

Mangahigh Mastery Series

Algebra Foundations

Student's pack



MANGAHIGH

westermann

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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. $4a$
4. $24 \div a$

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

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

6	9	-9
20	100	1 000
6	9	-9
36	-36	12

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

ANSWERS

9. $4a$ OR $3a$
10. $9 + a$ OR $10 - a$
11. a^2 OR a^3
12. $2a + 7$ OR $5a + 11$

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**?

ANSWERS

13. $5a$ $3b$ $10c$
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?



Gold



Silver



Bronze



1b CONSOLIDATION



Substitution

Name: _____

Calculate the following when $a = 6$.

1. $a + 7$
2. $11 - a$
3. $5a$
4. $42 \div a$

ANSWERS

Circle the correct answer.

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

ANSWERS

12	24	36
12	64	256
-49	14	49
-8	8	-6

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

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

ANSWERS

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

13. $4a$ $8b$ $7c$
14. $2a + b$ $a + b + c$ $5b$
15. $a + 3b - c$ $4b + c$ $2a + 4b - 2c$
16. $c^2 + 5$ $b^2 + 10$ $a^2 - 15$

ANSWERS

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. $5a + 7a + 2a$
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?

6. $2a + 5b + 3a + 7b = 7a + 10b$
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

Yes <input type="checkbox"/>	No <input type="checkbox"/>
Yes <input type="checkbox"/>	No <input type="checkbox"/>
Yes <input type="checkbox"/>	No <input type="checkbox"/>
Yes <input type="checkbox"/>	No <input type="checkbox"/>
Yes <input type="checkbox"/>	No <input type="checkbox"/>



2a STARTER (continued)

Simplifying expressions involving multiplication can be done as follows:

$$2a \times 4b = 8ab$$

$$5a \times 3a = 15a^2$$

Circle the correct simplification to the following expressions.

ANSWERS

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

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 n	$n + 5$	$5n$	$5 \div n$
17. 6 less than n	$6 - n$	$6n$	$n - 6$
18. 4 times as big as n	$4 + n$	$4n$	$4n + 4$
19. Half of n	$n \div 2$	$2n$	$n - 2$
20. One third of n	$3n$	$n + 3$	$n \div 3$



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.

1. $4a + 9a + 6a$
2. $7b - 2b + 5b$
3. $3y + 7y - 14y$
4. $6m - 9m - 2m$

ANSWERS

Are the following simplifications correct?

5. $4a + 3b + 7a + 2b = 11a + 5b$
6. $7a - 2b + 3a + 6b = 4a + 4b$
7. $8a - 6b + 3a + 5b = 11a - b$
8. $3a - 6b - 7a - 3b = -4a - 3b$

ANSWERS

Yes <input type="checkbox"/>	No <input type="checkbox"/>
Yes <input type="checkbox"/>	No <input type="checkbox"/>
Yes <input type="checkbox"/>	No <input type="checkbox"/>
Yes <input type="checkbox"/>	No <input type="checkbox"/>

Circle the correct simplification to the following expressions.

9. $7a \times 8b$
10. $3a \times 2b \times 5c$
11. $9a \times 4a$
12. $4b \times 3b \times 10b$

ANSWERS

$15ab$	$56ab$	$7a + 8b$
$10abc$	$6ab + 5c$	$30abc$
$36a$	$13a^2$	$36a^2$
$120b$	$120b^2$	$120b^3$

Which expression is:

13. 8 more than n
14. 4 less than n
15. 6 times as big as n
16. One quarter of n

ANSWERS

$n + 8$	$8n$	$8 \div n$
$4 - n$	$4n$	$n - 4$
$6 + n$	$6n$	$6 - n$
$n + 4$	$4n$	$n \div 4$