



## Simplifying and Substituting (H)

### Intervention Booklet

Name: \_\_\_\_\_

Class: \_\_\_\_\_

#### Useful websites:

**[www.mathswatchvle.com](http://www.mathswatchvle.com)**

*(Video explanations and questions)*

Username: STH...@twgash

Password: stmaths

**[www.methodmaths.com](http://www.methodmaths.com)**

*(Past papers online that get instantly marked)*

Centre ID: wga

Username: firstname

Password: lastname

**[www.hegartymaths.com](http://www.hegartymaths.com)**

*(Online tutorials and quizzes)*

Login: first name and last name are case sensitive

**[www.bbc.co.uk/schools/gcsebitesize/math](http://www.bbc.co.uk/schools/gcsebitesize/math)**

## Expand and Factorise Quadratics

### Things to remember:

- Use FOIL (first, outside, inside, last) or the grid method (for multiplication) to expand brackets.
- For any quadratic  $ax^2 + bx + c = 0$ , find a pair of numbers with a sum of  $b$  and a product of  $ac$  to factorise.

### Questions:

1. Expand and simplify  $(m + 7)(m + 3)$

.....  
**(Total for question = 2 marks)**

2. (a) Factorise  $6 + 9x$

.....  
**(1)**

(b) Factorise  $y^2 - 16$

.....  
**(1)**

(c) Factorise  $2p^2 - p - 10$

.....  
**(2)**

**(Total for Question is 4 marks)**

3. Solve, by factorising, the equation  $8x^2 - 30x - 27 = 0$

.....  
**(Total for Question is 3 marks)**

4. Factorise  $x^2 + 3x - 4$

.....  
**(Total for question is 2 marks)**

5. Write  $x^2 + 2x - 8$  in the form  $(x + m)^2 + n$  where  $m$  and  $n$  are integers.

.....  
**(Total for question is 2 marks)**

6. (a) Expand  $4(3x + 5)$

.....  
**(1)**

(b) Expand and simplify  $2(x - 4) + 3(x + 5)$

.....  
**(2)**

(c) Expand and simplify  $(x + 4)(x + 6)$

.....  
**(2)**

**(Total for Question is 5 marks)**

7. (a) Factorise  $x^2 + 5x + 4$

.....  
**(2)**

(b) Expand and simplify  $(3x - 1)(2x + 5)$

.....  
**(2)**

**(Total for Question is 4 marks)**

8. (a) Expand  $3(2 + t)$  ..... (1)
- (b) Expand  $3x(2x + 5)$  ..... (2)
- (c) Expand and simplify  $(m + 3)(m + 10)$  .....

..... (2)  
**(Total for Question is 5 marks)**

9. (a) Factorise  $x^2 + 7x$  ..... (1)
- (b) Factorise  $y^2 - 10y + 16$  .....
- \* (c) (i) Factorise  $2t^2 + 5t + 2$  ..... (2)

- (ii)  $t$  is a positive whole number.  
 The expression  $2t^2 + 5t + 2$  can never have a value that is a prime number.  
 Explain why.

.....

.....

.....

..... (3)  
**(Total for Question is 6 marks)**

## Algebraic Fractions – Simplifying

### Things to remember:

- Factorise the numerator and denominator;
- Cancel common factors;
- Then add/subtract/multiply divide if necessary.

### Questions:

1. Simplify  $\frac{p^2-9}{2p+6}$

.....  
(Total 3 marks)

2. Simplify fully  $\frac{6x^2+3x}{4x^2-1}$

.....  
(Total 3 marks)

3. Simplify  $\frac{x^2+2x+1}{x^2+3x+2}$

.....  
(Total 3 marks)

4. Simplify fully  $\frac{x^2+x-6}{x^2-7x+10}$

/

.....  
(Total 3 marks)

5. (a) Simplify  $\frac{2x+4}{x^2+4x+4}$

.....  
(3)

(b) Write  $\frac{1}{x+4} + \frac{2}{x-4}$  as a single fraction in its simplest form.

.....  
(3)  
(Total 6 marks)

6. Simplify fully  $\frac{x+3}{4} + \frac{x-5}{3}$

.....  
(Total 3 marks)

## Expanding more than two binomials

### Things to remember:

- Start by expanding two pair of brackets using the grid or FOIL method.
- Then expand the third set of brackets.
- Use columns to keep  $x^3$ ,  $x^2$  etc in line to help with addition.

### Questions:

1. Show that

$$(x - 1)(x + 2)(x - 4) = x^3 - 3x^2 - 6x + 8$$

for all values of  $x$ .

.....  
(Total for question is 3 marks)

2. Show that

$$(3x - 1)(x + 5)(4x - 3) = 12x^3 + 47x^2 - 62x + 15$$

for all values of  $x$ .

.....  
(Total for question is 3 marks)



3. Show that  
 $(x - 3)(2x + 1)(x + 3) = 2x^3 + x^2 - 18x - 9$   
for all values of  $x$ .

.....  
**(Total for question is 3 marks)**

4.  $(2x + 1)(x + 6)(x - 4) = 2x^3 + ax^2 + bx - 24$   
for all values of  $x$ , where  $a$  and  $b$  are integers.  
Calculate the values of  $a$  and  $b$ .

$a =$  .....

$b =$  .....

**(Total for question is 4 marks)**

## Inverse and Composite Functions

### Things to remember:

- $y = f(x)$  means that  $y$  is a function of  $x$ .
- $f(a)$  means the value of  $x$  is  $a$ , so substitute  $x$  with  $a$ .
- The graph of the inverse is the reflection of the graph in the line  $y = x$
- We find the inverse function by putting the original function equal to  $y$  and rearranging to make  $x$  the subject.
- We use the notation  $f^{-1}(x)$  for the inverse function.
- When a function is followed by another, the result is a composite function.
- $fg(x)$  means do  $g$  first, followed by  $f$ .

### Questions:

1. The functions  $f$  and  $g$  are such that  
 $f(x) = 1 - 5x$  and  $g(x) = 1 + 5x$   
(a) Show that  $gf(1) = -19$

- (b) Prove that  $f^{-1}(x) + g^{-1}(x) = 0$  for all values of  $x$ .

(2)

(3)

(Total for question = 5 marks)

2. The function  $f$  is such that

$$f(x) = 4x - 1$$

(a) Find  $f^{-1}(x)$

$$f^{-1}(x) = \dots\dots\dots (2)$$

The function  $g$  is such that

$$g(x) = kx^2 \text{ where } k \text{ is a constant.}$$

Given that  $fg(2) = 12$

(b) work out the value of  $k$

$$k = \dots\dots\dots (2)$$

**(Total for question = 4 marks)**

3. The functions  $f$  and  $g$  are such that

$$f(x) = 3(x - 4) \text{ and } g(x) = \frac{x}{5} + 1$$

(a) Find the value of  $f(10)$

$$\dots\dots\dots (1)$$

(b) Find  $g^{-1}(x)$

$$g^{-1}(x) = \dots\dots\dots (2)$$

(c) Show that  $f(x) = 9x - 48$

(2)  
(Total for question = 5 marks)

4.  $f(x) = 3x^2 - 2x - 8$   
Express  $f(x + 2)$  in the form  $ax^2 + bx$

.....  
(Total for question is 3 marks)