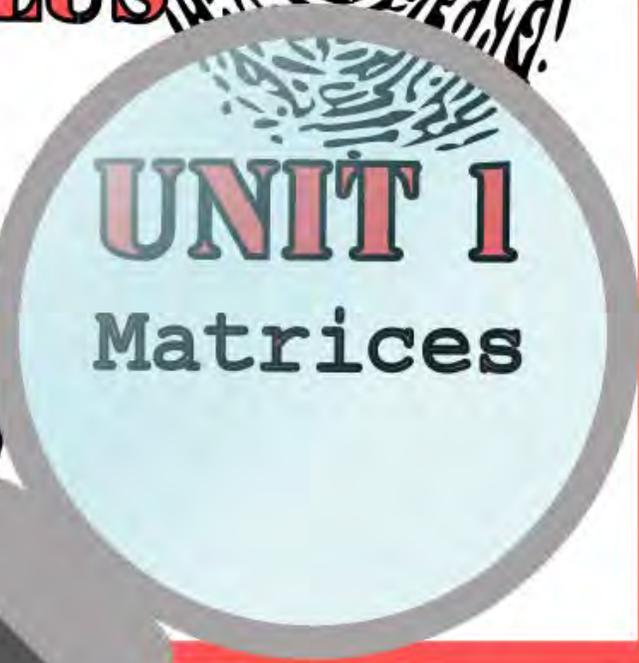
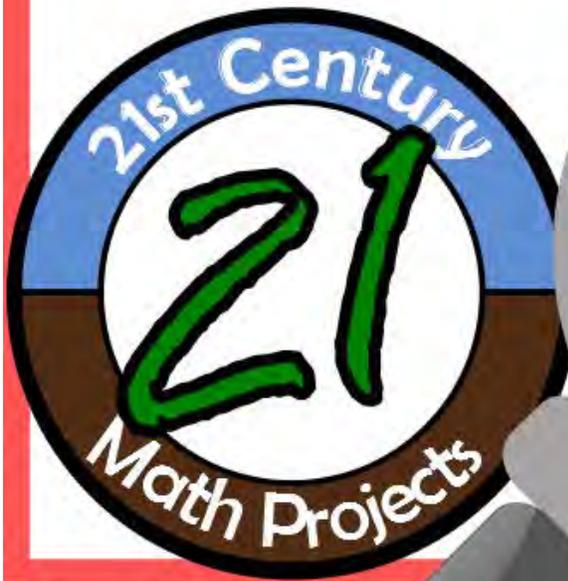


CSI:

ALGEBRA 2 / PRECALCULUS



CSI Algebra 2 & Pre-Calc: Matrices



Detectives,

Once again the world has been sent reeling by a string of high profile robberies. This time it seems Washington D.C. has been victims of the evil genius group, the Mathemagicians. Notes signed “Neo Eigenvector” have been discovered at each of the robbery sites. Once again a cryptic text message was sent to investigators, but it requires the puzzles to be cracked first. We believe the Mathemagicians have been successfully piecing together a world conquering device.

We’ve been told the result of the cryptic text message will calculate to Neo’s favorite number. Thus far there are six suspects that police have questioned. It is hoped that someone with a relatively strong number sense can crack some codes that have puzzled the detectives on the case so far.

Your job is to bring Neo to justice and save the planet. You need to be prepared to state your case and demonstrate your understanding of the following skills that Neo is known to use in his/her notes.



- Adding, Subtracting and Scalar Multiplication of Matrices
- Multiplying Matrices
- Determinants
- Inverses
- Solving Systems

Be sure to include:

- Other examples of the concepts
- Definitions
- Any other relevant information.

This is not a time to be sloppy. The slightest miscalculation or illegible footnote could result in a not guilty verdict.

Oh, did I mention that use of a calculator might prematurely set off his world conquering device? Good luck to you, gumshoe.

Chief Harris



CSI: THE EVIDENCE



NAME: _____

1.

CLUE

2.

CLUE

3.

CLUE



4.

CLUE

5.

CLUE

6.

CLUE

CRYPTIC TEXT MESSAGE

SUSPECT

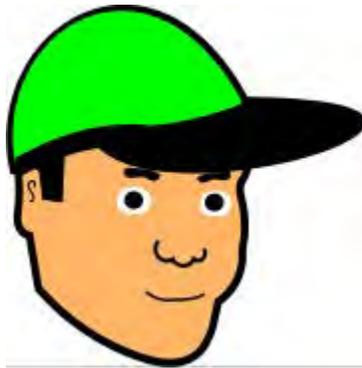
Who is Neo Eigenvector?



Name: Cesar

Occupation:
Engineer

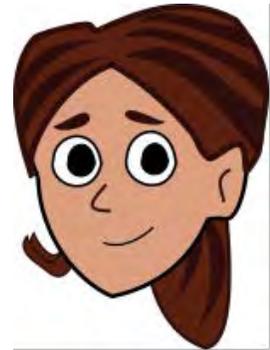
Favorite Number:
445



Name: Bella

Occupation: Political
Scientist

Favorite Number: 4.0



Name: Elizabeth

Occupation: Hair Stylist

Favorite Number: -10



Name: Dylan

Occupation: Liberal Arts
Professor

Favorite Number: 97,832



Name: DeAndre

Occupation: Small
Business Owner

Favorite Number: 500



Name: Marcy

Occupation: Artist

Favorite Number:
56,748



Scene #1 U.S. Capitol Building -- Washington, D.C.



Security guards were surprised to learn that Neo Eigenvector apparently made copies of Top Secret government files which may expedite the building of a World Conquering Device. In the Senate restroom, police found this note written on a stall.

$$A = \begin{bmatrix} 2 & 1 \\ 2 & 4 \end{bmatrix}$$

$$B = \begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$$

$$C = \begin{bmatrix} 10 & 6 & 0 \\ 2 & -3 & 5 \end{bmatrix}$$

$$D = \begin{bmatrix} -8 & -3 & -2 \\ -1 & -4 & 6 \end{bmatrix}$$

$$E = \begin{bmatrix} 4 & 3 \\ -1 & 2 \\ 5 & -9 \end{bmatrix}$$

$$F = \begin{bmatrix} 0 & -7 \\ 5 & 1 \\ 2 & -2 \end{bmatrix}$$

Welcome to the Matrix of Matrices. I will free your mind. But first I must frustrate my mind and journey to Congress. Where I overheard this exchange...



“I can create more complicated meandering square matrices than you!” yells the House. “Wanna bet?” the Senate replies, “My determinant will be bigger than your determinant!”

Do these operations create possible matrices? What is the determinant?

| | |
|--------|----------------------------|
| House | $((D + 2C) \times E) - 5B$ |
| Senate | $((A \times C) + 3D) + F$ |

House is Larger

Senate is Larger

Neither is Possible

h = its determinant

s = its determinant

w = 0

_____ = _____

Scene #2 John's Hopkins Medical Center -- Baltimore, Maryland

After a quick trip down the highway, Neo broke into one of the world's top medical schools and stole radiation materials. Investigators are unclear how they will be used in the world conquering device.



Four long-term patients require three kinds of medications. The 3x4 matrix shows the amounts of the medication each patient requires each day. If Patient A stays 10 days, Patient B stays 5 days, Patient C stays 20 days, Patient D stays 10 days, how much of each type of medication must the medical staff have on hand?

| | Patient A | Patient B | Patient C | Patient D |
|-------------|-----------|-----------|-----------|-----------|
| Prilosec | 5 units | 50 units | 25 units | 15 units |
| Hydrocodone | 15 units | 5 units | 20 units | 20 units |
| Prednisone | 25 units | 10 units | 15 units | 30 units |

Which of the following amounts is not enough?

925 units of Prilosec **a = 925**

775 units of Hydrocodone **c = 775**

900 units of Prednisone **d = 900**



Air traffic controllers were startled to find that one of the military stealth bombers was hotwired and stolen. Later, in sidewalk chalk they found this note on the runway.

An interesting thing I have learned is that everyone around here speaks in code. I've decided to join in on the fun. I have encrypted a word that has been connected to D.C. perhaps longer than any of its kind.

Here's the Biology of Cryptology Methodology:

$AB = X$ and thus $XB^{-1} = A$ where A equals the Unencrypted Matrix, B is the encoding matrix and X is the Encrypted Matrix.



| Encrypted Matrix | Encoding Matrix | Encoding Inverse |
|---|--|------------------|
| $X = \begin{bmatrix} 102 & 216 \\ 98 & 219 \\ 64 & 167 \\ 44 & 107 \\ 80 & 140 \end{bmatrix}$ | $B = \begin{bmatrix} 4 & 7 \\ 2 & 6 \end{bmatrix}$ | |

Is the encrypted word a...

| | | | |
|------------------------------|------------------------------|------------------------------|----------------------------|
| Country ↓ A = 5 | Person ↓ C = 15 | Animal ↓ H = 25 | City ↓ S = 30 |
|------------------------------|------------------------------|------------------------------|----------------------------|

_____ = _____

Scene #4 Smithsonian Museum of Natural History -- Washington, D.C.



Posing as an ordinary tourist, Neo Eigenvector stole the femur of an adult Apatosaurus.



Despite popular belief, there is not a treasure map on the back of the Declaration of Independence. However after a little inspection, there is a 4×4 determinant problem doodled by Ben Franklin. Don't believe me? Go see for yourself. Solve this monster determinant to get your next clue.

W = the determinant

W = _____

| | | | |
|----|----|----|----|
| 10 | 7 | -7 | 5 |
| -9 | 0 | 2 | -1 |
| 3 | -3 | 1 | -4 |
| -1 | 8 | 5 | 2 |

Scene #5 White House -- Washington, D.C.

Although the details are sketchy, a Secret Service member identified a person posing as a gardener digging up Michelle Obama's vegetable garden. All the tomatoes were taken!



DC MONUMENT BIKE TOUR



| | | |
|----------------------|--------------------|---------------------|
| CHILDREN \$25 | ADULTS \$40 | SENIORS \$30 |
|----------------------|--------------------|---------------------|

You can't drive around D.C. without nearly running over an 8th Grader. What gives? Why do schools only bring 8th Graders to D.C.? So of course I got stuck behind a group in line for a Bike Tour and I waited long enough to figure out a system of equations with three variables... so yeah... I waited a long time.

There are 188 people on the trip and their total cost for the bike tour was \$5040. There were twelve more adults than seniors on the trip. How many children were there?

| | |
|------------|---------------|
| 148 | a = 25 |
| 154 | d = 25 |
| 160 | s = 25 |



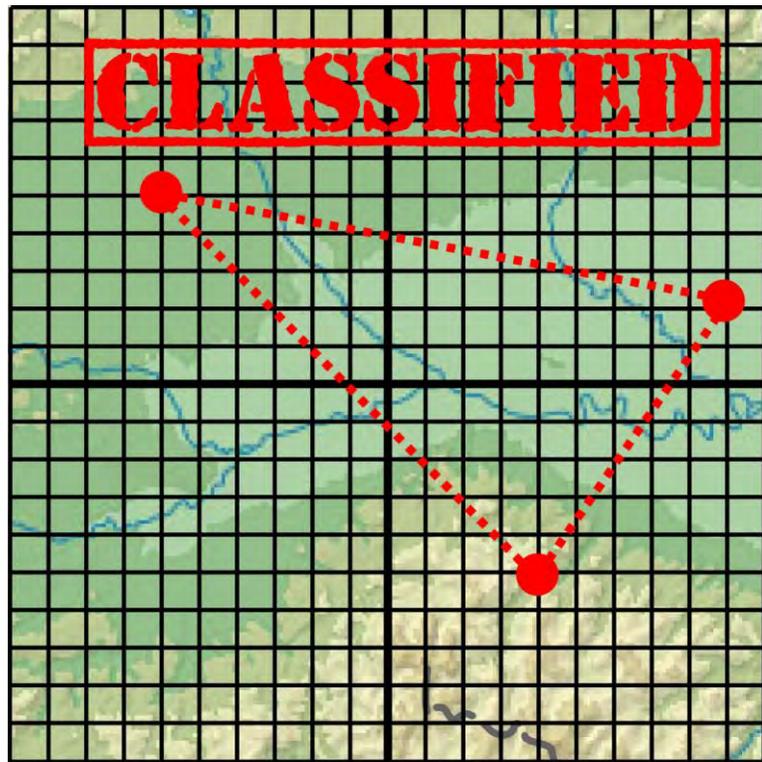
Last night, Neo Eigenvector repelled into the heavily alarmed wing of the Pentagon. Neo most definitely has soft feet because he made a getaway with a top secret safe. When asked about the contents of the safe, Pentagon spokesperson said, "Yeah, it's bad."

One thing I learned on my trip: Don't touch any buttons at the Pentagon. The Mathemagicians want OUR Device to conquer the world, not there's.

Thanks to someone Tweeting out some info, I got the scoop on an imminent search operation that the Army is planning.

Each unit represents 1 mile, thus each square represents 1 mi². The military has established a perimeter with three stations.

How much area do they need to cover for this operation? HINT:



$$\text{Area} = \pm \frac{1}{2} \begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$$

50
↓
a = 50

55
↓
c = 55

60
↓
d = 60

65
↓
h = 65

CRYPTIC PUZZLE SOLVER TEXT MESSAGE

Exiting the Matrix...

$$W \bullet A \div S + H - D \bullet C$$

Your new BFF, Neo Eigenvector