Our operatives have been captured from their super-secret base on Mars! The last transmission from Captain Spy Smith was thought to be a series of questions sent to his daughter (the pair shared a love of maths and would send each other brain teasers and tricky questions and race to see if they could complete them in the days between transmissions), but now we're not so sure...

This is where we need you: we believe the answers to the following questions are a coded message telling us where the spies have been taken. Solve each question, where each solution will correspond to a number from 1-26. Then, match that number to a letter - if the answer is **1** then the letter is **a**, if it's **2** then the letter is **b**, and so on through the alphabet all the way to 26 = z. The letters may not be in order so you will need to re-arrange them - we're sure they can't have been taken far, so the letters will spell out something on or near Mars. You can also find some comments from our agents on some of the questions in *[italics and square brackets]*

Question 6

Find the gradient of $f(x) = 3x(2x-5)(\sqrt{x}-2)$ at $x = 4$.

Question 2

At the start of the mission, we found 12 flies buzzing around the cargo hold and contained them in a tank that was originally meant for sample storage. After a week of being left to breed they'd increased their number to 46! If we suppose that the fly population could be modelled by the equation

$$P = Ae^{\lambda t}$$

where P is the number of flies, t is the number of days since we found them, and A and λ are real variables, how many days (from the start of the mission) until we've got 146??

[spy note: this question is perplexing, as there is no way any bugs could have survived the cleaning processes the cargo hold was subjected to! We can't risk any contamination of the surface! Unless...]

Question 3

Consider the curve $f(x) = \dfrac{1}{x} - 3x$ at point $A = (0.4, 1.3)$.
Find the y-intercept of the tangent line to $f(x)$ at A.

Question 4

Solve.

$$5y + 2x = 14 - z \tag{1}$$

$$3z + 2y = 3(x - 1) \tag{2}$$

$$4z + 7y + x = 11 \tag{3}$$

[spy note: the 'x' in this question was circled - could that be the important solution?]

Question 5

After studying the behaviour of a bizarre and highly energetic bird, physicists were able to model the distance it was from its nest at the start of every day by a simple polynomial equation

$$d = 2(216t - 18t^2 - 8t^3 - 249)$$

where t is the time in hours since it left its nest and d is the distance it is from its nest in metres. It is worth noting that this equation only holds until about 5 hours into the day, at which point the behaviour of the bird was completely different day to day.
After a certain time flying around every day the bird will come to rest. At this point, how far away from its nest (in metres) will the bird be?

Question 6

$$f'(x) = \frac{9x^3 - 2x^2 + 7\sqrt{x}}{x}$$

If $f(4) = 207$, find $f(1)$.