**Higher Homework 04**

1) a) Find the equation of the straight line through the points A (-1,5) and B (3,1) .

b) Find the size of the angle which AB makes with the positive direction of the $x$-axis.

2) Two sequences are generated by the recurrence relations

$u_{n+1} = a\,u_n + 10$ and $v_{n+1} = a^2\,v_n + 16$.

The two sequences approach the same limit as $n \longrightarrow \infty$ .

Determine the value of $a$ and evaluate the limit.

3) Two functions $f$ and $g$ are defined by,

$f(x) = 5x^2 - 2$ and $g(x) = \frac{1}{5}x + 3$

a) Find expressions for i) $f(g(x))$ ii) $g(f(x))$

b) Find expressions for i) $f^{-1}(x)$ ii) $g^{-1}(x)$

4) A recurrence relation is defined by $u_{n+1} = a\,u_n + b$.

$u_6 = 8$, $u_7 = 21$ and $u_8 = 47$. Find the values of a and b.

5) The rear tyre on a tractor has a slow puncture which reduces the pressure in the tyre by 20% each day. The tractor driver uses a foot pump every morning to add 5 units to the tyre pressure. If the puncture gets no worse over a long period, what will the pressure in the tyre be each morning after it has been re-inflated ?

6) On the first day in March, a bank loans a man £2500 at a fixed rate of interest of 1·5% per month. This interest is added on the last day if each month and is calculated on the amount due on the first day if the month. He agrees to make repayments on the first day of each subsequent month. Each repayment is £300 except for the smaller final amount which will pay off the loan.

a) The amount that he owes at the start of each month is taken to be the amount still owing just after the monthly repayment has been made.
Let $u_n$ and $u_{n+1}$ represent the amounts that he owes at the starts of two successive months.
Write down a recurrence relation involving $u_{n+1}$ and $u_n$.

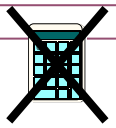
b) Find the date and the amount of the final payment.

7) a) The function $f(x) = 3x^2 + 11x - 20$. Solve $f(x) = 0$.

b) State the coordinates of the minimum turning point.

c) State the coordinates of the roots and turning point of the graph of $f(x+2)$.

d) State the coordinates of the roots and turning point of the graph of $f(5x)$.



8) Express each of the following in the form $(x + a)^2 + b$

a) $x^2 + 4x + 5$ b) $x^2 - 12x - 13$