Solutions

2.1

- $m_1\mathbf{r}_1 = (20, 0)$ g · m; $m_2\mathbf{r}_2 = 24(\cos 120°, \sin 120°) = (-12, 20.78)$ g · m.
- $\sum m\mathbf{r} = (8, 20.78)$ g · m, size **22**.**27** g · m.
- $\omega = 2\pi N/60 = 2\pi \times 1200/60 = 125.66$ rad/s; $F = mr\omega^2 = 0.02227 \times 125.66^2 =$ **351**.**7** N.

2.2

- $\omega = 62.83$ rad/s; primary $mr\omega^2 = 1.2 \times 0.05 \times 62.83^2 =$ **236**.**9** N.
- Secondary $mr\omega^2/n =$ **59**.**2** N, at twice the shaft frequency: 20 Hz.

3.1

- (a) $\sum m\mathbf{r}z = (20 \times 0.08 - 12 \times 0.22,\ 20.78 \times 0.22) = (-1.04, 4.573)$ g · m^2.
- (b) $m_B\mathbf{r}_B = -\sum m\mathbf{r}z/z_B = (3.467, -15.24)$ g · m, size 15.63 g · m.
- $m_B = 15.63/60 =$ **0**.**261** kg at **282**.**8**°.
- $m_A\mathbf{r}_A = -\sum m\mathbf{r} - m_B\mathbf{r}_B = (-11.47, -5.54)$ g · m, size 12.74 g · m.
- $m_A = 12.74/60 =$ **0**.**212** kg at **205**.**8**°.
- (c) A single mass cancels the force but sits in one plane, so the couple $\sum m\mathbf{r}z$ stays and rocks the shaft in its bearings: static balance only.

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