

~~*It is strongly recommended that you read about a subject before it is covered in lectures.*~~

<del>Lecture Date</del>	<del>Material Covered</del>	<del>Reading from Ohanian</del>
<del>#5 Fri 9/17</del>	<del>Circular Motion - Centrifuges Perceived Gravity Watch Videos on PIVoT (reference frames)</del>	<del>Page 84 - 86</del>
<del>#6 Mon 9/20</del>	<del>Newton's Laws</del>	<del>Page 99 - 112</del>
<del>#7 Wed 9/22</del>	<del>Weight - Perceived Gravity - Weightlessness Free Fall - Zero Gravity in Orbit (misnomer) Watch Videos on PIVoT (weightlessness)</del>	<del>Page 123 - 134</del>
<del>#8 Fri 9/24</del>	<del>Friction - There is an interesting article on Friction in Scientific American, Oct, 1996. Watch Videos on PIVoT (friction)</del>	<del>Page 134 - 140</del>
<del>#9 Mon 9/27</del>	<del>Exam Review</del>	<del>Lectures #1 - #5</del>
<del>Wed 9/29</del>	<del>Exam #1</del>	<del>Handout of 9/22</del>

~~*Due Friday, Sept 24, before 4 PM in 4-339B. Solutions will be posted on the Web Sat 9/25.*~~

~~2.1 Throwing Stones~~ page 51, problem 51.

~~2.2 Measurements of Gravitational Acceleration,  $g$ .~~

~~Use the measurements made during your first lecture of the two falling apples to calculate two values for  $g$  and their associated uncertainties. Do the two values agree within the accuracy of the measurements? Use the measurements obtained in the lecture that you attended.~~

~~2.3 Vector Addition~~ page 70, problem 8.

~~Watch videos on PIVoT (under vector and look at the simulations).~~

~~2.4 Vectors~~ page 71, problem 26.

~~2.5 Vector Scaling~~ page 71, problem 27.

~~2.6 Keep in Touch with the Dutch.~~

~~Recently I drove in The Netherlands and I saw a road sign that indicated: Venlo 31 km, Eindhoven 39 km. Not knowing anything else, what is the minimum and what is the maximum distance (approximately) between these two towns.~~

~~2.7 Perpendicular Vectors.~~

~~The vectors  $\mathbf{A} = 2\hat{x} - 3\hat{y}$  and  $\mathbf{B} = -\hat{x} + a\hat{y} - 5\hat{z}$  are perpendicular to each other. What is the value of  $a$ ?~~

~~2.8 Adding, Subtracting, and Multiplication of Vectors~~ page 71, problem 25.

~~Watch videos on PIVoT (under vector and look at the simulations).~~

~~Calculate also:~~

~~d)  $\mathbf{A} \cdot \mathbf{B}$  and  $\mathbf{B} \cdot \mathbf{A}$~~

~~e)  $\mathbf{A} \times \mathbf{B}$  and  $\mathbf{B} \times \mathbf{A}$~~

## Problem 2.7

You are given the vectors

$$\vec{A} = 2\hat{x} - 3\hat{y} \quad \text{and} \quad \vec{B} = -1\hat{x} + a\hat{y} - 5\hat{z}$$

Now you must choose a value of  $a$  that makes  $\vec{A}$  and  $\vec{B}$  perpendicular. Mathematically you must satisfy

$$\begin{aligned} \vec{A} \cdot \vec{B} &= 0 \\ \implies A_x B_x + A_y B_y + A_z B_z &= 0 \\ \implies 2(-1) + (-3)(a) + 0(-5) &= 0 \\ a &= -\frac{2}{3} \end{aligned}$$

## Problem 2.8

~~You are given the vectors~~

$$\vec{A} = -5\hat{x} - 3\hat{y} + \hat{z} \quad \text{and} \quad \vec{B} = 2\hat{x} + 1\hat{y} - 3\hat{z}$$

~~The calculations for parts (a), (b), and (c) are all done ‘component-wise.’~~

$$\begin{aligned} \text{(a)} \quad \vec{A} + \vec{B} &= (-5 + 2)\hat{x} + (-3 + 1)\hat{y} + (1 + -3)\hat{z} \\ &= -3\hat{x} - 2\hat{y} - 2\hat{z} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \vec{A} - \vec{B} &= (-5 - 2)\hat{x} + (-3 - 1)\hat{y} + (1 - -3)\hat{z} \\ &= -7\hat{x} - 4\hat{y} + 4\hat{z} \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad 2\vec{A} - 3\vec{B} &= (2(-5) - 3(2))\hat{x} + (2(-3) - 3(1))\hat{y} + (2(1) - 3(-3))\hat{z} \\ &= -16\hat{x} - 9\hat{y} + 11\hat{z} \end{aligned}$$

$$\begin{aligned} \text{(d)} \quad \vec{A} \cdot \vec{B} &= (-5)(2) + (-3)(1) + (1)(-3) \\ &= -16 \end{aligned}$$

$$\begin{aligned} \vec{B} \cdot \vec{A} &= (2)(-5) + (1)(-3) + (-3)(1) \\ &= -16 \end{aligned}$$

~~In fact it is true that  $\vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A}$  for any two vectors.~~

$$\begin{aligned} \text{(e)} \quad \vec{A} \times \vec{B} &= ((-3)(-3) - (1)(1))\hat{x} + ((1)(2) - (-5)(-3))\hat{y} + ((-5)(1) - (-3)(2))\hat{z} \\ &= 8\hat{x} - 13\hat{y} + 1\hat{z} \end{aligned}$$

$$\begin{aligned} \vec{B} \times \vec{A} &= ((1)(1) - (-3)(-3))\hat{x} + ((-3)(-5) - (2)(1))\hat{y} + ((2)(-3) - (1)(-5))\hat{z} \\ &= -8\hat{x} + 13\hat{y} - 1\hat{z} \\ &= -(8\hat{x} - 13\hat{y} + 1\hat{z}) \end{aligned}$$

~~In fact it is true that  $\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$  for any two vectors.~~