

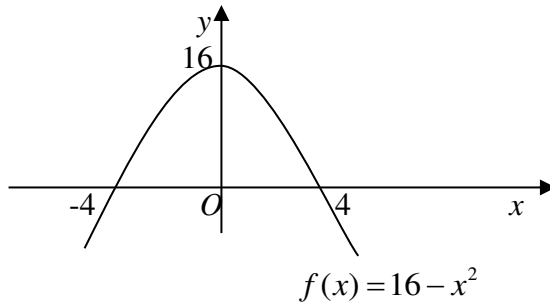
New Higher Homework 3

Section 1: Functions

1. $f(x) = \frac{1}{x^2 - 4}$, $g(x) = 2x$. If $h(x) = f(g(x))$, write down an expression for $h(x)$.
Suggest a suitable domain for the function h .

2. (a) Sketch the graph of $y = \log_2 x$.
(b) On the same diagram sketch the graph of $y = \log_2(x - 3)$.
[Show the coordinates of the points where your graphs cross the x -axis.]

3.



The above sketch shows the graph of $f(x) = 16 - x^2$.
On separate diagrams, sketch the graphs of:

- (a) $2f(x)$ (b) $16 - f(x)$
4. Given $f(x) = 2x^2 - 3$, find an expressions for $f^{-1}(x)$.

Section 2: Straight Line

1. A(-2,5), B(-1,3), C(1,-1). Prove that A, B and C are collinear and find the ratio in which B divides AC.
2. R is the point (10,3) and S is (-2,-3). Find the equation of the perpendicular bisector of RS.
3. A is the point (7,0), B is the point (-3,-2) and C is the point (-1,8).
Draw a sketch of the triangle ABC.
- (a) Find the equation of the median through C.
(b) Find the equation of the altitude through B.
(c) Find the coordinates of the point of intersection of the above median and altitude.

Section 3: Recurrence Relations

1. A sequence is defined by the equation $u_{n+1} = 0.9u_n + 2$, with $u_1 = 3$.
 - (a) Calculate u_2 .
 - (b) What is the least value of n such that $u_n > 10$?
 - (c) Explain why this sequence has a limit and calculate this limit algebraically.

2. A gardener feeds her trees weekly with “Bioforce, the wonder plant food”. It is known that in a week the amount of plant food in the trees falls by about 25%.
 - (a) The trees contain no Bioforce initially and the gardener applies 1g of Bioforce to each tree every Saturday. Bioforce is only effective when there is continuously more than 2g of it in the tree. Calculate how many weekly feeds will be necessary before the Bioforce becomes effective.
 - (b)
 - (i) Write down a recurrence relation for the amount of plant food in the tree immediately after feeding.
 - (ii) If the level of Bioforce in the tree exceeds 5g, it will cause leaf burn. Is it safe to continue feeding the trees indefinitely?

3. A sequence is defined by the recurrence relation $u_{n+1} = au_n + b$ ($n > 0$). Given $u_1 = 7$, $u_2 = 19$ and $u_3 = 43$ find the values of a and b .