**Lower Elementary:**

*Question:* Grace plants a pea for her science fair project and measures how much it grows each week. The first week, it grows 2 centimetres. After 2 weeks, it is 5 centimetres tall. After 3 weeks, it is 9 centimetres tall. After 4 weeks, it is 14 centimetres tall. After 5 weeks, it is 20 centimetres tall. If the pattern continues, how tall will the pea plant be after 6 weeks?



**Upper Elementary:**

*Question:* Natalie collects water samples from 6 random puddles around her neighbourhood and counts the number of mosquito larvae in each. She finds 12, 22, 0, 13, 8, and 13 larvae in the samples. What is the average number of larvae per water sample that Natalie collected?

**Middle School:**

*Question:* Bill’s science fair project is to test the different bacteria in the mouths of dogs and people. He swabs his own mouth and his dog’s mouth and then dabs a square centimetre of each in separate petri dishes. If the human mouth bacteria colony grows by a factor of 3 each day and the dog bacteria colony grows by a factor of 1.5 each day, then how much bigger will the area covered by the human bacteria be after 3 days?

**Algebra and Up:**

*Question:* Luke makes a papier mache, right-circular-cone-shaped volcano model for his science fair project. The cone is 1.2 metres tall before he cuts off the top, which makes the volcano 2 decimetres shorter. If the area of the circular base of the cone is 144π square decimetres, then what is the volume of the volcano model after its top has been removed?

(Hint: The volume of a cone is ⅓ of the area of its base times its height.)

**Lower Elementary:**

*Question:* Grace plants a pea for her science fair project and measures how much it grows each week. The first week, it grows 2 centimetres. After 2 weeks, it is 5 centimetres tall. After 3 weeks, it is 9 centimetres tall. After 4 weeks, it is 14 centimetres tall. After 5 weeks, it is 20 centimetres tall. If the pattern continues, how tall will the pea plant be after 6 weeks?

*Answer:* 27 centimetres

*Solution:* The plant grew two centimetres the first week, 5 – 2 = 3 centimetres the second week, 9 – 5 = 4 centimetres the third week, 14 – 9 = 5 centimetres the fourth week, and 20 – 14 = 6 centimetres the fifth week. The pattern is that it grows 1 more centimetre each week than it did the last. So, it will grow 7 centimetres the sixth week, making it 20 + 7 = 27 centimetres tall.



**Upper Elementary:**

*Question:* Natalie collects water samples from 6 random puddles around her neighbourhood and counts the number of mosquito larvae in each. She finds 12, 22, 0, 13, 8, and 13 larvae in the samples. What is the average number of larvae per water sample that Natalie collected?

*Answer:* 11½ larvae

*Solution:* To find the average, we add up all the numbers of larvae and then divide by the number of samples. Natalie collected a total of 12 + 22 + 0 + 13 + 8 + 13 = 68 mosquito larvae in her samples. So, the average number of mosquito larvae in a sample is 68 ÷ 6 = 11½.

**Middle School:**

*Question:* Bill’s science fair project is to test the different bacteria in the mouths of dogs and people. He swabs his own mouth and his dog’s mouth and then dabs a square centimetre of each in separate petri dishes. If the human mouth bacteria colony grows by a factor of 3 each day and the dog bacteria colony grows by a factor of 1.5 each day, then how much bigger will the area covered by the human bacteria be after 3 days?

*Answer:* 23.625 square centimetres

*Solution:* Over three days, the human bacteria colony triples in area 3 times. So, the human bacteria colony will be 1 × 3 × 3 × 3 = 27 square centimetres. The dog bacteria does the same thing, but its factor is 1, so it will be 1 × 1.5 × 1.5 × 1.5 = 3.375. So, the human bacteria colony is 27 – 3.375 = 23.625 square centimetres bigger.

**Algebra and Up:**

*Question:* Luke makes a papier mache, right-circular-cone-shaped volcano model for his science fair project. The cone is 1.2 metres tall before he cuts off the top, which makes the volcano 2 decimetres shorter. If the area of the circular base of the cone is 144π square decimetres, then what is the volume of the volcano model after its top has been removed?

(Hint: The volume of a cone is ⅓ of the area of its base times its height.)

*Answer:* 573⅓π cubic decimetres

*Solution:* One way to find the difference in volume between the cut-off cone and the volume of the whole cone. The whole cone is ⅓ × 144π × 12 = 576π cubic decimetres before the top is removed. The dimensions of the cut-off cone are 2 ÷ 12 = ⅙ those of the whole. Since the base is in two dimensions, its area is ⅙ × ⅙ × 144π = 4π square decimetres. The volume of the cut-off cone is ⅓ × 4π × 2 = 2⅔π cubic decimetres, and the difference is 573⅓π cubic decimetres.