Lecture 1 - What is Math 20 about?

Course website/handout - ACE

A: Math 20 is about integration, one of the main operations of calculus. Integration is the process of "putting together" data and arriving at a single quantity.

Examples:

- Suppose a hot air balloon rises at a constant rate of $\frac{1}{2} \text{m/sec}$. How far up will the balloon be after one minute?
- An astronomer studying a pulsar takes the luminosity measurements of a star three times:
  
<table>
<thead>
<tr>
<th>Date</th>
<th>Luminosity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/01</td>
<td>4.2 units</td>
</tr>
<tr>
<td>5/01</td>
<td>3.8 units</td>
</tr>
<tr>
<td>6/01</td>
<td>4.1 units</td>
</tr>
</tbody>
</table>

  What is the average luminosity over 3 months?

- What are the areas of a rectangle, triangle, circle, pentagon?
- What are the volumes of a prism, pyramid, sphere, cone?
- What is the length of a straight line?

How integration allows us to answer more general questions:

- Balloon's upward velocity might not be a constant, but could vary as a function of $t$. Height after $t$ minutes.
- The astronomer could take continuous measurements to an average.
- Areas of curved regions
- Volumes with nonconstant cross-sections
- Lengths of curved lines

Integration: breaks up a complicated task into infinitely many simpler tasks, then combines the results to answer.