**Answers to lecture problems – lectures 1 to 6**

**Lecture 1**

**Slide 1**

Value of the component in row 2 and column 3 of the matrix: –3.

Order: 3 × 4.

Matrix is: $\left(\begin{matrix}-1&6\\0&2\end{matrix}\right)$

**Slide 6**

$$\left(\begin{matrix}\begin{matrix}1\\3\end{matrix}&\begin{matrix}1\\3\end{matrix}&\begin{matrix}2\\3\end{matrix}\end{matrix}\right)$$

$$\left(\begin{matrix}1&2\\-1&3\end{matrix}\right)$$

$$\left(\begin{matrix}\begin{matrix}0&2\end{matrix}\\\begin{matrix}-5&-7\end{matrix}\\\begin{matrix}6&10\end{matrix}\end{matrix}\right)$$

–1

**Slide 9**

False

True

**EF** and **FG** defined, **EG** not.

E.g. $3\left(\begin{matrix}\begin{matrix}1&-2\end{matrix}\\\begin{matrix}-3&1\end{matrix}\\\begin{matrix}-2&4\end{matrix}\end{matrix}\right)$

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$$\begin{matrix}x+2y-z\\-y+z\\2x+3y-2z\end{matrix}$$

$$\left(\begin{matrix}2&-1\\-3&2\end{matrix}\right)\left(\begin{matrix}x\\y\end{matrix}\right)=\left(\begin{matrix}12\\7\end{matrix}\right)$$

$$\left(\begin{matrix}\begin{matrix}-1&2&2\end{matrix}\\\begin{matrix}-3&2&-1\end{matrix}\\\begin{matrix}-1&5&1\end{matrix}\\\begin{matrix}0&2&-1\end{matrix}\end{matrix}\right)\left(\begin{matrix}x\\y\\z\end{matrix}\right)=\left(\begin{matrix}12\\5\\0\\-3\end{matrix}\right)$$

Yes.

**Lecture 2**

**Slide 2**

$$\left(\begin{matrix}-5&-6&-3\\-5&2&1\\0&4&-8\end{matrix}\right)$$

–20

$$\frac{1}{20}\left(\begin{matrix}5&6&3\\5&-2&-1\\0&-4&8\end{matrix}\right)$$

**Slide 5**

$$a\left|\begin{matrix}f&g&h\\j&k&l\\n&o&p\end{matrix}\right|-b\left|\begin{matrix}e&g&h\\i&k&l\\m&o&p\end{matrix}\right|+c\left|\begin{matrix}e&f&h\\i&j&l\\m&n&p\end{matrix}\right|-d\left|\begin{matrix}e&f&g\\i&j&k\\m&n&o\end{matrix}\right|$$

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$$\left(\begin{matrix}\frac{3}{5}&\frac{1}{5}\\-\frac{2}{5}&\frac{1}{5}\end{matrix}\right)$$

$$\left(\begin{matrix}\frac{1}{2}&0\\\frac{1}{2}&-1\end{matrix}\right)$$

**A**

**Slide 12**

$$\left(\begin{matrix}11&12&13\\21&22&23\\31&32&33\end{matrix}\right)$$

**Lecture 3**

**Slide 2**

Eigenvalues 2 and 5

Eigenvectors $\left(\begin{matrix}1\\1\end{matrix}\right)$ and $\left(\begin{matrix}0\\1\end{matrix}\right)$

Eigenvalues 2, –1 and 4

Eigenvectors $\left(\begin{matrix}1\\0\\0\end{matrix}\right)$, $\left(\begin{matrix}0\\1\\0\end{matrix}\right)$ and $\left(\begin{matrix}0\\0\\1\end{matrix}\right)$

**Lecture 4**

**Slide 2**

Atmospheric pressure: scalar field

Ocean currents: vector field

Height above sea level: scalar field

$$⇀=\left(\begin{matrix}0\\0\\-4\end{matrix}\right)$$

**Slide 4**

$$-4sinx-2zexp\left[-2xz\right]$$

$$-2xexp\left[-2xz\right]$$

**Slide 9**

0

$$√3$$

$$\frac{1}{\sqrt{2}}\left(\begin{matrix}1\\1\\0\end{matrix}\right)$$

**Lecture 5**

**Slide 1**

Divergence positive for top two points

$$4x+xy$$

**Slide 6**

$$3cosx-2z$$

2

**Lecture 6**

**Slide 1**

Curl positive on LHS

$$\left(\begin{matrix}0\\0\\y-1\end{matrix}\right)$$

**Slide 5**

$$\left(\begin{matrix}0\\0\\-2sinx\end{matrix}\right)$$

$$\left(\begin{matrix}0\\0\\2\end{matrix}\right)$$