Computational Maths/Information Technology solutions

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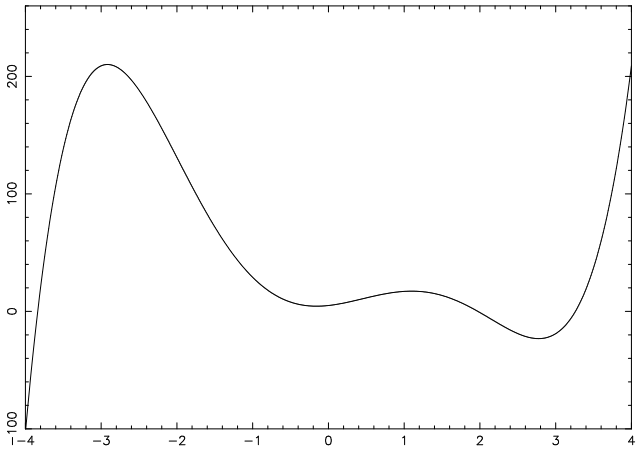
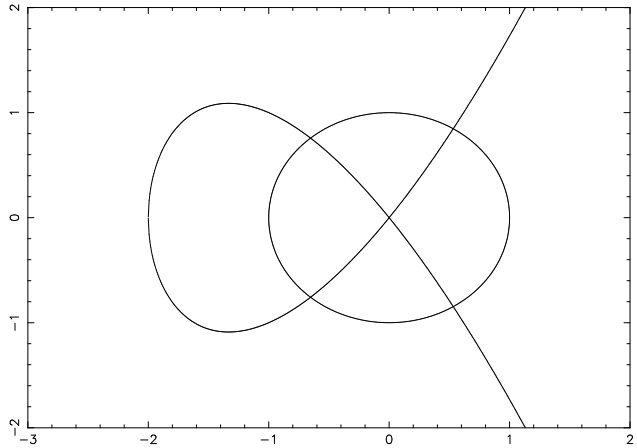
1. (a) Sketch (no scales -1) [*3 marks*]



4 stationary points $(-2.92, 210.14)$, $(-0.16, 4.42)$, $(1.10, 17.20)$, $(2.77, -23.18)$ [*3 marks*]

(b) Sketch (no scales -1) [*3 marks*]



4 roots $(-0.653, \pm 0.758)$ and $(0.532, \pm 0.847)$ [*3 marks*]

2. Check function `fa` defined [*1 mark*]

Evaluate at 3 points to check correct [*3 marks*]

First root is $x = 0.6180$ [*2 marks*]

check function `fb` defined [*1 mark*]

Turn over ...

and evaluate at $x = -1.61803401$ [*1 mark*]

check magnitude of gradient less than one at this point [*2 marks*]

Note: there are many rearrangements that work here, for example

$$f_b(x) = -\left(3 - 4x - x^2\right)^{1/4}$$

Here the $-$ sign is essential in the programme as your 4th root will be positive. Any rearrangement that had the correct root, and converged will do. A correct rearrangement that didn't converge still got some marks.

Second root is -1.6180 [*2 marks*]

3. Check function g(x) defined. [*1 mark*]

   Check function at 3 points to see if correct. [*4 marks*]

   Roots are -1.7085 -0.1506, 0.1501 [*5 marks*]

4. Inverses are

$$A^{-1} = \begin{pmatrix} -1.6 & -1 & 1.4 \\ -1.2 & -1 & 0.8 \\ 1.8 & 1 & -1.2 \end{pmatrix}, \qquad B^{-1} = \begin{pmatrix} 2 & -1 & 1.5 \\ -3 & 2 & -2.5 \\ 5 & -3 & 3.5 \end{pmatrix}$$

   [*6 marks*]

   Inverse is $B^{-1}A^{-1}$, require `BA` to be entered. [*2 marks*]

5. =NPER(1.25%,-150,4000,0,0) giving an answer of 32.639 (not required). [*2 marks*]

   Require 33 months. (no marks for 32.639) [*2 marks*]

   =PMT(1.25%,33,4000,0) [*2 marks*]

   monthly payments £148.67 (ignore sign) [*2 marks*]