Meeting 3 Student’s Booklet

Inclination: Explorations on Slopes Part 1

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A stork is flying at a constant direction towards the nest. Will it ever reach it?

Argue mathematically, convincing your friends of your answer.
Doves are flying in different straight directions, to deliver messages to different heights of a tower of height 200 ft. Find out the height at which each dove arrives.

The solution for bird A is given below, as an example. You can do your work on the next page.

**SOLUTION FOR BIRD A: 8 UNITS UP THE GROUND**

Everytime bird A moves 2 units to the right (2 →), it rises 2 units (2 ↑). So if it moves 1 →, it also moves 1 ↑.

Bird A starts from a position which is 6 units to the left of the building, and 2 units up the ground. To reach the building, it needs to move 6 →. As it does that, it also moves 6 ↑, reaching a height of 2+6=8 units up the ground.
Find out the height at which each dove arrives.

B:

C:
2 The slope of a line

The slope of a line is a number that tells us how steep the line is: the larger the slope, the steeper the line.

The slope $m$ is defined as follows:

- Pick point in the line.
- Move 1 unit to the right and then move up (or down) to get back to the line.
- Whatever number of units $m$ you moved vertically is the slope.

Another way to find slopes: choosing two points on a line, forming a “slope triangle” (as in the figure), and calculate the following fraction:

$$m = \frac{\text{RISE}}{\text{RUN}}$$

45 degrees
Horizontal and vertical change are the same

- $m = \infty$
- $m = 6$
- $m = 3$
- $m = 2$
- $m = 1$
- $m = 1/2$
- $m = 1/5$
- $m = 0$
A bird that moves horizontally would be describing a line with slope zero (0), because there is no rise.
RISE OVER RUN

“The larger the slope, the steeper the line”

Complete the values of the slopes of these lines. You may use the formula RISE / RUN, or any other method you want.

RISE / RUN

m = __
m = ___
m = __
m = 4/5

m = ___
m = 1/5
# Game of Slopes

Do slopes with your arm or with a cane!

Make 2 Teams, and take turns playing.

Put all 6 cards on the table.

Each turn, one player must do charades (using their arms, for example) for one slope from the table. If the team guesses correctly, they get the card (cross the card, it is out of the game).

The Team with most cards wins

<table>
<thead>
<tr>
<th>slope</th>
<th>slope</th>
<th>slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>m = 0</td>
<td>m = 1</td>
<td>m = 2</td>
</tr>
<tr>
<td>m = 5</td>
<td>m = 1/4</td>
<td>m = 10</td>
</tr>
</tbody>
</table>
The hypotenuses of all these slope triangles have the same inclination or slope $m$. What is $m$?

Draw another triangle of the same slope, with base equal to $1/2$.

If we move all triangles aligning them to the left part of the frame, what happens?

There is a dot in the frame. Draw a second dot so that the line joining them has a slope of $6/8$.

Draw the line. Where does the line meet the right side of the frame? Explain why.
The straight arrow has some dots, and the horizontal and vertical positions are shown. What is the slope of the arrow?

\[ m = \] 

What will be the vertical position of the arrow when its horizontal position is equal to 14.1?

What is the slope of this line? \( m = \) 

Draw the right triangle corresponding to this slope. If you stretch triangle horizontally by a factor of \( x^2 \) (and maintain its height), what happens to the slope?

\[ \]
CLIMBING ANIMALS

A bug can climb walls of slope 3 or less.

A crab can climb walls of slope 4/3 or less.

A snail can climb walls of slope 3/4 or less.

Determine how far each of the three animals gets.
(You will need to specify their horizontal and vertical positions).
3 How Tall are you?

GROWTH

Which of the following graphs better describes how the height of a person changes with the pass of time? Justify your answers!

(a) Height

(b) Height

(c) Height

(d) Height

Age

10 20 30 40

Age

10 20 30 40

Age

10 20 30 40

Age

10 20 30 40
AGES FROM 0 TO 2

In the next pages you will find age-charts for people from 0 to 2 years (boys/girls).

In the following, use the chart as a tool. The chart tells us the estimated eighth of a person depending on its age.

Choose any of the 5 curves and suppose that you follow that curve.

(a) Draw your curve with a color

(b) Are the growth rates speeding up or slowing down, as time passes? Explain.

(c) Which is larger:

the average rate of change of height from 0 to 4 months OR the average rate of change of height from 4 to 10 months

(c) When you were 4 months old, your mother gave you a magic potion that allowed to keep the growth rate that you had at that time, instead of following the curve.

What would have been your height when you were 6 months old? What would be your height now?

(d) Suppose that your mother wanted you to be as tall as possible. Would she have rather chosen to give you the potion when you were 2 months old? Why?
3 HOW TALL ARE YOU?
3  HOW TALL ARE YOU?

Boys

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3 HOW TALL ARE YOU?

AGES FROM 3 TO 20

USE THIS GROWTH CHART TO COMPLETE THE QUESTIONS IN THE NEXT PAGE

1 INCH = 2.54 CM

1 in

0.5 cm

1 in
(1) Find your age and height (estimate your height if you are not sure)

(2) Find your curve and color it (or draw a new curve if your point was not in that curve)

(3) When you were 7 years old, your friend took you to a midget Mansion. It was so small that they would only let in kids whose height were less than 120 cm. Were you able to get in? How do you know?

(4) Suppose that there is a magic potion that you can only drink once in your life, and if you drink it, you will grow at whatever rate you were growing at that time. If you want to be really tall when you are 20, is it better to drink the potion when you are 14 years old, or 17 years old? Why?

(5) If you drink the potion at the chosen age, predict your height when you are 20 years old.
4 Duplicating rectangles

We want to break the World Record of Most rectangles drawn in 3 minutes, such that each rectangle has twice the area of the previously drawn rectangle.

1. Predict: how many rectangles will you be able to draw?

2. Your mentor will give you 3 minutes and you have to draw as many rectangles as you can!

READY... SET... GO!

3. Starting with a 1x1 rectangle and following the rules above, how would you draw 8 the rectangles in a grid so that they don’t overlap and they are all contained in a square of area as small as possible?

4. Find 1+2+4+8+16+32+64+128 using the previous problem.

5. What is 1+2+4+...+2048 + 4096?