfrac{v_0^2}{R}\,\hat{\jmath} = (748.2\,\text{ft/s}^2)\,\hat{\jmath}$ and $\vec{a}_{v_{\max}} = -\dfrac{v_0^2}{R}\,\hat{\jmath} = (-748.2\,\text{ft/s}^2)\,\hat{\jmath}$

2.26 $\ddot{x} = \dfrac{8v_0^2 a^3}{\left(y^2 + 4a^2\right)^2}$

$\ddot{y} = \dfrac{-4v_0^2 a^2 y}{\left(y^2 + 4a^2\right)^2}$

2.28 $\vec{v} = (203.2\,\hat{\imath} + 117.3\,\hat{\jmath})$ ft/s

$\vec{a} = (-27.53\,\hat{\imath} + 47.69\,\hat{\jmath})$ ft/s^2

2.30 $v_{\max} = 80.82$ ft/s

2.32 $\vec{v} = (51.32\,\hat{\imath} - 1.046\,\hat{\jmath})$ ft/s

$\vec{a} = -(0.3873\,\hat{\imath} + 19.00\,\hat{\jmath})$ ft/s^2

2.34 $v = \omega\sqrt{d^2 - x^2}\sqrt{1 + h^2\left(\frac{x}{d^2} - \frac{x^3}{d^4}\right)^2}$

$v = 0.5236\,\text{ft/s}, \quad v = 0.4554\,\text{ft/s}, \quad \text{and} \quad v = 0$

2.36 $\vec{v}_A = -(72.00\,\hat{\imath} + 96.00\,\hat{\jmath})\,\text{ft/s}$

$\vec{a}_A = (460.8\,\hat{\imath} - 345.6\,\hat{\jmath})\,\text{ft/s}^2$

2.38 Computer Problem

2.40 $t_{\text{braking}} = 7.854\,\text{s}$

2.42 $|a|_{\text{max}} = 3.600\,\text{m/s}^2$

$\big(t_{|a_{\text{max}}|}\big)_1 = 3.927\,\text{s} \quad \text{and} \quad \big(t_{|a_{\text{max}}|}\big)_2 = 11.78\,\text{s}$

$\big(s_{|a_{\text{max}}|}\big)_1 = 12.84\,\text{m} \quad \text{and} \quad \big(s_{|a_{\text{max}}|}\big)_2 = 128.5\,\text{m}$

2.44 Largest distance traveled in 1 s is $d = 0.2667\,\text{m}$, corresponding to $a = \beta_1\sqrt{t}$

2.46 $v(0) = -0.080\,00\,\text{ft/s}$

2.48 $v_0 = 10.10\,\text{m/s}$

2.50 $a_c = 22.36\,g$

2.52 $t_{\text{stop}} = 2.880\,\text{s}$

2.54 $\eta = 98.10\,\text{s}^{-1}$

2.56 $\dot{x} = \big\{7.000\sin[(1.000\,\text{rad/s})t] + 10.50\cos[(0.5000\,\text{rad/s})t] - 10.50\big\}\,\text{m/s}$

$x = \big\{7.000 - 7.000\cos[(1.000\,\text{rad/s})t] + 21.00\sin[(0.5000\,\text{rad/s})t] - (10.50\,\text{s}^{-1})t\big\}\,\text{m/s}^2$

2.58 $t_{\text{stop}} = 0.2233\,\text{s}$

2.60 $v_{\text{term}} = 4.998\,\text{m/s}$

2.62 $|v|_{\text{max}} = 1.128\,\text{m/s}$

$s_{|v|_{\text{max}}} = 0.1250\,\text{m} \quad \text{and} \quad s_{|v|_{\text{max}}} = -0.1250\,\text{m}$

2.64 $v(t) = \frac{mg}{C_d}\left(1 - e^{-C_d t/m}\right)$

$v_{\text{term}} = \frac{mg}{C_d}$

2.66 $v_f = 3.563\,\text{m/s}$

2.68 Computer Problem