Project Title: CSI Algebra: Lines

Standard Focus: Patterns, Algebra and Functions

Time Range: 1-3 Days

Supplies: Pencil and Paper

Topics of Focus:
- Slope
- Calculating, graphing and interpreting lines
- Parallel and Perpendicular lines

This particular was mapped to the curriculum in Glencoe Algebra 1 Chapter 5 and can be used as an enrichment or review activity.

| Functions | 8.F | 3. Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. |
| Functions | 8.F | 4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models. |
| Interpreting Functions | F-IF | 7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. |
| Expressing Geometric Properties with Equations | G-GPE | 5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). |
| Expressing Geometric Properties with Equations | G-GPE | 6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. |
| Interpreting Categorical and Quantitative Data | S-ID | 6c. Fit a linear function for a scatter plot that suggests a linear association. |

Procedures:

A.) Student will be given the letter from Chief Harris, the possible suspects, and crime scene puzzles.

B.) Students will work in pairs or individually to solve the crime.
C.) Students will determine which suspect should be arrested.

D.) Students will create a portfolio of evidence proving that they have arrested the right person and will demonstrate their understanding of their mathematical content present in the problem.

*E.) Students can present their evidence to the class as an oral presentation.

*Extensions
CSI Algebra: Lines

Detectives,

The sun sets, the winds blow, and the international evil genius terrorist group the Mathemagicians wreak havoc on yet another world region. It seems they are making progress in their plans to build a world conquering device despite our best efforts to apprehend their cronies. China is the victim of the latest string of heists at the hands of a henchman (or henchwoman), Li Squareds. It is not a sure, Li Squareds is definitely some kind of henchperson.

As has become the calling card of the Mathemagicians, they have left behind a trail of notes with a cryptic text message. The text message when substituted correctly will calculate to the Li’s favorite number. So far there are six suspects that have been questioned. It is hoped that someone with a relatively strong number sense and spatial reasoning can crack the codes that have puzzled the detectives on the case so far.

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

- Slope & Rates of Change
- Calculating, graphing, and interpreting lines
- Parallel and Perpendicular lines

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. It is important to remember 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. ____________

2. ____________

3. ____________
<table>
<thead>
<tr>
<th>Name</th>
<th>Occupation</th>
<th>Favorite Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ken</td>
<td>Butcher</td>
<td>7</td>
</tr>
<tr>
<td>Tripiti</td>
<td>Pet Store Owner</td>
<td>10</td>
</tr>
<tr>
<td>Brandi</td>
<td>Realtor</td>
<td>13</td>
</tr>
<tr>
<td>Pete</td>
<td>Rock Star / Philanthropist</td>
<td>-19</td>
</tr>
<tr>
<td>Dawne</td>
<td>Archivist</td>
<td>-10</td>
</tr>
<tr>
<td>Nash</td>
<td>Insurance Salesman</td>
<td>11</td>
</tr>
</tbody>
</table>
Scene #1  National Art Museum of China -- 中国美术馆

Li Squareds broke into the National Art Museum of China and emerged with a ceremonial dragon dance costume. Cameras caught a glimpse of this heist as Li danced out of the museum untouched -- in full dragon gear. Security Guards assumed the night custodians were having a bit of fun.

Nǐhǎo dudes, I’m honored that your elite team of investigators has decided to waste hundreds of man-hours attempting to crack my uncrackable puzzles. I hope you like change. Rates of change in fact. No place in the world changes as fast as China, and no evil mathematician group increases the rate of change like the Mathemagicians!!1!1!

I drew this amazing piece of dragon art out of 18 straight line segments.

Find the slope of all 18 segments and add them together. This answer will be equal to 龙. (All Undefined Slopes will count as 0 and all ordered pairs are integer coordinates)

(Note: Don’t count the flaming ball of fire, that’s just there to be super cool.)

龙 = __________

Scene #2  Quanjude Restaurant -- 全聚德

A waitress noticed that eighteen mutated duck legs were stolen. After a thorough investigation, police found pieces of this note in five different fortunate cookies.

I just realized that going to China qualifies as roaming on my cell phone plan. I need to get a local cell or I’m going to need to sell my car and I really need to stay in touch with the rest of the Mathemagicians. Oh no! More change! Here are my options:

<table>
<thead>
<tr>
<th>Company</th>
<th>Unlimited Calls (per month)</th>
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<td>Mobile</td>
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RMB = Renminbi, the official currency of China

If I send 1,500 texts per month, which plan is the cheapest? Write equations for each company to find out! The first English letter of the cheapest company will be equal to 2.
Scene #3  Beijing West Railway Station -- 北京西客站

A conductor on a high speed train entered an onboard restroom and imagine his surprise to find the ceiling been dismantled, the wiring in disarray, and a hybrid electric fuel cell missing. Found written on a roll of toilet paper was this note left by Li Squareds.

These trains sure go fast. After doing some riding, I built these linear models to estimate their travel time including their station stops. If I’m trying to conquer the world quickly, I need the fastest train.

Which one is the fastest? (x = hours, y = miles. I’m using mph instead of km/h for you silly Americans.)

<table>
<thead>
<tr>
<th>U</th>
<th>D</th>
<th>T</th>
<th>M</th>
<th>B</th>
</tr>
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<tbody>
<tr>
<td>y + 12 = 175x</td>
<td>y + 5 = 31x</td>
<td>y = 100x - 10</td>
<td>y = x - 0.15</td>
<td></td>
</tr>
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(letter of train) = (speed of train)

Scene #4  Yabuli Ski Resort – 亚布力滑雪旅游度假区

A kiloton of pure Mongolian snow was snatched off the top of the highest mountain in the Yabuli Ski Resort. Investigators deciphered this note written in the snow in some sort of liquid.

As you can imagine when descending the slopes, I have a need -- a need for speed. Figure out which hill gives me the steepest, dopest, decline. Graph and label them so you don’t get confused.

hill M: Travels through points (1, 7) & (6, 4)

hill T: 2x + 6y = 30

hill U: Travels through the point (6, 1) with a slope of -4/5

(fastest hill) = (its slope)

_______ = _______
Scene #5  The Great Wall -- 万里长城

Investigators believe forty-five perfectly square limestone bricks were taken from the North Pass in the Great Wall. It is believed these bricks will be foundational pieces in the world conquering device.

Lots of interesting landscaping in this country. I'm certainly happy to be heading back home with all my goodies, but I've been inspired to go home and do some yard work. In fact I plan to make the Great Wall of Li Squareds. The big question is where to put it...

If you want to figure out where I'm going to put it, just follow the directions and figure out the equation of the final line.

1. A line parallel to A that travels through the point (5, 1).
   This line is ______________

2. A line perpendicular to the new line that travels through the point (0, 2).
   This line is _____________

3. A line perpendicular to the new line that travels through the point (-2, -2).
   This line is _________

4. A line parallel to the new line that travels through the point (-1, 1).
   This line is _________

Find the line and then the next piece of the puzzle.

<table>
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<th>y = ½ x + 1</th>
<th>y = -2x -1</th>
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© 21st Century Math Projects
Inside what is now the modern Palace Museum, curators discovered nine ritual bronze vessels of the Shang and Zhou eras were stolen. These vessels demonstrate the technological sophistication of early metal casting. Li Squareds left this note their place.

Change is good. Fast change is better. You should take a look at China's recent Gross Domestic Product. It's on the up and up.

Based on the trend line, what is the GDP predicted to be in the year 2018?

有一个愉快的一天

钱 = _______

CRYPTIC PUZZLE SOLVER TEXT MESSAGE

Double check your stroke order when using your Mandarin. Loving Lines. ttyl Li Squareds

(M + 喜) * 钱 + (龙 * U) + [(T + M - 喜) / 龙]
Thank you for being my Math Friend!

If you liked this 21st Century Math Project, you might like others. (Click the logo)

Math it Up.
Boomdiggity.

© 21st Century Math Projects
Who is Li Squareds?

Name: Ken
Occupation: Butcher
Favorite Number: 7

Name: Tripiti
Occupation: Pet Store Owner
Favorite Number: 10

Name: Brandi
Occupation: Realtor
Favorite Number: 13

Name: Pete
Occupation: Rock Star / Philanthropist
Favorite Number: -19

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Occupation: Archivist
Favorite Number: -10

Name: Nash
Occupation: Insurance Salesman
Favorite Number: 11
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Hill M slope = -3/5, U = -4/5, T = -1/3
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   \( y = \frac{1}{2} x + 1 \)

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   This line is I
   \( y = -2x - 1 \)

3. A line perpendicular to the new line that travels through the point (-2, -2).
   This line is B
   \( y = -2x + 1 \)

4. A line parallel to the new line that travels through the point (-1, 1).
   This line is C
   \( y = \frac{1}{2} x - 1 \)

Find the line and then the next piece of the puzzle.

爱 = \( \frac{1}{2} \)  |  喜 = -2  |  信 = -2  |  熊猫 = \( \frac{1}{2} \)
Scene #6  The Forbidden City  -- 故宫博物院

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有一个愉快的一天

212866 + 48863(12)

钱=799222

CRYPTIC PUZZLE SOLVER TEXT MESSAGE

Double check your stroke order when using your Mandarin. Loving Lines. ttyl Li Squareds

10=龙...  T = 186 ... U = -4/5 ... 钱=799222 ... M = 2  喜 = -2

(M + 喜) * 钱 + (龙* U) + [(T + M - 喜) / 龙]

(2+2) * 799222 + (10*-4/5) + [(186+2- -2)/ 10]

0 +8 +19 = 11

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