L	A	S	T		N	A	M	E					

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F	I	R	S	T		N	A	M	E	

Cover Sheet for 2014-2015 Fall Semester MATH 3200/5200 (Barsamian) Homework 7
(Due at the start of class Monday, October 27, 2014. Staple this cover sheet to the front of your work.)

Problem:	**1**	**2**	**3**	**4**	**5**	**6**	**Total**	**Rescaled**
Your Score:								
Possible:	**10**	**20**	**20**	**20**	**10**	**20**	**100**	**10**

Reading: In Chapter Three, Maps Between Spaces, read the following subsections:
Three.II.2.Homomorphisms: Range Space and Null Space (p. 191-200)

Suggested Exercises: Three.II.2 Exercises # 21, 22, 23, 24, 26, 31, 33, 36 (p. 200-201)

[1] (10 points) Define the map $f: \mathcal{P}_2 \to \mathcal{P}_3$ by $f\big(p(x)\big) = x \cdot p(x)$.
Which of these vectors are in the null space of f? Which vectors are in the range space? Explain.

(a) $\overrightarrow{v_a} = x^2$ (b) $\overrightarrow{v_b} = 7x + 5x^2$ (c) $\overrightarrow{v_c} = 7 + 5x^2$ (d) $\overrightarrow{v_d} = 0$ (e) $\overrightarrow{v_e} = 5$

Find the null space, nullity, rank, and range space of each map.

[2] (20 points) The map $f: \mathbb{R}^2 \to \mathcal{P}_2$ defined by $f\begin{pmatrix} a \\ b \end{pmatrix} = 2bx - 5bx^2$.

[3] (20 points) The map $g: \mathcal{M}_{2\times 2} \to \mathbb{R}$ defined by $f\begin{pmatrix} a & b \\ c & d \end{pmatrix} = b - c$.

[4] (20 poinst) The injection map $\iota: \mathbb{R}^2 \to \mathbb{R}^3$ defined by $\iota\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} a \\ b \\ 0 \end{pmatrix}$

[5] (10 points) Find the nullity of each map.

(a) $f: \mathbb{R}^3 \to \mathbb{R}^5$ of rank 3 (b) $g: \mathcal{P}_2 \to \mathcal{P}_2$ of rank 1 (c) $h: \mathcal{P}_4 \to \mathbb{R}^3$ an onto map

[6] (20 points)
For the homomorphism $h: \mathcal{P}_3 \to \mathcal{P}_3$ defined by $h(a + bx + cx^2 + dx^3) = (a + c)x + (b + d)x^3$, find

(a) $\mathcal{N}(h)$ (b) $nullity(h)$ (b) $h^{-1}(x + x^3)$. (c) $h^{-1}(1 + x + x^2 + x^3)$.
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