Marks

Question 10 (12 marks) Use a SEPARATE writing booklet.

(a) Helen sets up a prize fund with a single investment of \$1000 to provide her school with an annual prize valued at \$72. The fund accrues interest at a rate of 6% per annum, compounded annually. The first prize is awarded one year after the investment is set up.

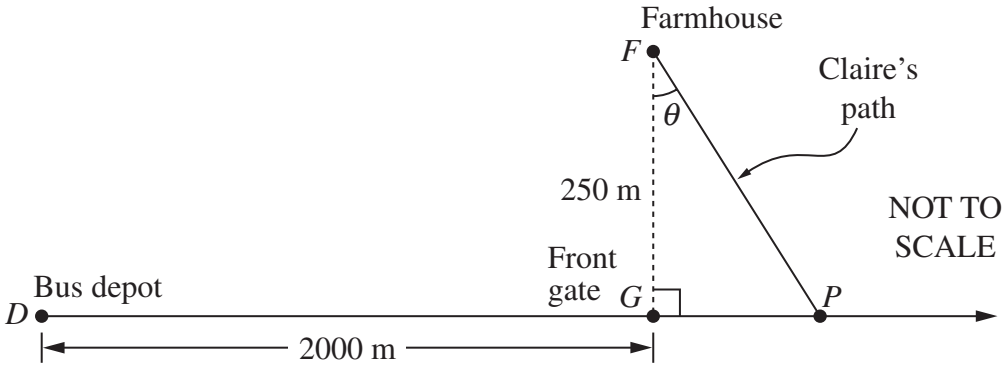
(i) Calculate the balance in the fund at the beginning of the second year. **1**

(ii) Let $\$B_n$ be the balance in the fund at the end of n years (and after the nth prize has been awarded). Show that $B_n = 1200 - 200 \times (1.06)^n$. **2**

(iii) At the end of the tenth year (and after the tenth prize has been awarded) it is decided to increase the prize value to \$90. **3**

For how many more years can the prize fund be used to award the prize?

(b)



The diagram shows a farmhouse F that is located 250 m from a straight section of road. The road begins at the bus depot D, which is situated 2000 m from the front gate G of the farmhouse. The school bus leaves the depot at 8 am and travels along the road at a speed of 15 m s^{-1}. Claire lives in the farmhouse, and she can run across the open paddock between the house and the road at a speed of 4 m s^{-1}. The bus will stop for Claire anywhere on the road, but will not wait for her.

Assume that Claire catches the bus at the point P on the road where $\angle GFP = \theta$.

(i) Find two expressions in terms of θ, one expression for the time taken for the bus to travel from D to P and the other expression for the time taken by Claire to run from F to P. **2**

(ii) What is the latest time that Claire can leave home in order to catch the bus? **4**

End of paper