STEP CORRESPONDENCE PROJECT

Feedback: Assignment 1

Warm-up

1 **(i)** Some people used the difference of two squares, which worked nicely.

The answer could have been given in expanded form or in factorised form.

You might like to consider whether verifying the result for two values of x is sufficient to show that the answer is correct.

(ii) There are lots of ways of doing this.

You could start by noticing that $A = 1/B \iff AB = 1$, so all you have to do is show that $(\sqrt{1+x^2} - x)(\sqrt{1+x^2} + x) = 1$.

You can also rationalise the denominator on the right hand side.

For the last part, you can just say that $\sqrt{1+x^2} \approx x$ when x is much larger than 1. Even if you hadn't done the first part of this question, it would have been worth having a go at the last part.

Preparation

2 **(i)** You should remember to label the important points on the graph including the limits of the domain (i.e. the end-points of the graph).

(ii) The important point to notice is that the greatest value occurs at one end of the domain.

(iii) Although this part does not mention drawing a sketch, it is a really good idea to give a sketch which locates the vertex of the parabola — does it lie in the given domain of x or not?

(iv) This part was to get you thinking about how to find the vertex and it was meant as a hint for the next part.

(v) The other parts of the question should have nudged you in the correct direction. You should not take k to be an integer; if the question intended k to be an integer, it would

have stated this explicitly.

Your sketches should clearly show the location of the vertex of the parabola.

The question was asking for the maximum and minimum values of the graph for a **fixed** yet **unknown** value of k. The answers are expressions involving k, and (for the maximum) are different for positive and negative k (unless you do something clever). When $k > 2$ it is vital that you locate the vertex in relation to the domain of x.

The STEP question

3 This was quite a hard question — perhaps too hard for the very first assignment — and some people where not sure exactly what the question was asking.

The greatest and least values should have been given in terms of a, b and c; these parameters were **fixed** but **unknown**. The question was **not** asking you for the maximum and minimum values over all possible values of a, b and c.

There were quite a number of students with good (and even correct) answers who failed to support these answers adequately. In STEP (and many other examinations) correct answers on their own do not receive much credit. You must justify your answers fully.

(i) In the first part of the STEP question, you are asked: for a general $y = bx + a$ what are the greatest and least values in the given domain? Really it is not much harder than question 2i, but the greatest and least values are expressions involving a and b (and different for positive and negative b). Remember that a and b are **fixed** and **unknown**.

(ii) In the second part of the STEP question, you need to consider $c = 0$ as a separate case; but it is fine to say that when $c = 0$ the situation is just the same as in part (i).

When $c > 0$ the crucial thing is the location of the vertex of the parabola. The maximum and minimum values (which will be in terms of a, b and c) will vary depending on whether the x coordinate of the vertex (v say — it will be in terms of b and c) lies in the range $v < -10$, or in the range $-10 \leqslant v \leqslant 0$, etc.

Warm down

4 Some people thought that this was the hardest bit of the assignment and some people thought it was the easiest!

The first thing to do is draw your own diagram (big!) and put the lengths you have been given (R, a, b and r) on your diagram. Then it is just a case of using the area of a circle formula and a bit of Pythag.