Key Stage 5 – Let me get this straight

Notes for teachers

At a glance

Scientists at the University of Oxford often use mathematical modelling as a key part of their research. Modelling how information travels through social media sites is a part of understanding ways to analyse and potentially reduce the spread of misinformation.

This activity looks at how to transform non-linear graphs that might be used to describe the spread of information through social media sites to linear ones in order to check that the data fits the relationship and to obtain unknown constants.

Learning Outcomes

- Students can manipulate equations to achieve a linear relationship between variables in the form \( y = mx + c \)
- Students can use the gradient and intercept of a linear graph to obtain unknown constants

Each student will need

- Student worksheet, calculator, pencil

Possible Lesson Activities

1. Starter activity
   - Show the students ‘Keeping Social Media Social’ video
   - Ask students to discuss briefly when they choose to share/retweet etc posts they see on social media

http://www.oxfordsparks.ox.ac.uk/content/keeping-social-media-social
• Modelling the Spread: Ask all the students to stand up and select a volunteer to start ‘sharing’ a post by tapping two people on the shoulder. Those two people need to each tap two people who are standing up on the shoulder and then sit back down to show they have received the ‘post’. The people who have been tapped on the shoulder then each tap two more standing people on the shoulder and so on. Very quickly everyone in the room will be sitting down showing they have ‘seen’ the post

• If the post were shared this way every second (and there were an infinite number of people who hadn’t seen it)

1) What would be the mathematical relationship between the time and the number of new posts per second to being tweeted?

It may help if students fill out a table of the first few values

<table>
<thead>
<tr>
<th>t, time in seconds</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>n seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>p, number of new posts</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>16</td>
<td>32</td>
<td>64</td>
<td>?</td>
</tr>
</tbody>
</table>

Answer: \( p=2^t \)

2) [Optional] Verify that the total number of posts (including previous posts) being tweeted after \( n \) seconds, \( P_n \), is given by \( P_n=2^{n+1}-1 \) for \( n=3, n=6 \)

2. Main activity: Let me get this straight

• Give out the student worksheet and go through the answers after each section (see below for answer sheet)

3. Plenary

• A report by the World Economic Forum puts forward a risk factor of ‘digital wildfires’ – social media events in which provocative content spreads rapidly and broadly, causing significant harm. The University of Oxford is involved in the Digital Wildfires project (see link below) and is looking at ways that the spread of this content can be prevented or reduced.

• Do the students think that stopping the spread of information would ever be possible? If it was possible, would it be desirable?

Weblinks

• Digital wildfire KS4/5 resources on TES website

• Oxford Sparks Keeping Social Media Social page

• Digital Wildfire research page
  http://www.digitalwildfire.org/
Answers to *Let me get this straight* student worksheet

<table>
<thead>
<tr>
<th>Equation</th>
<th>Plot ? (vertical)</th>
<th>Against ? (horizontal)</th>
<th>Gradient</th>
<th>Intercept</th>
</tr>
</thead>
<tbody>
<tr>
<td>p= 2t^2+5</td>
<td>p</td>
<td>t^2</td>
<td>2</td>
<td>+5</td>
</tr>
<tr>
<td>p= 3 + \frac{18}{t}</td>
<td>p</td>
<td>1/t</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>p^2=100+18t</td>
<td>p^2</td>
<td>t</td>
<td>18</td>
<td>100</td>
</tr>
<tr>
<td>p = 5at^2+b^2</td>
<td>p</td>
<td>t^2</td>
<td>5a</td>
<td>b^2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>t</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>4</td>
<td>4.5</td>
<td>6</td>
<td>8.5</td>
<td>12</td>
<td>16.5</td>
</tr>
<tr>
<td>t^2</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>16</td>
<td>25</td>
</tr>
</tbody>
</table>

Gradient = 0.5  Intercept = 4  \( p=0.5t^2+4 \)

**Logarithmic Graphs**

1) \( p=5t^{1.7} \)  Gradient=1.7
2) \( p=5t^{-1.6} \)  Gradient = -1.6
3) \( p=5t^{2a} \)  Gradient=2a

**Please retweet**

k is 1.5 (gradient is -1.5)

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