Pre-Calculus CP 1 – ICE for Sections 8.1 – 8.5 Name: KEY

NO CALCULATOR!!

Multiply the following matrices:

1) $\begin{bmatrix} 4 & 1 \\ -3 & 7 \end{bmatrix} \bullet \begin{bmatrix} -3 & 4 \\ 6 & 9 \end{bmatrix} = \begin{bmatrix} -12+6 & 16+9 \\ 9+42 & -12+63 \end{bmatrix} = \begin{bmatrix} -6 & 25 \\ 51 & 51 \end{bmatrix}$

$2\times2 \quad 2\times2 \quad 2\times2$

2) $\begin{bmatrix} 0 & 5 & 7 & -1 \end{bmatrix} \bullet \begin{bmatrix} -3 & 8 \\ 1 & 2 \\ 0 & -5 \\ 4 & 3 \end{bmatrix} = \begin{bmatrix} 0+5+0-4 & 0+10-35-3 \end{bmatrix}$

$1\times4 \quad 4\times2 \quad 1\times2$

$= \begin{bmatrix} 1 & -28 \end{bmatrix}$

Solve for the missing variables:

3) $\begin{bmatrix} 3x & -2 \\ -1 & 8 \end{bmatrix} + \begin{bmatrix} -4 & 0 \\ -7 & -8 \end{bmatrix} = \begin{bmatrix} -16 & -2 \\ y & 0 \end{bmatrix}$

$3x-4 = -16$ $\quad 3x = -12$

$-1 - 7 = y = -8$ $\quad x = -4$

4) $\begin{bmatrix} -2 & 1 & 2 \\ 3 & 2 & 4 \\ 0 & -2 & 4 \end{bmatrix} \begin{bmatrix} 1 \\ x \\ 3 \end{bmatrix} = \begin{bmatrix} 6 \\ 19 \\ y \end{bmatrix}$

$3\times3 \quad 3\times1$

$-2+x+6 = 6$

$x = 2$

$0-4+12 = y$

$8 = y$

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Find the following determinants BY HAND:

5) $\begin{vmatrix} -4 & 2 \\ 5 & -2 \end{vmatrix}$ $= +8-10 = -2$

6) $\begin{vmatrix} 12 & 2 \\ -5 & 8 \end{vmatrix}$ $= 96--10 = 106$

7) $\begin{vmatrix} 3 & -12 & 1 \\ 10 & 9 & 0 \\ -5 & 6 & -2 \end{vmatrix}$ $= 3(-18-0)+12(-20-0)+1(60+45)$

$= 3(-18)+12(-20)+105$

$= -54-240+105$

$= -189$

8) If the area of triangle ABC is 5, find the value(s) of y if the vertices of the triangle are (-A(1,2) B(4,0) and C(1,y)

$5 = \pm\frac{1}{2}\begin{vmatrix} 1 & 2 & 1 \\ 4 & 0 & 1 \\ 1 & y & 1 \end{vmatrix} = \pm\frac{1}{2}(1(0-y)-2(4-1)+1(4y-0))$

$-y-6+4y = 3y-6$

$10 = 3y-6$

$16 = 3y$

$\frac{16}{3} = y$

or $-10 = 3y-6$

$-4 = 3y$

or $\frac{-4}{3} = y$

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Find the following inverses BY HAND:

9) $\begin{bmatrix} 4 & -5 \\ -3 & 4 \end{bmatrix}^{-1} = \frac{1}{16-15}\begin{bmatrix} 4 & 5 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 4 & 5 \\ 3 & 4 \end{bmatrix}$

10) $\begin{bmatrix} 1 & 8 \\ 1 & 7 \end{bmatrix}^{-1} = \frac{1}{7-8}\begin{bmatrix} 7 & -8 \\ -1 & 1 \end{bmatrix} = \begin{bmatrix} -7 & 8 \\ 1 & -1 \end{bmatrix}$

11) $\begin{bmatrix} 7 & 2 \\ 3 & 1 \end{bmatrix}^{-1} = \frac{1}{7-6}\begin{bmatrix} 1 & -2 \\ -3 & 7 \end{bmatrix} = \begin{bmatrix} 1 & -2 \\ -3 & 7 \end{bmatrix}$

13) Verify the following are inverses by multiplying BY HAND- show all the steps
- what is the name of the final matrix?

$\begin{bmatrix} -4 & 3 \\ -3 & 2 \end{bmatrix}\begin{bmatrix} 2 & -3 \\ 3 & -4 \end{bmatrix} = \begin{bmatrix} -8+9 & 12+-12 \\ -6+6 & 9-8 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

2x2 2x2

Identity Matrix

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Calculator Friendly! ☺

Multiply the following matrices:

2 x 4 4 x 2

1) $\begin{bmatrix} 4 & 0 \\ -3 & -6 \end{bmatrix} \cdot \begin{bmatrix} 2 & -2 \\ -9 & 4 \end{bmatrix}$

$= \begin{bmatrix} 8 & -8 \\ 48 & -18 \end{bmatrix}$

2) $\begin{bmatrix} -9 & 3 & 0 & 1 \\ -2 & 4 & -5 & 6 \end{bmatrix} \cdot \begin{bmatrix} -3 & 8 \\ 1 & 2 \\ 0 & -5 \\ 4 & 3 \end{bmatrix}$

$= \begin{bmatrix} 34 & -63 \\ 34 & 35 \end{bmatrix}$

3) The numbers of calories burned by individuals of different body weights performing different types of aerobic exercises for a 20 minute time period are shown in the matrix below:

$$A = \begin{array}{c} \\ \text{bicycling} \\ \text{jogging} \\ \text{walking} \end{array} \begin{array}{c} \begin{array}{cc} \text{120lb} & \text{150lb} \end{array} \\ \begin{bmatrix} 109 & 136 \\ 127 & 159 \\ 64 & 79 \end{bmatrix} \end{array}$$

3 x 2

A 120 lb person and a 150 lb person bicycled for 40 minutes, jogged for 10 minutes and walked for 60 minutes. Organize the time spent exercising in a matrix named B:

2 $\frac{1}{2}$

1 x 3

3

Time Exercise $\begin{bmatrix} \text{bic} & \text{jog} & \text{walk} \\ 2 & \frac{1}{2} & 3 \end{bmatrix}$

Compute BA and interpret the result. Be sure to use labels on your answer matrix!

$BA = \begin{bmatrix} 2 \cdot 109 + \frac{1}{2}(127) + 3 \cdot 64 & 2(136) + \frac{1}{2}(159) + 3(79) \end{bmatrix}$

$= \text{cals burned} \begin{array}{c} \begin{array}{cc} \text{120 lb} & \text{150 lb} \end{array} \\ \begin{bmatrix} 473.5 & 588.5 \end{bmatrix} \end{array}$

120 lb person burned 473.5 cal

150 lb " " 588.5 cal

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Using the determinant and the area formula that goes with it, find the area of the triangle with the given vertices:

4) (0,1) (2,7) (5,5)

$$A = \pm\frac{1}{2}\begin{vmatrix} 0 & 1 & 1 \\ 2 & 7 & 1 \\ 5 & 5 & 1 \end{vmatrix} = \pm\frac{1}{2}(-22)$$

$$= 11 \text{ u}^2$$

5) (2,-6) (-1,-4) (0,2)

$$A = \pm\frac{1}{2}\begin{vmatrix} 2 & -6 & 1 \\ -1 & -4 & 1 \\ 0 & 2 & 1 \end{vmatrix} = \pm\frac{1}{2}(-20) = 10 \text{ u}^2$$

Find the inverses of the following matrices using your calculator:

6) $\begin{bmatrix} -3 & 4 \\ 7 & 9 \end{bmatrix}^{-1}$

$$= \begin{bmatrix} -9/55 & 4/55 \\ 7/55 & 3/55 \end{bmatrix}$$

7) $\begin{bmatrix} 2 & 1 & -2 \\ 5 & 3 & 0 \\ 4 & 3 & 8 \end{bmatrix}$

$$INV = \begin{bmatrix} 12 & -7 & 3 \\ -20 & 12 & -5 \\ 3/2 & -1 & 1/2 \end{bmatrix}$$

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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

8) Use $A=\begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$ to encode the message TOO MANY SECRETS. Show how the matrices are set up:

$$\begin{bmatrix} 20 & 15 \\ 15 & 0 \\ 13 & 1 \\ 14 & 25 \\ 0 & 19 \\ 5 & 3 \\ 18 & 5 \\ 20 & 19 \end{bmatrix} \times \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix} =$$

Encoded message: 35, 85, 15, 30, 14, 29, 39, 103, 19, 57, 8, 19, 23, 51, 39, 97

9) The message below was coded using matrix $A=\begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix}$. Decode the message by multiplying by the inverse and spell out the original message:

Coded message: 18 33 27 39

$$\begin{bmatrix} 18 & 33 \\ 27 & 39 \end{bmatrix} \times A^{-1} = \begin{bmatrix} 3 & 15 \\ 15 & 12 \end{bmatrix}$$

Message: COOL

10) Decode the message 42, 107, 10, 25, 20, 40 that was coded with $A=\begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$ and spell out the original message:

$$\begin{bmatrix} 42 & 107 \\ 10 & 25 \\ 20 & 40 \end{bmatrix} \times A^{-1} = \begin{bmatrix} 19 & 23 \\ 5 & 5 \\ 20 & 0 \end{bmatrix}$$

Message: SWEET

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Solve the following systems of equations by setting up matrices and using inverses to solve. Show the matrix equation you are using to solve including the operation.

11) $2x+5y+w=11$
$x+4y+2z-2w=-7$
$2x-2y+5z+w=3$
$x-3w=-1$

$X = A^{-1} \cdot B$

$$\begin{bmatrix} 2 & 5 & 0 & 1 \\ 1 & 4 & 2 & -2 \\ 2 & -2 & 5 & 1 \\ 1 & 0 & 0 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ w \end{bmatrix} = \begin{bmatrix} 11 \\ -7 \\ 3 \\ -1 \end{bmatrix} \Rightarrow \begin{bmatrix} 7 \\ -1 \\ -3 \\ 2 \end{bmatrix}$$

A $\quad X$ $\quad B$

$(7, -1, -3, 2)$

12) In the 2005 Orange Bowl, the University of Southern California won the National Championship by defeating the University of Oklahoma by a score of 55 to 19. The total points scored came from 22 different scoring plays, which were a combination of touchdowns, extra-point kicks, field goals and safeties, worth 6, 1, 3 and 2 points, respectively. The same number of touchdowns and extra-point kicks were scored, and there were three times as many field goals as safeties. How many touchdowns, extra-point kicks, field goals, and safeties were scored?

$T + E + F + S = 22$

$T = E \rightarrow T - E = 0$

$F = 3S \rightarrow F - 3S = 0$

$6T + 1E + 3F + 2S = 74$

$$\begin{matrix} T & E & F & S \end{matrix}$$

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 0 & 0 \\ 0 & 0 & 1 & -3 \\ 6 & 1 & 3 & 2 \end{bmatrix} \begin{bmatrix} T \\ E \\ F \\ S \end{bmatrix} = \begin{bmatrix} 22 \\ 0 \\ 0 \\ 74 \end{bmatrix} \Rightarrow \begin{bmatrix} 9 \\ 9 \\ 3 \\ 1 \end{bmatrix}$$

A $\quad X$ $\quad B$

$X = A^{-1}B$

9 TD
9 E
3 F
1 safety