# Mangahigh Mastery Series

# Algebra Foundations Student's pack



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# 1a STARTER

#### **Substitution**



Name:

In this worksheet you will practise substituting integers into algebraic expressions.

Substitution means putting numbers where the letters are.

For example, if a = 4, then a + 7 = 4 + 7 = 11.

Calculate the following when a = 3.

#### **ANSWERS**

- 1. a + 5
- 2. 10 - a
- 3. 4*a*

24 ÷ a

When squaring a number we multiply it by itself.

Squaring a negative number gives a positive answer.

For example, if a = -5, then  $a^2 = (-5)^2 = -5 \times -5 = 25$ .

Circle the correct answers.

#### **ANSWERS**

**ANSWERS** 

- 5. If a = 3, then  $a^2 = ...$
- If a = 10, then  $a^2 = ...$ 6.
- 7. If a = -3, then  $a^2 = ...$
- If a = -6, then  $a^2 = ...$

9 6 -920 100 1 000 6 9 -936 -3612

If a = -2, which of the following is greater?

#### 9. 4*a* OR 3*a*

- 10. 9 + aOR 10 - a
- 11.  $a^2$  $a^3$ OR
- 12. 2a + 75a + 11OR

#### 1a STARTER (continued)

We can also substitute values for more than one letter into an expression. For example, if a = 3 and b = 2, then  $4a + 2b = 4 \times 3 + 2 \times 2 = 12 + 4 = 16$ .

When a = 4, b = 5 and c = 2, which of the following is **incorrect**?

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<b>13.</b> 5 <i>a</i> 3 <i>b</i> 10 <i>c</i>

**14.** 
$$2a + c$$
  $2b$   $3b - a$  \_\_\_\_\_\_

**15.** 
$$4c + a$$
  $2b + c$   $3a + c$ 

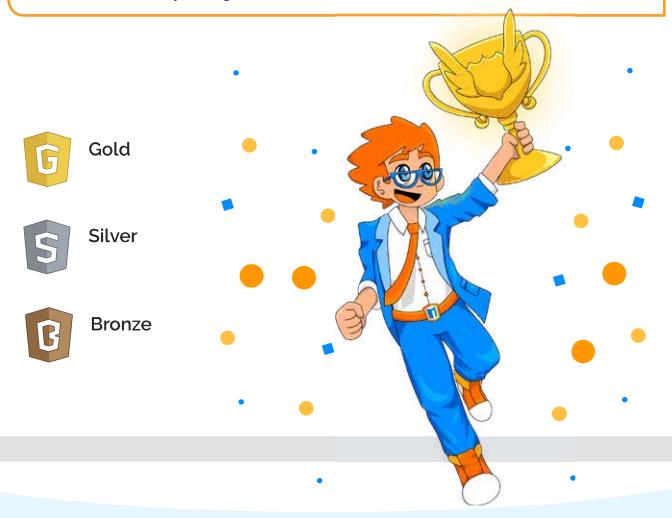
**16.** 
$$c^2 + 10$$
  $b^2 - 10$   $a^2 - 1$ 



Now go online to www.mangahigh.com to play these activities and practise what you have learnt.

- Substitute integers into algebraic expressions with exponents (quiz)
- Substitute whole numbers into expressions with exponents (quiz)

Try to answer three Hard questions in a row to earn a Bronze medal! Remember to try each activity at least three times. What is your highest score?



# 1b CONSOLIDATION

#### **Substitution**



Name:

Calculate the following when a = 6.

- a + 71.
- 2. 11 - a
- 3. 5*a*
- 4. 42 ÷ a

**ANSWERS** 

Circle the correct answer.

- If a = 6, then  $a^2 = ...$ 5.
- 6. If a = 4, then  $a^3 = ...$
- If a = -7, then  $a^2 = ...$ 7.
- If a = -2, then  $a^3 = ...$

**ANSWERS** 

12	24	36

If a = -5, which of the following is greater?

- 9. 2*a* OR 5*a*
- 10. 12 + aOR 8 - a
- 11.  $a^2$  $a^3$ OR
- **12.** 4*a* + 1 OR 3a - 5

**ANSWERS** 

When a = 6, b = 3 and c = 4, which of the following is the odd one out?

**13.** 4*a* 

8*b* 

7*c* 

14. 2a + b

a+b+c

5*h* 

15. a + 3b - c

4b + c

2a + 4b - 2c

16.  $c^2 + 5$ 

### 2a STARTER

### Simplifying expressions



Name:

In this worksheet you will practise simplifying algebraic expressions.

We can simplify expressions involving addition and subtraction by collecting like terms. For example, 4a + 5a + 3a = 12a.

Simplify the following expressions.

1.	5a	+	7 <i>a</i>	+	<b>2</b> <i>a</i>

2. 
$$8b - 3b + 4b$$

3. 
$$6y + 4y - 12y$$

4. 
$$2m - 5m - 3m$$

5. 
$$6c - 3c + 5c$$

**ANSWERS** 

We can also simplify expressions by collecting like terms when there are two or more variables.

For example, 2a + 7b + 4a - 3b = 6a + 4b.

Are the following simplifications correct?

2a + 5b + 3a + 7b = 7a + 10b6.

7. 
$$8a + 2b + 4a + 7b = 12a + 9b$$

8. 
$$4a - 3b + 2a + 8b = 6a + 5b$$

9. 
$$2a + 4b - 5a - 7b = 3a - 3b$$

**10.** 
$$7a + 2b - 5a - 2b = 2a + 2b$$

**ANSWERS** 

No Yes

Yes No

Yes No

Yes No

Yes No

#### 2a STARTER (continued)

Simplifying expressions involving multiplication can be done as follows:

$$2a \times 4b = 8ab \qquad 5a \times 3a = 15a^2$$

Circle the correct simplification to the following expressions.

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$\sim$	I VI v	3 V V	no	

11.	$5a \times 3b$	8ab	15 <i>ab</i>	15 <i>a</i> + <i>b</i>
12.	$2a \times 3b \times 4c$	9abc	6ab + 4c	24abc
13.	$3a \times 7a$	21 <i>a</i>	$10a^{2}$	$21a^2$
14.	$2a \times 4a \times 5a$	40 <i>a</i>	40 <i>a</i> <sup>2</sup>	40 <i>a</i> <sup>3</sup>
15.	$4a^2 \times 3a^2$	$12a^{2}$	12 <i>a</i> <sup>3</sup>	$12a^4$

We can find new expressions that related to a variable by adding, subtracting, multiplying or dividing.

For example, 3 more than n can be written n + 3 and 7 times n can be written 7n.

Which expression is:

#### **ANSWERS**

				•
16.	5 more than <i>n</i>	n + 5	5 <i>n</i>	5 ÷ <i>n</i>
17.	6 less than <i>n</i>	6 – n	6 <i>n</i>	n – 6
18.	4 times as big as <i>n</i>	4 + n	4n	4n + 4
19.	Half of <i>n</i>	n ÷ 2	2n	n – 2
20.	One third of <i>n</i>	3n	n + 3	n ÷ 3



Now go online to www.mangahigh.com to play these activities and practise what you have learnt.

- Use algebra to solve problems (quiz)
- Simplifying constants Jabara (game)
- Coefficients, like terms, multiplying constants Jabara (game)

Try to answer three Hard questions in a row to earn a Bronze medal!

Remember to try each activity at least three times.

What is your highest score?



Gold



Silver



Bronze

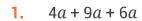
# **2b CONSOLIDATION**

### Simplifying expressions



Name:

Simplify the following expressions.



2. 
$$7b - 2b + 5b$$

3. 
$$3y + 7y - 14y$$

4. 
$$6m - 9m - 2m$$

**ANSWERS** 

Are the following simplifications correct?

**ANSWERS** 

5. 4a + 3b + 7a + 2b = 11a + 5b

6. 
$$7a - 2b + 3a + 6b = 4a + 4b$$

7. 
$$8a - 6b + 3a + 5b = 11a - b$$

8. 
$$3a - 6b - 7a - 3b = -4a - 3b$$

Yes No

Circle the correct simplification to the following expressions.

**ANSWERS** 

15*ab* 

56*ab* 

7a + 8b

9.

10*abc* 

6ab + 5c

30*abc* 

11.  $9a \times 4a$ 

36*a* 

 $13a^{2}$ 

 $36a^{2}$ 

12.  $4b \times 3b \times 10b$ 

 $7a \times 8b$ 

10.  $3a \times 2b \times 5c$ 

120*b*  $120b^{2}$ 

 $120b^{3}$ 

Which expression is:

**ANSWERS** 

13. 8 more than n

4 less than *n* 

**15.** 6 times as big as *n* 

**16.** One quarter of *n* 

n + 8

8n

 $8 \div n$ 

4-n

4n

n-4

6 + n

n + 4

6*n* 

4n

6-nn ÷ 4