

# Springburn Academy : Mathematics Department

## Higher Mathematics : Lesson Starters

### Block 2                      Functions

Only use a calculator if necessary

#### Task 1

1         $f(x) = 2x - 1$ ,  $g(x) = 3 - 2x$  and  $h(x) = \frac{1}{4}(5 - x)$ .

(a) Find a formula for  $k(x)$  where  $k(x) = f(g(x))$

(b) Find a formula for  $h(k(x))$

2        The functions  $f$  and  $g$ , defined on suitable domains, are given by  $f(x) = \frac{1}{x^2 - 4}$  and  $g(x) = 2x + 1$ .

(a) Find an expression for  $h(x)$  where  $h(x) = g(f(x))$ . Give your answer as a single fraction.

(b) State a suitable domain for  $h$ .

3         $\underline{v} = \begin{pmatrix} 3 \\ 2 \\ -5 \end{pmatrix}$ ,  $\underline{u} = \begin{pmatrix} -9 \\ 10 \\ 3 \end{pmatrix}$ , evaluate  $|\underline{uv}|$

4        Determine the nature of the roots of  $4x^2 - 5x + 20$

#### Task 2

1        Find the inverse of  $f(x) = 4x + 9$

2        Find the inverse of  $f(x) = 3x^2 - 6$

3        Find the equation of the median AD of triangle ABC where the coordinates of A, B and C are (-2, 3), (-3,-4) and (5, 2) respectively.

4        Given  $p(x) = x^2 + x - 6$ , which of the following are true?

I.  $(x + 3)$  is a factor of  $p(x)$ .

II.  $x = 2$  is a root of  $p(x) = 0$ .

**Task 3**

1 On a suitable set of real numbers, functions  $f$  and  $g$  are defined by  $f(x) = \frac{1}{x+2}$  and  $g(x) = \frac{1}{x} - 2$ . Find  $f(g(x))$  in its simplest form.

2  $f(x) = 3 - x$  and  $g(x) = \frac{3}{x}$

(a) Find  $p(x)$  where  $p(x) = f(g(x))$ .

(b) If  $q(x) = \frac{3}{3-x}$  find  $p(q(x))$  in its simplest form.

3 D, E and F have coordinates (10,-8,-15), (1,-2,-3) and (-2, 0, 1) respectively.

(a) (i) Show that D, E and F are collinear.

(ii) Find the ratio in which E divides DF.

4 For what value of  $k$  does the equation  $x^2 - 5x + (k + 6) = 0$  have equal roots?

**Task 4**

1 Sketch the graph of  $f(x) = 4x + 8$  and on the same diagram, sketch its inverse.

2 Sketch the inverse of  $f(x) = x^3 - 2$

3 Find the equation of the line that is perpendicular to  $4x + 12y - 18 = 0$  and goes through the point (-3, -5)

4 For the function  $f(x) = 4x^5 - 3x^2 + 12$ , find  $f'(x)$