# Phys 218 – Fall 2017
## All Sections

### Exam I

**Short Answer:**

A)  a) $\vec{D} = 40\hat{i}$ km $- 20\hat{j}$ km $\hfill$ [LO 2.1]

  b) $\langle v \rangle = 36$ km/h $\hfill$ [LO 3.1, 3.2, 3.3, 11.1]

B)  a) $\vec{R} \cdot \vec{S} = RS \cos(\theta_R - \theta_S)$ $\hfill$ [LO 2.2]

  b) $\vec{R} \times \vec{S} = -RS \sin(\theta_R - \theta_S)\hat{k}$ or $\vec{S} \times \vec{R} = +RS \sin(\theta_R - \theta_S)\hat{k}$ $\hfill$ [LO 2.3]

C)  a) $v = \sqrt{AR}$ $\hfill$ [LO 3.4, 18.1]

  b) $T = 2\pi\sqrt{R/A}$ $\hfill$ [LO 3.5, 19.1]

  c) $f = \frac{30}{\pi}\sqrt{\frac{A}{R}}$ $\hfill$ [LO 19.2]

D)  a) $\vec{a} = (30$ m/s$^6)t^4\,\hat{i}$ $\hfill$ [LO 8.1, 12.1]

  b) $\vec{r} = \left[2\text{ m} - (2\text{ m/s})t + (1\text{ m/s}^6)t^6\right]\hat{i}$ $\hfill$ [LO 8.2, 8.3, 12.2]

E)  a) There are many correct answers; one example is
  "*...she reaches her maximum walking speed and stays* $\hfill$ [LO 7.1, 7.2]
  *at that speed for a second. She then slows down as she*
  *notices her friend in a coffee shop and turns around*
  *after overshooting the cafe by about half a metre.*"

  b) $\vec{r}(t) = \left[(4\text{ m/s})t - (1\text{ m/s}^2)t^2\right]\hat{i}$ $\hfill$ [LO 7.3, 14.1]
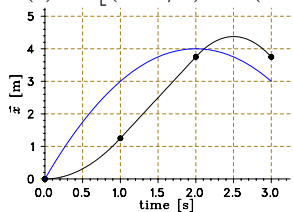


F)  a) Is constant: $a_x(t) = -12.5$ m/s$^2$ $\hfill$ [LO 8.4, 15.1]

  b) Not constant: $a_x(t) = 0.2$ m/s$^2 + (10$ m·s$)t^{-3}$ $\hfill$ [LO 8.5, 15.2]

  c) Is constant: $\vec{a}(t) = 0.5\hat{i}$ m/s$^2 - 0.5\hat{j}$ m/s$^2$ $\hfill$ [LO 8.6, 15.3]

**Problem 1:**  (a) $\hfill$ [LO 13.1, 13.2, 13.3]
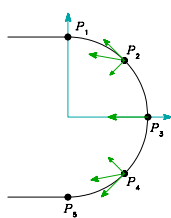


  (b) $|a_r| = \frac{v_3^2}{R}$ $\hfill$ [LO 18.2]

  (c) $|a_{\text{total}}| = \sqrt{\frac{v_2^4}{R^2} + \frac{(v_3 - v_1)^2}{t_{13}^2}}$ $\hfill$ [LO 11.2, 12.5, 18.3]

  (d) $t_{15} = \frac{\pi R}{v_1}$ $\hfill$ [LO 19.3]

**Problem 2:**  (a) $v_{x0} = v_0 \sin\theta\hat{i}$ and $v_{y0} = v_0 \cos\theta\hat{j}$ $\hfill$ [LO 1.1, 1.2]

  (b) $h = v_0 \cos\theta\, t - \frac{1}{2}gt^2$ $\hfill$ [LO 14.2]

  (c) $\vec{v} = v_0 \sin\theta\hat{i} + (v_0 \cos\theta - gt)\hat{j}$ $\hfill$ [LO 14.3, 14.4]

  (d) $H = \frac{v_0^2 \cos^2\theta}{2g}$ $\hfill$ [LO 3.6, 14.5]

**Problem 3:**  (a) $\vec{v}_{\text{P/G}} = (v_h - v_p)\hat{i}$ $\hfill$ [LO 1.3, 1.4, 20.1]

(b) $t_1 = \sqrt{2h/g}$          [LO 3.7, 14.6]

(c) $\vec{v}_{P/T} = \left(v_2 - \frac{D}{t_2}\right)\hat{i}$          [LO 1.5, 11.3, 20.2, 20.3]